# NM - 2

# GENERAL CORRESPONDENCE

# YEAR(S): 1993

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Roswell District Office
1717 West Second Street
Roswell, New Mexico 88201-2019

OIL CONSERVATION DIVISION
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IN REPLY
REFER TO:
6514 (06016)

SEP 22 1993

Mr. Bill LeMay, Director
Oil Conservation Division
P. O. Box 2088
Santa Fe, NM 87504

Dear Mr. LeMay:

Enclosed is a copy of the final Detailed Investigation/Mitigation Action Plan approved by the Committee at the August 16, 1993, meeting in Carlsbad, NM. A copy of the summary minutes will be forthcoming.

Please feel free to call me if you have any questions concerning the plan.

Sincerely,

John H Whiting

FOR Leslie M. Cone
District Manager

1 Enclosure:
1 - Detailed Investigation/Mitigation Action Plan

SOUTHEAST NEW MEXICO PLAYA LAKES COORDINATING COMMITTEE

DETAILED INVESTIGATION/MITIGATION ACTION PLAN

## I. HISTORICAL OVERVIEW

Potash mining and intensive mineral development in southeastern New Mexico has existed for over 60 years. This area is known as the Secretary's Potash Area and has been utilized intensively for development of mineral resources including potash, oil and gas. Development of oil and gas resources started in the mid to late 1920's and potash mining activity originated in the early 1930's. Environmental consequences were given little consideration during the early periods of mineral development in the semiarid regions of the southwest. Natural resources available for industrial purposes were utilized for development. This was a common practice at the time and not considered harmful.

Environmental awareness became a major concern in the 1970's and has continued through to the present with law, regulation and policy standards becoming part of everyday activity for small business, industry and state and federal agencies. An Environmental Assessment Record (EAR) was prepared for the potash mines in the mid 1970's. The primary focus of this effort was water quality and did not address the affects on wildlife. In the early 1990's bird mortality was discovered by the US Fish and Wildlife Service on some of the playa lakes in the Secretary's Potash Area in southeast New Mexico. Wildlife mortality was primarily associated with three playas, Salt Lake (aka Laguna Grande del Sal), Laguna Toston, and Laguna Gatuna. Of the three playa lakes, only Laguna Toston received water from potash mining activities. Laguna Gatuna was historically used by the Oil and Gas Industry and Laguna Grande del Sal is currently used for commercial salt extraction.

The U.S. Fish and Wildlife Service and New Mexico Department of Environment initiated studies in the Secretary's Potash Area. The Bureau of Land Management (BLM) and the potash industry provided historic water data from mining and mineral development. Federal, state and industry concerned about the past uses of the playa lakes and possible environmental effects met in Albuquerque, New Mexico, at an interagency forum in March 1993. That meeting lead to the formation of an interagency organization known as the Southeast New Mexico Playa Lakes Coordinating Committee. The goals and objectives of this committee were to resolve wildlife mortality problems through investigations and mitigative action.

Since March 1993, by direction of the interagency committee, a Planning Group supported by two workgroups (Research and Interim Mitigation/Remediation) have been developing the objectives needed to continue investigation/mitigation actions in the playa region.

On July 20, 1993, the Southeast New Mexico Playa Lakes Coordinating Committee agreed to pursue a detailed investigation/mitigation action plan that focused on the causes of mortality, interim mitigation at Laguna Toston through deterrent activities and on-site development of alternative habitat. The detailed investigation/mitigation plan would be presented to the Committee at a public meeting in Carlsbad, New Mexico, on September 16, 1993. The detailed action plan describes the objectives and investigation methods and identifies potential investigation sources for completion of each task.

## II. ACTION PLAN

### A. CAUSES OF WILDLIFE MORTALITY

#### 1. Pathological, Physiological and/or Physical Mortality Factors

OBJECTIVES:

* Determine cause(s) of mortality (natural or man-made) at playa lakes (e.g., Laguna Gatuna, Laguna Toston, and Laguna Grande de Sol (Salt Lake)). (Includes literature review of locations with analogous situations.)

* Determine if mortality is result of exposure at playa lakes or a result of off-site factors.

* Determine total mortality at playa lakes (e.g., identify percentage of bird carcasses that sink to playa lake bottoms).

INVESTIGATION METHODS:

* Weekly surveys for wildlife mortality at the above mentioned playa lakes would be conducted from October through February. Bimonthly surveys would be conducted from March-September, and may be increased in frequency if necessary. A representative sample of intact carcasses recovered in accordance with U.S. Fish & Wildlife Service protocol from the playa lakes would be submitted for necropsy and histopathology determinations.

* Multiple caged-bird trials using captively raised birds would be conducted during the period of October through March to attempt to replicate wild bird exposure effects and identify mortality factor(s).

* Perform laboratory trials using reconstituted water matching chemistry of playa lakes. Laboratory trials would help determine if avian mortality at the playa lakes is a result of exposure to the lakes or is due to previous environmental exposure outside of the playa lakes region.

* Comparative chemical and pathological analysis of wild waterfowl entering, remaining and leaving study site.

* Pond-bottom surveys and captively raised birds (and/or carcasses) would be released in playa lakes, tagged, and movement and site of deposition monitored to determine the percent of bird mortality (e.g., the percent of birds that die at playa lakes that are not counted on the shoreline).

POTENTIAL INVESTIGATIVE SOURCES:

* U. S. Fish and Wildlife Service, National Wetlands Research Center, Lafayette; Louisiana. Principal Investigator: Dr. Clinton W. Jeske

* U. S. Fish and Wildlife Service, National Wildlife Health Research Center, Madison, Wisconsin. Principal Investigator: Dr. J. Christian Franson

* National Biological Survey

* Competitive Federal Government Contract
* Cooperative Agreement (with a college/university)

SCHEDULE

* Field work and laboratory trials would be performed over three (3) years. Final report would be completed in fourth year (4th).

** Short term strategy will be for National Wildlife Health Center to come to New Mexico and properly collect birds for necropsy and histopathology work, if a die-off occurs in 1993.

FUNDING SOURCES:

* Federal Agency funding
* Funding from private groups - conservation easements

## 2. Literature Review and Summary

OBJECTIVES:

* Review and summarize information relevant to the Secretary's Potash Area/playa lake region including data on water quality, hydrology, playa ecology, bird mortality, and potash and oil and gas industry operations.

INVESTIGATION METHODS:

* Conduct literature search
* Review pertinent literature on water quality, hydrology, playa ecology, etc.
* Perform trend analyses to identify any changes in certain area characteristics over time.
* Prepare draft executive summary.
* Prepare final report of review and summary of information, including an annotated bibliography.

POTENTIAL INVESTIGATION SOURCES:

* New Mexico Department of Environment
  Surface Water Quality Bureau
  U.S. Fish & Wildlife Service
  (fund one inter-bureau personnel (IBP) position)
* Bureau of Land Management
* Competitive Federal Government Contract
* Cooperative Agreement (with a college/university)

SCHEDULE:

* All objectives would be completed within one year (FY 1994).

FUNDING SOURCES:

* Federal Agency funding
* Funding from private groups - conservation easements

3. <u>Extent of Problem Areas and Site-Specific Differences</u>

OBJECTIVES:

* Determine the amount, timing, and aerial extent of wildlife use and mortality at playa lakes within the Secretary's Potash Area/playa lake region.

* Identify factors responsible for site-specific differences in wildlife mortality and migratory bird use of playa lakes.

INVESTIGATION METHODS:

* Characterize playa lake water chemistry, plant and invertebrate community composition of playa lakes that receive, versus those that do not receive, industry discharges, including playas where bird mortality has been observed and playas where no bird mortality has been observed.

* Recover and record the number of bird carcasses found on the shorelines of playa lakes.

* Evaluate day and night time activities and behavior of water birds on playa lakes to quantify differences between sites.

* Use a geographic information system to overlay and identify relationships among water chemistry, ambient water and air temperatures, and migratory bird numbers, behaviors, and mortality.

* Conduct aerial censuses of waterbirds on individual playa lakes during the fall and spring migrations.

POTENTIAL INVESTIGATION SOURCES:

* U. S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center, Section of Pacific States Ecology, Dixon, California. Principal Investigator: Dr. Douglas A. Barnum.

* National Biological Survey

* Competitive Federal Government Contract

* Cooperative Agreement (with a college/university)

* New Mexico Game & Fish Department - aerial census

SCHEDULE:

* Three (3) years would be required for field work, data analysis and GIS development. Final report write-up would occur in year four (4).

FUNDING SOURCES:

* Federal Agency funding

* Funding from private groups - conservation easements

## B. MITIGATION / REMEDIATION

### 1. Interim Mitigation

#### a) Laguna Toston Determent Activities

OBJECTIVES:

* Reduce wildlife mortality on Laguna Toston while other investigative actions are conducted.

* Reduce wildlife use of Laguna Toston during peak migrating periods (October through April).

* Monitor and evaluate interim mitigation methods.

MITIGATION METHODS:

* *Deterrent activities may include:*
  Use of a boat to deter birds from loafing on Laguna Toston.

  Noisemakers in the form of propane canon and delayed noisemakers fired from shotguns.

  New Mexico Potash Corporation would apply for bird-handling permit from U.S. Fish & Wildlife Service to allow for capture, care and release of birds showing signs of distress. U. S. Fish & Wildlife Service will provide assistance for permitting.

  (Costs associated with deterrent activities would be New Mexico Potash Corporation's responsibility.)

MITIGATION SOURCES:

* Mitigation activities would be conducted by New Mexico Potash Corporation.

* Coordination and technical assistance would be available from interagency sources associated with the Southeast New Mexico Playa Lakes Coordinating Committee.

SCHEDULE:

* The deterrent activities would take place annually from October through April or other periods as necessary.

FUNDING SOURCES:

* Federal Agency funding

* Funding from private groups - conservation easements

## b) On-Site Mitigation at Laguna Toston

OBJECTIVES:

* Determine if on-site habitat development is beneficial or detrimental to wildlife in Laguna Toston area.

* Monitor and evaluate wildlife use of four-acre moist soil management techniques for Laguna Toston sites.

MITIGATION METHODS:

* Develop, through moist soil management techniques, four-acre fresh water sites adjacent to Laguna Toston.

* Monitor and evaluate wildlife use of this site by observing and recording wildlife activities, period of use, species use, water quality sampling, etc.

MITIGATION SOURCES:

* Materials and construction cost (including water) would be supplied by New Mexico Potash Corporation.

* Technical assistance would be provided by Bureau of Land Management.

SCHEDULE:

* The fresh water site would be initiated for use by wildlife in the fall of 1993.

* Monitoring and evaluation would start with the fall migration of 1993.

ESTIMATED FUNDING REQUIRED: - $8,000

Development cost of site and annual water requirement (eight acre/feet) to be supplied by New Mexico Potash Corporation.

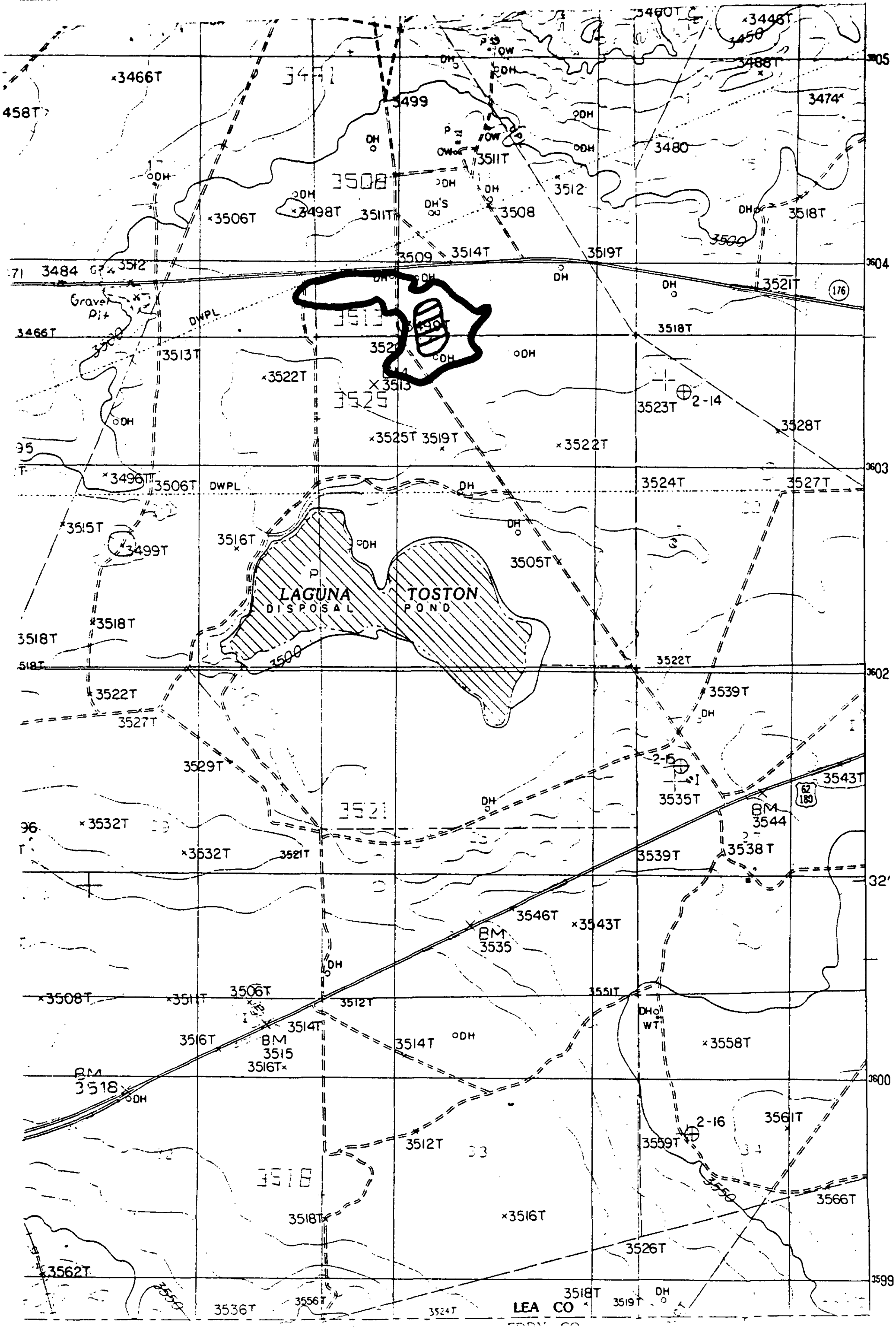
2. Monitoring / Evaluation

The effects of interim mitigation activities are an essential part of the investigation/mitigation action plan and would be monitored and evaluated at Laguna toston as part of the causes of mortality studies (#3-Extent of Problem Areas). All the playa lakes, including Laguna Toston would be evaluated using the same criteria. New Mexico Potash Corporation personnel tending Laguna Toston would record the data.

3. Long Term Mitigation/Remediation

a. Off-Site - Off-site alternative habitat development might be another long-term solution in the Pecos River Basin. This alternative could be addressed through an off-site mitigation process. Alternative habitat enhancement has been one of the tools available to achieve compensation for unavoidable project-related resource losses. If the investigation plan reveals that bird mortality is naturally occurring, other mitigative measures may be considered and the Southeast New Mexico Playa Lakes Coordinating Committee would be terminated or Charter changed.

b. On-Site - The factors causing wildlife mortality in the Secretary's Potash Area are unknown at this time. The investigation plan is designed to identify causative factors responsible for wildlife mortality, and at that time, mitigation and/or remediation actions would be determined, assessed and implemented.



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SUMMARY MINUTES
Southeast New Mexico Playa Coordinating Committee
September 16, 1993

Frank Splendoria opened meeting and introduced himself as the Acting State Director for the Bureau of Land Management, New Mexico. He explained that as of Oct. 4, 1993, Bill Calkins, currently Associate State Director in Alaska will assume the Acting State Director responsibilities. Mr. Splendoria further explained that Monte Jordan, Associate State Director and Committee Chairperson would be transferring to Denver and, therefore, would no longer be facilitating these meetings. Mr. Splendoria had been brought up to date on the background activities of the Committee. Mr. Splendoria told the group that his position with the BLM was that of Deputy State Director, Division of Operations, working with oil & gas, land and mineral records. His background includes education in Biology, zoology, physiology.

Mr. Splendoria then asked Ms. Leslie Cone, Planning Group Leader, to review the Report submitted to the Committee prior to discussion. He stated that if the Committee could not reach a consensus on the contents, discussion would be heard, and decisions made on what actions would be necessary to reach consensus.

All Committee members then introduced themselves for the benefit of all attendees.

Ms. Cone then explained that at the last meeting a Detailed Investigation/Mitigation Action Plan had been presented to the Coordinating Committee. This Action Plan was discussed and it was agreed that refinements would be made and brought back to the Committee at this time.

She explained that the Planning Group and the Research and Interim Mitigation/Remediation Workgroups were looking at the mortality issue; looking for a cause and ways to proceed toward solving the problem.

Specific studies will be done to determine cause- focusing on Laguna Toston. Ms Cone stated that if it were known whether the cause was natural or man-made it would be easier to pursue solving the problem. Investigative methods have been outlined. At the present time the total amount of mortality is not known.

Coming up on another season; same time frame as last year. It is believed that all investigations involving cause of death would be completed in three (3) years. This is the short-term strategy. Cost estimate is $400,000.

Mr. Yates clarified that it was not the Committee's responsibility to determine or set costs.

Ms Cone reiterated that not a lot could be done until a cause is determined; that a literature review would be done, using information relevant to the Secretary's Potash Area on water quality. This should take about one year, with a cost of about $50,000.

Ms. Cone discussed the extent of the problem areas and site-specific differences, stating that some playas receive different amounts of outside influences.

Many birds land on the playas; the majority take off, some do not. It is not known why. A systematic approach is needed to determine the birds'attraction to these playas. This research would take three to four years, with an estimated cost of $600,000.

**Interim Mitigation** - Ms. Cone explained that annual deterrent activity was begun last spring. Using a boat and circling the area seems to work the best. This activity will be monitored. New Mexico Potash Co. has borne this cost.

Mr. Splendoria asked who would be collecting and analyzing the data and Ms. Cone Leslie replied that these decisions not yet been made.

Ms. Cone referred to a map showing the location of this joint project with NM Potash. Will monitor the project to see whether birds can be drawn to a fresh water area and whether positive or negative results are obtained. This would about $8,000. Ms. Cone reiterated the need and importance of monitoring and evaluation.

**Long-Term Mitigation and Remediation** - Ms. Cone explained that this area would be developed more fully by this Workgroup when cause of mortality is known.

It was decided at this time to discuss and hear comments on each of the areas of the Plan.

Mr. Bruce Morrison, NM Dept. of Game and Fish, asked if thought has been given to the timeframe of how long it takes birds to get salt encrusted; that this would indicate the frequency of surveys needed. He was told that caged birds would be used and water would be reproduced in a laboratory setting to provide these answers.

Mr. Marvin Watts stated that there were many factors involved; that much knowledge was needed concerning the lakes and variables occurring in these lakes. He stated that he felt that at certain times of the year results would be quite different.

Mr. Frank Yates stated that it opened up a liability on the part of the Committee regarding other mortality in the playa area, such as to endangered species. He stated that he would like to see a buffer built in to protect the Committee.

Leslie reiterated that intent is not for punitive reasons; but that if Industry is involved, they would not be excused from violations; that this could not be guaranteed in writing.

Ms. Cone stated that the Planning Workgroup would get back together and decide how this research is to be done, coming back to the Committee for recommendations.

Mr. Splendoria asked if these investigation methods were just "ideas" at this time and Ms. Cone replied that they were.

Mr. Yates asked about potential investigative sources. He stated that he would like to see funding from private groups, coalitions, etc. included as alternative sources. The Committee agreed.
Mr. Yates also suggested having private funding included under the guise of a conservation easement.

Mr. Splendoria suggested that the Audobon Society might be a potential source of funding, etc.

It was agreed that the final proposal as to who does the research should be approved by the Committee. etc.

Mr. Morrison stated that the NM Dept. of Game and Fish had very experienced personnel doing surveys which include fly-overs, counting, etc. This could greatly assist with an aerial census. It was agreed that this option would be added to the Plan as a potential source.

Mr. Yates stated that he had doubts about using this method and was assured that each census would be specific.

Mr. Yates stated that he would like to see a statement included that aerial surveys would be done in a manner to obtain and ensure most accurate information. Mr. Morrison referred to the protocol that must be followed re surveys. It was agreed that the word "individual" would be added where aerial census is discussed in the Plan.

Ms. Cone stated that she would try and assure words were clear and not ambiguous.

Mr. Squires asked whether there were any mortalities associated with Laguna Plata and asked why Laguna Tonto had not been investigated. Leslie stated that there were three areas where known mortalities have occurred and these are listed in the Plan.

Ms. Cone stated that the Planning Workgroup had tried to present a Plan that was simple and to the point.

Ms. Fowler-Propst stated that playas are unique and that after avoidance, mitigation should be in kind, on-site, with habitat of equal value, etc.

It was stated that depending on the cause of the mortality estimated amounts needed for mitigation/remediation could change.

A motion was made and seconded to -

> **remove funding estimates from Plan**

This motion passed by acclamation.

Mr. Yates stated that he felt the Committee should be disbanded if mortality is found to be naturally occurring. He also stated that these discussed modifications and changes should be made to the plan before receiving Committee approval.

A motion was made and seconded to -

> **amend the Charter to include a specific term for the need for and existence of the Southeast New Mexico Playa Lakes Coordinating Committee.**

This motion accepted by acclamation.

A motion was made by Mr. Morrison that-

> **the Southeast New Mexico Play Lakes Coordinating Committee accept the Detailed Investigation/Mitigation Action Plan, with the changes enumerated and agreed upon by the members of the Committee.**

Ms. Jennifer Fowler-Propst seconded the motion and it was passed by acclamation.

Mr. Splendoria stated that the changes would be made to the Plan and mailed to all Committee members.

The next meeting was scheduled for Friday, December 10, 1993, at the Carlsbad Resource Area Office.

Meeting adjourned at 11:15 a.m.

SUMMARY MINUTES
Southeast New Mexico Playa Coordinating Committee
July 20, 1993

Chairman Monte Jordan opened the meeting and asked all members to introduce themselves for the benefit of the public attendees. He then explained that the Committee would, at this meeting, decide upon the investigative approach needed to determine the possible causes and solutions to the wildlife mortality problems in the region. The Committee met in May 1993, and discussed looking at ways to determine what was happening and ways to solve the problem.

Mr. Jordan then referred to the Southeast New Mexico Playa Lakes Coordinating Committee Charter and a proposed change submitted by Mr. Frank Yates. A copy of the proposed change was distributed to all members and discussion was heard. It was stated that the only change needed seemed to be the addition of having all news releases approved by the Committee before release. After further discussion it was agreed that a majority approval would be sufficient. A motion was made and seconded and approved by acclamation that Paragraph 5 of the Charter be amended as follows:

> "The BLM will have draft news releases approved by a majority of Committee members prior to mailing to the respective media contacts. Five (5) working days will be allowed for comments."

Chairman Jordan will amend the Charter and an original document will be sent to all members for signature.

Ms. Leslie Cone, Chairperson of the Planning Group, then gave a brief summary and overview of the Investigation/Mitigation Action Plan presented by the Planning Group (see Attachment #1). She stated that in the 1970's an Environmental Assessment Record (EAR) was prepared; however, bird mortality or impacts to wildlife were not a major issue. Bird mortality became an issue last fall when a significant number of dead birds were found at a number of playa lakes. The first step is to find out the cause of death.

Mr. Yates asked if the cost estimates included BLM expenses as well as outside and lab costs. Ms. Cone explained that all possible costs to get this task accomplished were included. Determination of cause of death could affect cost estimates and timeframes of other factors.

In response to a question about interim mitigation, Ms. Cone stated that to date the most effective deterrent has been placing personnel in a boat to frighten away birds and that this would continue during the migration seasons. Ms. Cone explained that multiple species had been found dead in the area but that there was not much historical data available. The literature search defined in the plan would reveal what data is available.

Mr. Jordan stated that if the Committee approved the plan, that site specific plans would include a monitoring evaluation. Ms. Fowler-Propst, U.S. Fish & Wildlife Service, stated that this monitoring will provide information concerning whether keeping birds from one area would make them more vulnerable to other playas.

Mr. Yates asked if there was on-site alternative habitat now and was told no, but that the Planning Group did have a proposal. It was stated that off-site alternative habitat was seen as an opportunity to enhance habitat and that it was not felt that effort should be spent on on-site areas until the cause of death has been determined.

Mr. Jordan reiterated the steps to be taken in the plan under causes of mortality and asked if the Committee had any comments.

Mr. Morrison suggested that a review of the impacts of stress, i.e. migration, be included.

Mr. Jordan stated that the Committee would need to make a recommendation on continuance of the interim mitigation at Laguna Toston.

Mr. Yates stated that he assumed pathology would be considered. in the literature review. Ms. Fowler-Propst explained that all forms of literature review would be included in the cause of death determination. Diseases will be discussed and included in reports given.

It was also explained that the timeframes given were necessary due to the timeframes for some laboratory results. However, the cause of death could probably be determined within 45 days.

It was stated that changes in habitat in the area in the last 60 years should be considered. It is also felt that some historical migration bird habitat has been eliminated and that restoration of old habitat should be considered.

Lewis Derrick, member of the public, asked if the Committee would like to take tests from a playa on his property to see if there was any difference. Mr. Jordan suggested that this area might be approached as a possible control site.

Mr. Thayer stated that the variations in lakes are extensive and that much time might be involved.

Mr. Morrison stated that he would like to move that the Committee accept the plan as presented.

Mr. Yates then stated that a control period should be established to determine the extent of the bird mortality to monitor type of success for short- and long-term mitigation.

Mr. Jordan then asked the Fish & Wildlife Service whether or not the present determent should be continued. Ms. Fowler-Propst stated that the assumption has been that efforts will be continued. Effects of "hazing" are of interest to the Fish & Wildlife Service; they will not ask for a moratorium, but they will ask for a monitoring plan using as much data gathering as possible. No efforts should be precluded until we get the answers being sought.

Mr. Morrison stated that he felt that the plan as proposed should be approved or disapproved, not re-written. Mr. Vail stated that once the expanded plan is put together, it should be brought back before the Committee.

Mr. Jordan stated that the Fish & Wildlife Service and BLM recognize their responsibility and will pursue avenues for funding before pressing Industry for dollars. It was suggested that the new National Biological Survey (NBS) might be interested in getting involved.

Mr. Morrison made a motion that the Committee accept the plan as a conceptual plan and that the Planning Group develop the details to bring back to the Coordinating Committee for approval. This motion was seconded by Marvin Watts and passed by acclamation.

Ms. Fowler-Probst stated that it is important to bring this to the attention of the Washington Offices as soon as possible, and that the Committee should meet again prior to approval of any plan.

Mr. Jordan agreed that this must be done very quickly in order to obtain FY 94 funding.

Mr Yates asked if it would be a requirement to have a specific agency in mind before requesting any money. Ms. Fowler-Probst stated that she would like to have the flexibility of putting this project before the NBS.

Mr. Yates stated that he felt this type of research should go to a known entity. Mr. Jordan again stated that this must be done very quickly, that the Committee members should report the position of the Committee to their superiors and report back on responses received.

Mr. Dan Davis, NMED representative, also stated that he felt the research should be contracted out to an entity that has an established credibility.

Mr. Jordan reiterated the need for raising the funding issue as soon as possible. He asked how long it would take to get the plan ready, in detail. The response was early in September.

Ms. Fowler-Probst stated that details of the plan should be kept within the realm of the experts.

Mr. Yates stated that because of the financial considerations the Committee must be involved at different stages.

Ms. Cone stated that depending upon the outcome of the cause of mortality, plans may change concerning Industry's funding participation. Will proceed within the government and then involve Industry when and where indicated.

Chairman Jordan stated that all data would be brought forward and all meetings and information would be made public.

Mr. Jordan asked when the next reports could be ready. Mr. Piatt stated that there now needed to be a focus on specific tasks to be done in order to compile a good cost estimate.

Mr. Jordan asked for a draft detailed plan by September 10, 1993, to allow work to begin quickly. This should include what needs to be done in FY 94, with specifics being developed. This is necessary to go forward with requests for funding. After review the Committee will meet again on September 16, 1993.

Mr. Jordan then called for questions from the public.

It was stated that it has not been established that there is a problem, and that the deaths may be from natural causes.

It was stated that it should be assumed that if these deaths had been happening in the past, someone would have known about t.

It was asked if there were various species of waterfowl found and the answer was yes, as well as deer and aquatic insects. In response to a question as to kinds of birds found, Ms. Fowler-Propst stated that there had not been a stringent collection regime done as of this time.

It was stated that the Committee should not contract with Environmental groups such as The Nature Conservancy , Sierra Club, etc. for data collection to ensure a non-biased research effort. The Committee agreed that the most objective source would be used.

Mr. Jordan asked if there were any more questions or further discussions to be heard. There were none and the meeting adjourned at 10:55 am.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397


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IN REPLY
REFER TO:

1703/3046(064)

MAR 17 1993

New Mexico Oil & Conservation Division
Attention: Mr. Roger Anderson
Attention: Bill Olsen
P.O. Box 2088
Santa Fe, NM 87504-2008

Dear Sirs:

Enclosed is our letter to Mr. Jack Henry authorizing B&E, Inc. to proceed with the closure of their three trespass pits. Again, we are eager to maintain communication and cooperation with you for the closing of the Tuzlu Kopek facility.

Please contact us with any questions you may have.

Sincerely,

Leslie M. Cone

Leslie M. Cone
District Manager

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397

TAKE PRIDE IN AMERICA

IN REPLY
REFER TO:

1703/3046(064)

MAR 16 1993

Johnson and Gibbs
Attention: Mr. Jack Henry
First City Tower
1001 Fannin St., Suite 1200
Houston, TX 77002

Dear Mr. Henry:

We are pleased to approve the work plan that B&E, Inc. has submitted for the final closure of the three trespass pits at their Tuzlu Kopek disposal facility. With this letter, we authorize access to BLM-managed land so that facility closure may proceed both on public and adjacent fee lands. We would again like to stress that proper safety procedures be followed at all times during closure.

Please let us know the date on which on-site work will commence. A BLM representative may be present (though off-site) at times during closure to observe the work being done.

We are eager to assist you with information concerning the re-vegetation of the three pits, including what type of seed to use, where to obtain it, and how to promote maximum growth. We will gather this information and forward it to you as soon as possible.

Please contact us with any other questions or concerns you may have.

Sincerely,

s/T. Kreager

FOR Leslie M. Cone
District Manager

OIL CONSERVATION DIVISION
RECEIVED
93 MAR 24

# United States Department of the Interior


BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397


TAKE PRIDE IN AMERICA

IN REPLY
REFER TO:

1703/3046 (064)

MAR 12 1993

New Mexico Oil Conservation Division
Attention: Mr. Roger Anderson
Attention: Mr. Bill Olson
P.O. Box 2088
Santa Fe, NM 87504-2088

Dear Sirs:

Thank you for taking the time to review the B&E, Inc. Phase I Site Investigation Report for the Tuzlu Kopek facility. We hope to maintain this interagency cooperation, as you and B&E proceed with the closure of the State-permitted part of the disposal facility.

As managers of adjacent land, we would like to ensure that all threats of contamination due to past facility activity be analyzed and eliminated. Specifically, we are concerned that past discharges into Laguna Quatro may have adversely affected the public lands within that lake. As a potentially affected party, we request that a study of the facility's effect on the lake--including water and sediment sampling--be conducted during the closure process. We also ask that our agency, Bureau of Land Management, Department of Interior, be included in the review of all studies or reports generated as part of the facility closure.

If we can be of any assistance in your efforts to clean up and close the Tuzlu Kopek facility, please contact Cate Cebrowski in our Roswell District Office (622-9042).

Sincerely,

Tony L. Ferguson

for Leslie M. Cone
District Manager

# JOHNSON & GIBBS

A Professional Corporation
ATTORNEYS AND COUNSELORS

First City Tower
1001 Fannin Street
Suite 1200
Houston, Texas 77002
713/752-3300

Fax: 713/752-3788

Writer's Direct Dial Number
(713) 752-3394

Other Locations:
Austin, Texas
Dallas, Texas
Washington, D.C.


OIL CONSERV... ON DIVISION
REC... VED

'93 MAR 10 AM 8 47

March 8, 1993

**BY FAX**

Ms. Leslie M. Cone
District Manager
Bureau of Land Management
P.O. Box 1397
Roswell, New Mexico 88202-1397

Re: Final Closure of Pits located on Bureau of Land Management Property

Attention: Cate Cebrowski

Dear Ms. Cone:

On behalf of B & E, Inc. ("B & E"), I am hereby responding to your letter dated March 2, 1993 regarding the above matter.

B & E expects to start work at the site on or before April 1, 1993. Thereafter, B & E, subject to weather and equipment breakdowns, will work on-site at least five days per week until the pit closures are complete.

As we discussed, B & E will be doing most if not all of the work in-house. B & E will use only those employees who are thoroughly familiar with the equipment being used and will insure that all workers wear hard hats and rubber boots on site. Further, the employees will be provided with personal $H_2S$ monitors and instructed in proper methods to minimize the potential for sludge to be removed from the pits by virtue of caking on equipment or clothing.

It is expected that the pit berms will provide adequate native soil and caliche to properly close the pits. B & E will purchase and mix in an additional 19 cubic yards of lime as a stabilizing and dewatering agent. That amount equates to approximately 1 to 2 percent of the total sludges in the three pits.

It will be necessary to conduct further research to determine the best and most cost effective manner in which to revegetate the area. The attempt to revegetate will occur after the twelve inch mounded cover is in place. We would appreciate any assistance you may offer in this area and will provide further details after determining the proper approach.

B & E anticipates that the work will be completed within 90 days from the start date. It is our understanding that when the work has been completed, the Bureau of Land Management ("BLM") will provide B & E with a written closure letter where by the trespass issues raised in BLM's letter dated January 23, 1992 will be resolved.

I appreciate your assistance in this matter and look forward to receiving BLM's permission to access the site both for purposes of pit closures on BLM Land and closure of the pit on the adjacent fee lands. Should you have further questions or concerns, please let me know.

Very truly yours,

JOHNSON & GIBBS, P.C.
A Professional Corporation

Jack W. Henry by ddp

Jack W. Henry

cc: Philip B. Withrow - President, B & E, Inc.
Roger Anderson - OCD, Santa Fe, New Mexico
Mike Williams - OCD, Artesia, New Mexico

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397

TAKE PRIDE IN AMERICA

IN REPLY
REFER TO:

1703 (064)

MAR 02 1993

Johnson and Gibbs
Attention: Jack Henry
1001 Fannin St., Suite 1200
Houston, TX 77002

Re: BLM Review of Phase I Final Investigation Report for the B&E Tuzlu Kopek Disposal Facility.

Dear Mr. Henry:

Following review of the Phase I Final Report, we have approved B&E's chosen alternative of encapsulation in place for remediation of the three disposal pits. It appears that the proposed backfilling and subsequent coverage and revegetation of the pits will curtail the migration of contaminants and their potential direct contact with receptors on site. We do believe that the following actions will further diminish the risk of contaminant migration and ask that they be implemented as part of the remediation process:

1) Lime must be added to the source and berm materials during the backfill process to maximize COI stabilization as suggested in section 8.1 of the Final Report.

2) The coverage of the pit areas must ultimately be mounded to prevent the ponding of water and any infiltration down through the pits.

We will also require additional details on pit coverage and revegetation at the site including:

1) The source of native soil/caliche needed for a twelve-inch cover of the pits and mounding.

2) The procedures to be used to promote revegetation above the pits.

We would like these additional concerns to be addressed in a response and implemented in the final closure of the three disposal pits. We expect a schedule of when closure work is expected to be performed and completed.

We must emphasize that B & E's liability for the land on which the pits lie does not end with pit closure. If, for some reason, contamination of this land as a result of B & E activity becomes an environmental concern in the future, B & E may be held responsible for a more extensive removal or clean-up.

We are very anxious to resolve this issue and reduce all possible sources of contamination to the public lands. We appreciate your efforts and cooperation in helping us do so.

Please contact Cate Cebrowski or Tim Kreager at (505) 622-9042 with any further questions.

Sincerely,

Leslie M. Cone

Leslie M. Cone
District Manager

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

February 25, 1993

**CERTIFIED MAIL**
**RETURN RECEIPT NO. P-667-242-322**

Mr. Phil Withrow
B&E, Inc.
700 N. Shipp
Hobbs, New Mexico 88240

**RE: PHASE I SITE INVESTIGATION REPORT**
**B&E TUZLU KOPEK DISPOSAL FACILITY**
**EDDY COUNTY, NEW MEXICO**

Dear Mr. Withrow:

The New Mexico Oil Conservation Division (OCD) has completed a review of B&E's January 1993 "PHASE I SITE INVESTIGATION REPORT FOR THE B&E INC. TUZLU KOPEK DISPOSAL FACILITY". The report contains the results of B&E's investigation of the extent of contamination, an assessment of the associated risks and a proposal for remediation of three unlined pits located on United States Bureau of Land Management (BLM) property adjacent to the B&E Tuzlu Kopek Disposal Facility.

The above referenced document satisfies the OCD's requirements for determining the extent of contamination from the pits and the associated environmental risks of the contaminants. The recommended remedial actions contained in the report are hereby approved with the following conditions:

1. One to two percent by weight of lime will be added to the pit source and berm material during the pit stabilization process to serve as a dewatering and stabilization agent.

2. Upon completion of the remedial activities, the pit sites will be mounded and contoured to prevent stormwater from ponding over the pit locations.

Please be advised that OCD approval does not relieve you of liability should remaining contaminants result in actual pollution of surface waters or ground waters which may be actionable under other laws and/or regulations. OCD approval also does not relieve you of responsibility for compliance with other federal, state and local laws and/or regulations.

The OCD understands that B&E wishes to close the remainder of the Tuzlu Kopek Disposal Facility. Please contact us in the near future to discuss B&E's proposed closure procedures for the facility.

If you have any questions please, contact me at (505)827-5885.

Sincerely,

Will C. Olson

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Mike Williams, OCD Artesia District Supervisor
Jim Piatt, NMED Surface Water Bureau Chief
Jack Henry, Johnson & Gibbs
Leslie Cone, BLM Roswell District Manager

State of New Mexico
# ENVIRONMENT DEPARTMENT

BRUCE KING
*GOVERNOR*

JUDITH M. ESPINOSA
*SECRETARY*

RON CURRY
*DEPUTY SECRETARY*

TELECOPIER TRANSMITTAL

DATE: 2/22/93 TIME: ______ PAGE: 1 OF 14

PLEASE DELIVER THE FOLLOWING PAGES TO:

TO: Roger Anderson

LOCATION: NMOCD

TELEPHONE NUMBER: 827 5812

TELECOPIER NUMBER: 827 5741

FROM: Glenn Saums

LOCATION: NMED

TELEPHONE NUMBER: 827-2827

TELECOPIER NUMBER: (505) 827-0160

COMMENTS:

FYI
Re: B&E Discharges

New Mexico DRUG FREE It's a State of Mind

Harold Runnels Building • 1190 St. Francis Drive • P.O. Box 26110 • Santa Fe, New Mexico 87502
(505) 827-2850 FAX (505) 827-2836

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202-2733

cc → Roger Anderson, OCD
Garrison McCaslin, NMCD-Roswell
Tom Burt, NMCD-Carlsbad

FEB 12 1993

REPLY TO: 6W-ET

CERTIFIED MAIL: RETURN RECEIPT REQUESTED (P 341 527 733)

Mr. Phil Withrow
President
B & E, Inc.
P. O. Box 2292
Hobbs, New Mexico 88240

RECEIVED
FEB 2 2 [redacted]

Re: Docket No. VI-93-1611
Facility No. NMU000066

Dear Mr. Withrow:

Enclosed is a Complaint which the U.S. Environmental Protection Agency ("EPA") is issuing to you as a result of our determination that you have unlawfully discharged a pollutant into a water of the United States in violation of Section 301 of the Clean Water Act, 33 U.S.C. § 1311. The complaint requests that a penalty of up to $25,000 be assessed against you for these violations.

You have the right to a hearing to contest the factual allegations in the Complaint. If you admit the allegations, or they are found to be true after you have had an opportunity for a hearing on them, you have the right to contest the penalty proposed in the Complaint. I have enclosed a copy of the procedures the Agency follows in cases of this kind. Please note the requirements for a Response in §§28.2(u) and 28.20. <u>If you wish to contest the allegations in the Complaint or the penalty proposed in the Complaint, you must file a Response within thirty (30) days of your receipt of the enclosed Complaint to the EPA Regional Hearing Clerk at the following address</u>:

Regional Hearing Clerk (6C)
U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

RECEIVED
FEB 2 2 1993

If you do not file a Response by the applicable deadline [see §28.20(a) and (b)], you will be defaulted. Each allegation in the Complaint will be deemed to be admitted as true by you. You will have waived your right to appear in this action for any purpose and will also have waived your right to be notified of any Agency proceedings that occur before a civil penalty may be imposed. Provided that the Complaint is legally sufficient, the Presiding Officer will then find the company liable for a civil penalty, and the Regional Administrator may then assess against you a civil penalty of $10,000 per violation for your alleged violations.

If you wish to settle this matter without further legal action, you may waive your right to a hearing and within thirty (30) days sign the enclosed Consent Order and return it to EPA for approval by the appropriate EPA officials. Be advised that by signing the Consent Order you will be agreeing to pay the penalty provided and will waive your right to appeal the Order. You have the right to be represented by an attorney at any stage of the proceedings, including in any informal discussions with EPA. If you believe you need to receive an extension of the thirty (30) day deadline to file a Response in order to discuss settlement of this case, please sign the enclosed "Stipulation Extending Response Deadline" and return to EPA [ATTENTION (6W-EA)] before the thirty (30) day deadline. If you have any questions, I recommend that you, or your attorney, contact Mr. Jim Collins at (214) 655-2128.

Sincerely yours,

/s/ Roger C. Hartung

Roger C. Hartung
Chief
Enforcement Branch (6W-E)

Enclosure

cc: w/complaint - Regional Hearing Clerk (6C)

Mr. Jim Piatt, Bureau Chief
Surface Water Quality Bureau
New Mexico Environment Department

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6

| | | |
|---|---|---|
| IN THE MATTER OF | § | ADMINISTRATIVE COMPLAINT |
| B & E, INC.<br>P. O. Box 2292<br>Hobbs, New Mexico 88240 | § | Proceeding to Assess Class 1 Civil Penalty Under Section 309(g) of the Clean Water Act |
| FACILITY NO. NMU000061 | § | Docket No. VI-93-1611 |

STATUTORY AUTHORITY

1. This Administrative Complaint is issued under the authority vested in the Administrator of the U.S. Environmental Protection Agency ("EPA") by Section 309(g)(2)(A) of the Clean Water Act ("Act"), 33 U.S.C. § 1319(g)(2)(A). The Administrator has delegated this authority to the Regional Administrator of EPA, Region 6, who in turn has delegated it to the Water Management Division Director of EPA, Region 6 ("Complainant").

2. Pursuant to Section 309(g)(2)(A) of the Act, and in accordance with the proposed "Consolidated Rules of Practice Governing Class I Civil Penalties Under the Clean Water Act", 56 Fed. Reg. 29,996 (July 1, 1991) ("Part 28"), Complainant hereby requests that the Regional Administrator assess a civil penalty against B & E, Inc., ("Respondent") for the unlawful discharge of a pollutant into navigable waters in violation of Section 301(a) of the Act, 33 U .S.C. § 1311(a) without authorization by a National Pollutant Discharge Elimination System ("NPDES") permit in violation of certain terms and conditions of an NPDES permit issued by EPA pursuant to Section 402 of the Act, 33 U.S.C. § 1342.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6

| | | |
|---|---|---|
| IN THE MATTER OF | § | ADMINISTRATIVE COMPLAINT |
| B & E, INC.<br>P. O. Box 2292<br>Hobbs, New Mexico 88240 | § | Proceeding to Assess Class 1 Civil Penalty Under Section 309(g) of the Clean Water Act |
| | § | Docket No. VI-93-1611 |
| FACILITY NO. NMU000061 | § | |

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2. Pursuant to Section 309(g)(2)(A) of the Act, and in accordance with the proposed "Consolidated Rules of Practice Governing Class I Civil Penalties Under the Clean Water Act", 56 Fed. Reg. 29,996 (July 1, 1991) ("Part 28"), Complainant hereby requests that the Regional Administrator assess a civil penalty against B & E, Inc., ("Respondent") for the unlawful discharge of a pollutant into navigable waters in violation of Section 301(a) of the Act, 33 U .S.C. § 1311(a) without authorization by a National Pollutant Discharge Elimination System ("NPDES") permit in violation of certain terms and conditions of an NPDES permit issued by EPA pursuant to Section 402 of the Act, 33 U.S.C. § 1342.

ALLEGATIONS

3. Respondent is a corporation organized under the laws of New Mexico, with a place of business located in Eddy County, New Mexico, and is a "person" within the meaning of Section 502(5) of the Act, 33 U.S.C. § 1362(5).

4. Respondent owns and operates a trucking company located in Eddy County, New Mexico ("the facility"), which is, and was at relevant times, a "point source" within the meaning of Section 502(14) of the Act, 33 U.S.C. § 1362(14).

5. Section 301(a) of the Act, 33 U.S.C. § 1311(a), prohibits the discharge of pollutants into the navigable waters of the United States, except in compliance with certain sections of the Act.

6. During the period from April 1991 through January 1992, the Respondent discharged from the facility oil field produced waters to Laguna Quatro, which is a "navigable water" within the meaning of Section 502(7) of the Act, 33 U.S.C. § 1362(7).

Produced water is a "pollutant" within the meaning of Section 502(6) of the Act, 33 U.S.C. § 1362(6).

7. At no time did the Respondent have an NPDES permit for the discharges described above in Paragraph 6.

PROPOSED PENALTY

Based on the foregoing Allegations, and pursuant to the authority of Section 309(g)(2)(A) of the Act, the Complainant proposes that the Regional Administrator assess administrative penalties against Respondent in the amount of $25,000.

OPPORTUNITY TO REQUEST HEARING

The Respondent may, pursuant to Section 309(g) of the Act, request a hearing on the proposed penalty assessment. The procedures for hearing, if one is requested, are set out in Part 28, a copy of which is attached with this Complaint.

In order to be entitled to a hearing under the Act, the Respondent must file a Response within thirty (30) days after receipt of this Administrative Complaint to:

Regional Hearing Clerk (6C)
U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

The Response must be signed by the Respondent and contain all the information required by Section 28.2(u) of Part 28, including the name, address, and telephone number of Respondent and, if represented by counsel, the same information concerning counsel. The Respondent must also either (1) admit liability; or, (2) deny liability in whole or in part and specify each allegation of fact or conclusion of law as to liability which is in dispute and the specific factual or legal grounds for your defense; and, (3) oppose or agree to pay the proposed penalty in this Administrative Complaint.

If not already designated, the Regional Administrator shall designate a Presiding Officer for this action no later than twenty (20) days after this Administrative Complaint has been served. The Presiding Officer shall rule on all motions submitted by parties, and will set the time and place for further proceedings in the action, including any hearing on penalty and/or liability.

The Respondent will be deemed to have admitted each allegation in the Administrative Complaint and will have waived its opportunity to appear in this action for any purpose, including contesting any default finding, if it does not, within thirty (30) days, either (1) file a Response as described in Part 28; (2) file a settlement of the case reached with the Complainant; (3) receive an extension from the Complainant to file the response; or, (4) certify to the Hearing Clerk that it has made a penalty settlement offer to the Complainant.

The Complainant is authorized to extend the deadline for the Respondent to file a Response for up to ninety (90) additional days in order to assist settlement. If the Respondent makes a penalty settlement offer before thirty (30) days following receipt of the Administrative Complaint have elapsed, its time for filing its Response is extended for an additional thirty (30) days. There are no other ways to receive an extension of the filing deadline for the Response.

INFORMAL CONFERENCE

The Respondent may request an informal conference with the Complainant concerning the alleged violations and the amount of the proposed penalty. The Respondent's request for an informal conference does not extend the thirty (30) day period in which it must submit a written Response in order to preserve its right to a liability hearing. To request an informal conference relating to this Administrative Complaint, you should contact Mr. Jim Collins at (214) 655-2128.

Date: FEB 12 1993

RC. Hartung

Roger C. Hartung
Chief
Enforcement Branch (6W-E)
Water Management Division
1445 Ross Avenue
Dallas, Texas 75202-2733

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6

| | | |
|---|---|---|
| IN THE MATTER OF | § | |
| | § | CONSENT ORDER |
| B & E, INC. | § | |
| P. O. Box 2292 | § | |
| Hobbs, New Mexico 88240 | § | DOCKET NO. VI-93-1611 |
| | § | |
| FACILITY NO. NMU00006 | § | |
| | § | |

STATUTORY AUTHORITY

1. This Consent Order is issued under the authority vested in the Administrator of the U.S. Environmental Protection Agency ("EPA") by Section 309(g)(2)(A) of the Clean Water Act ("Act"), 33 U.S.C. § 1319(g)(2)(A). The Administrator has delegated this authority to the Regional Administrator of EPA, Region 6, who in turn has delegated it to the Water Management Division Director of EPA, Region 6. In accordance with the "Consolidated Rules of Practice Governing Class 1 Civil Penalties Under the Clean Water Act" ("Part 28"), the Director hereby issues this Consent Order.

STIPULATIONS AND FINDINGS

B & E, Inc., ("Respondent"), by its attorney or other authorized representatives stipulates, and EPA finds as follows:

2. On February 12, 1993, EPA issued an Administrative Complaint, Docket No. VI-93-1611, pursuant to Section 309(g)((2)(A) of the Act, alleging that Respondent was in violation of Section 301(a) of the Act, 33 U.S.C. § 1311(a), and proposing a penalty of $25,000. In the Administrative Complaint, EPA alleged that:

During the period of April 1991 through January 1992 the Respondent discharged oil field produced waters to Laguna Quatro.

2. On or about , EPA notified the public of Administrative Complaint, Docket No. VI-93-1611.

3. On February 12, 1993, the State of New Mexico was given an opportunity to consult with EPA regarding the assessment of an administrative penalty against the Respondent.

4. Respondent admits the jurisdictional allegations in the Administrative Complaint as set forth above and neither admits nor denies the specific violations alleged in the Administrative Complaint. Respondent waives its right to a hearing under Section 309(g)(2)(A) of the Act, and to appeal this Order under Section 309(g)(8) of the Act, 33 U.S.C. §1319(g)(8).

CONSENT ORDER

Based on the foregoing Stipulations and Findings, and under the authority of Section 309(g)(2)(A), EPA HEREBY ORDERS AND RESPONDENT HEREBY CONSENTS, that:

General Provisions

1. The provisions of this Consent Order shall be binding upon Respondent, its officers, directors, agents, servants, employees, and successors or assigns.

Ms. Ruth Gibson (6W-EA)
Water Management Division
Enforcement Branch
U.S. EPA, Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Mr. Jim Collins (6C-A)
Regional Counsel
U.S. EPA, Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

6. Docket No. VI-93-1611 should be clearly typed on the check to ensure credit.

7. Your adherence to these procedures will ensure proper credit when payments are received.

8. If EPA does not receive payment within thirty (30) days of the effective date, interest will accrue on the amount due from the due date at the current annual rate prescribed and published by the Secretary of the Treasury in the Federal Register and the Treasury Fiscal Requirements Manual Bulletin per annum through the date of payment.

9. If the payment is overdue, EPA will also impose a late-payment handling charge of $15, with an additional delinquent notice charge of $15 for each subsequent 30-day period. Finally, EPA will apply a six (6) percent per annum penalty on any principal amount not paid within ninety (90) days of the due date.

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397

TAKE PRIDE IN AMERICA

CONSERVATION DIVISION
RECEIVED
'93 FEB 22 AM 9 27

IN REPLY REFER TO:

1703 (064)

FEB 19 1993

New Mexico Oil Conservation Division
Attention: Roger Anderson
P.O. Box 2088
Santa Fe, NM 87504

RE: Scheduled meeting of the Phase I Site Investigation Report

Dear Mr. Anderson:

We would like to confirm that a meeting has been scheduled for discussion of the Phase I Site Investigation Report for the B&E, Inc. Tuzlu Kopek Disposal Facility. This meeting will take place on March 2, 1993 at 9:00 a.m. in the Bureau of Land Management, Roswell District Office Conference Room, 1717 W. Second St., Roswell, NM.

We are eager to meet with you and to proceed with the final closure of this facility. If you have any questions prior to this meeting, please do not hesitate to call Cate Cebrowski or Tim Kreager at (505) 622-9042.

Sincerely,

Leslie M. Cone

Leslie M. Cone
District Manager

cc:
Johnson and Gibbs
Attention: Mr. Jack Henry
First City Tower
1001 Fannin St., Suite 1200
Houston, Tx 77002

RETEC
REMEDIATION TECHNOLOGIES INC

1301 West 25th Street
Suite 406
Austin, Texas 78705
Telephone: (512) 477-8661
Facsimile: (512) 480-0113

January 18, 1993

Mr. Phil Withrow
B & E, Inc.
700 N. Shipp
Hobbs, New Mexico 88240

Re: Tuzlu Kopek Phase I Site Investigation Final Report

Dear Mr. Withrow:

Enclosed you will find a copy of the Phase I Site Investigation Report for the Tuzlu Kopek Disposal Facility, issued in final form. As required by the Bureau of Land Management (BLM), the report includes a Qualitative Human Health Risk Evaluation and Ecological Risk Assessment. The Human Health Risk Evaluation was implemented in accordance with the New Mexico Environmental Department's Risk Assessment guidelines memorandum. The Ecological Risk Assessment was implemented in accordance with the Interim Final guidance provided in the CERCLA document entitled Environmental Evaluation Manual (OSWER Directive 9285.7-01).

In accordance with a request by Mr. Jack Henry of Johnson & Gibbs, one copy of this report is being sent to Mr. Al Collar of the BLM and one copy is being sent to Mr. Roger Anderson of the New Mexico Oil Conservation Division (OCD).

Please contact me at (512)477-8661 with any questions regarding this report or any other matter related to this project. It has been a pleasure working with you on this site investigation project.

Sincerely,

Fred Closmann

Fred Closmann
(Project Manager)

Enclosure

cc: J. Henry (Johnson & Gibbs)
A. Collar (BLM)
R. Anderson (OCD)
R. Kabrick (RETEC)
M. Campbell (RETEC)

# SOUTHEAST NEW MEXICO PLAYA LAKES COORDINATING COMMITTEE

JULY 20, 1993
Carlsbad, NM

# TABLE OF CONTENTS

# BLMNEWS

NEW MEXICO•OKLAHOMA•TEXAS•KANSAS


Date July 8, 1993
Release No. 93-07-03

Contact Mary O'Keeffe
Phone 505-438-7507


## PLAYA INTERAGENCY/INDUSTRY GROUP TO MEET

The first public meeting of the Southeast New Mexico Playa Lakes Coordinating Committee will be held on Tuesday, July 20, 1993, at 9:00 a.m. in the Conference Room of the Carlsbad Resource Area Office located at 620 E. Greene, Carlsbad. The Committee will decide upon the investigative approach needed to determine the possible causes and solutions to the wildlife mortality problems in the region.

The Committee is the result of an interagency meeting held earlier this year concerning the wildlife mortality problems in the playa region of southeastern New Mexico. Chartered in May, the Committee's objective is to provide interagency and industry representation, coordination, consultation, technical assistance and advice to resolve the wildlife mortality problems. BLM Director Jim Baca said, "This Committee provides an excellent opportunity for ecosystem management with multi-agency and industry participation."

Members of the Committee are Monte Jordan, Committee Chair, Bureau of Land Management; Jennifer Fowler-Probst, U.S. Fish and Wildlife Service; Judith Espinosa, New Mexico Environmental Department; Bill Montoya, New Mexico Department of Game and Fish; Bill Lemay, New Mexico Energy, Mineral and Natural Resources Department; Jami Bailey, New Mexico Land Office; Marvin Watts and Walt Thayer represent the Potash Industry; and Frank Yates represents the Oil and Gas Industry.

Area. The public land protected by this closure is located at:

**Principal Meridian, Montana**

T. 1 S., R. 26 E.,
Sec. 30, Lot 10, SWSE;
Sec. 31, NWNE.

DATES: Comments will be accepted for 30 days following the date of publication of the closure in the **Federal Register**.

ADDRESSES: Interested parties may submit comments related to this closure to the Area Manager, BLM Billings Resource Area Office, 810 E. Main, Billings, Montana, 59105.

FOR FURTHER INFORMATION CONTACT: Billy G. McIlvain, Area Manager, BLM Billings Resource Area Office, 810 E. Main, Billings, Montana, 59105, or call (406) 657–6262.

SUPPLEMENTARY INFORMATION: Opening this area will require an opening order in the Federal Register and public participation. Authority for this action is outlined in sections 302, 303, and 310 of the Federal Land Policy and Management Act of October 21, 1976 (43 U.S.C. 1716) and Title 43 Code of Federal Regulations Subpart 8364 (43 CFR 8364.1). Any person who fails to comply with this closure is subject to arrest and a fine up to $1,000 or imprisonment not to exceed 12 months, or both. This closure applies to all persons except those persons authorized by the Bureau of Land Management.

**Arnold E. Dougan,**

*Acting District Manager.*

[FR Doc. 93–13672 Filed 6–9–93; 8:45 am]

BILLING CODE 4310–DN–M

[NV–050–93–4350–01]

## Las Vegas District Advisory Council Meeting

AGENCY: Bureau of Land Management, Department of the Interior Notice is hereby given in accordance with Public Law 920463 that a meeting of the Bureau of Land Management, Las Vegas District Advisory Council will be held July 9, 1993, from 9 a.m. to 3 p.m. in the BLM Las Vegas District Office, Las Vegas, Nevada.

The meeting agenda is as follows:

1. Introduction
2. Election of Chairman
3. Briefing on U.S. Fish and Wildlife Service Desert Tortoise Recovery Plan
4. District Issues Summary
5. Public Comment Period
6. Afternoon tour for Council members of Issues Areas

Advisory Council meetings are open to the public. Persons wishing to make oral comments to the Council must notify the District Manager, Bureau of Land Management, Las Vegas District, P.O. Box 26569, Las Vegas, NV 89126 prior to July 5, 1993.

Minutes of the meeting will be available on request.

Dated: May 26, 1993.

**Ben F. Collins,**

*District Manager, Las Vegas, NV.*

[FR Doc. 93–13647 Filed 6–9–93; 8:45 am]

BILLING CODE 4310–HC–M

[NM–060–4340–01]

## Southeast New Mexico Playa Lakes Coordinating Committee Meeting

AGENCY: Bureau of Land Management, Interior.

ACTION: Southeast New Mexico Playa Lakes Coordinating Committee Meeting.

DATES: Tuesday, July 20, 1993, beginning at 9 a.m.

FOR FURTHER INFORMATION CONTACT: Leslie M. Cone, District Manager, Bureau of Land Management, 1717 West 2nd Street, Roswell, NM 88201, (505) 622–9042.

SUPPLEMENTARY INFORMATION: The proposed agenda will include presentations by the research and interim mitigation/remediation workgroups on recommended proposals for investigation of wildlife mortality in the playa lakes area of southeast New Mexico. The meeting will be held at the Carlsbad Resource Area Office, 620 E. Greene, Carlsbad, New Mexico. Workgroup recommendations will be presented at 9 a.m. to the Southeast New Mexico Playa Lakes Coordinating Committee. Final decisions on proposals of the workgroups will be made by the Southeast New Mexico Playa Lakes Coordinating Committee. Summary minutes will be maintained in the Roswell District Office and will be available for public inspection during regular business hours (7:45 a.m.–4:30 p.m.) within 30 days following the meeting. Copies will be available for the cost of duplication.

**Leslie M. Cone,**

*District Manager.*

[FR Doc. 93–13686 Filed 6–9–93; 8:45 am]

BILLING CODE 4310–FB–M

[AZ–930–5410–10–A105; AZA 27352]

## Application for Conveyance of Mineral Interests

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice of receipt of application for conveyance of mineral interests, Yavapai County, Arizona.

SUMMARY: Notice is given that, pursuant to section 209b, Federal Land Policy and Management Act of 1976 (43 U.S.C. 1719(b)), Double Bar A Livestock Co., Inc., has applied to purchase the mineral estate described as follows:

**Gila and Salt River Meridian, Arizona,**

T. 11 N., R. 5 W.,
Sec. 27, W½NW¼;
Sec. 28, lots 1, 4, that portion of W½NE¼ not included in Patent No. 02–89–0007, November 4, 1988.

Containing 153 acres, more or less.

FOR FURTHER INFORMATION CONTACT: Evelyn Stob, Bureau of Land Management, Arizona State Office, P.O. Box 16563, Phoenix, Arizona 85011–6563, Phone (602) 650–0353.

SUPPLEMENTARY INFORMATION: Upon publication of this notice in the Federal Register, the mineral interests within the legal description given above will be segregated from the public land laws, including the mining laws. The segregative effect of the application shall terminate upon issuance of a conveyance document, final rejection of the application, or two years from the date of publication in the **Federal Register**, whichever occurs first.

Dated: June 2, 1993.

**Evelyn Stob,**

*Acting Chief, Branch of Lands Operations.*

[FR Doc. 93–13670 Filed 6–9–93; 8:45 am]

BILLING CODE 4310–32–M

[AZ–020–03–4210–04; AZA–25546]

## Realty Action Exchange of Public Land; Maricopa County, AZ

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice of Realty Action, Exchange.

SUMMARY: The Bureau of Land Management proposes to exchange public land in order to achieve more efficient management of the public land through consolidation of ownership and the acquisition of unique natural resource lands. All or part of the following described Federal lands, except those parcels lying within the Black Canyon Trail Cooperative Management Agreement Area, are being considered for disposal via exchange pursuant to section 206 of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1716:

**Gila and Salt River Base and Meridian, Maricopa County, Arizona**

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management

# CHARTER

## Southeast New Mexico Playa Lakes Coordinating Committee

1. OFFICIAL DESIGNATION: Southeast New Mexico Playa Lakes Coordinating Committee

2. COMMITTEE OBJECTIVES AND SCOPE: Provide interagency and Industry representation, coordination, consultation, technical assistance and advice to the Bureau of Land Management (BLM), U. S. Fish and Wildlife Service (FWS), New Mexico Environmental Department (NMED), New Mexico Energy, Minerals and Natural Resources Department (NMEM&NRD), New Mexico State Land Office (NMSLO), New Mexico Department of Game and Fish NM (NMDG&F), Potash Industry and Oil and Gas Industry concerning efforts to resolve wildlife mortality problems in the playa region of southeastern New Mexico.

3. PERIOD OF TIME NECESSARY FOR THE COMMITTEE'S ACTIVITIES: The need for the committee is expected to continue until such time as the wildlife mortality problems in the playa region of southeastern New Mexico are resolved. The Committee's continuation will be periodically reviewed and rechartered as deemed necessary by a majority of the signatory parties to the Charter.

4. OFFICIAL TO CHAIR COMMITTEE: The BLM State Director, New Mexico

5. ADMINISTRATIVE SUPPORT: Administrative support for activities of the Committee will be provided by the BLM State Director of New Mexico. BLM's administrative support role will be limited to meeting logistics, distribution of minutes from all meetings, and news releases concerning committee activities. All other financial support to complete Coordinating Committee responsibilities will be borne by the representative agency or industry.

6. DUTIES OF THE COMMITTEE: The Committee will be responsible for coordinating the necessary investigations and studies as well as mitigation measures needed to resolve the issue of wildlife mortality on the playas in southeastern New Mexico. The BLM is the lead agency for all Committee responsibilities.

7. COMMITTEE COMPOSITION: The membership of the Committee is as follows. Designated representatives may serve for any member.

Chairperson - Acting BLM State Director, Monte Jordan
NMED - Secretary, Judith Espinosa
NMDG&F - Director, Bill Montoya
NMSLO - Deputy Division Director, Jami Bailey
FWS - Jennifer Fowler-Propst
NMDEM&NR - Bill LeMay
Potash Industry - Marvin Watts
- Walt Thayer
Oil and Gas Industry - Frank Yates, Yates Petroleum, Corp.

The Committee will continue to review the need for possible additional membership on the Committee. If such a need is determined, additional members may be added as necessary.

7a. COMMITTEE WORK GROUPS: To facilitate the functioning of the Committee, a Planning Group was established whose primary responsibility would be to direct specific work groups. The initial Planning Group membership will be as follows or utilize designated representatives:

BLM - Leslie Cone, Roswell District Manager
FWS - Mark Wilson
NM Environmental Department - Jim Piatt
Potash Industry - Scott Vail
Oil and Gas Industry - Walter Dueease, Marathon Oil Co.

Two specific work groups have been established to date:

1. Research
2. Interim Mitigation/Remediation

The Research Work Group will be lead by FWS and the Interim Mitigation/Remediation Work Group by the BLM. Each Work Group will individually propose what they deem necessary to be considered to resolve the issue of wildlife mortality on playas in southeastern New Mexico.

It is hoped that the work of this coordinating committee will eliminate the need for law enforcement actions in the future. However, nothing in this agreement or the formation of the committee is intended to interfere with the statutory enforcement or regulatory responsibilities of any Federal or State agency.

This Charter is agreed to by the following Coordinating Committee Members:

| | Committee Member | Date |
|---|---|---|
| BLM | | 5/17/93 |
| NM Environmental Department | | |
| NM Department of Game & Fish | | |
| NM State Land Office | | |
| U.S. Fish & Wildlife Service | | |
| NM Energy, Minerals & Natural Resources | | |
| Potash Industry | | |
| | | |
| Oil & Gas Industry | | |

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management

STATEMENT OF MUTUAL GOALS

Southeast New Mexico Playa Lakes Coordinating Committee

WHEREAS, with the goals of improving the ecological conditions of playa lakes systems, resolving wildlife mortality problems and meeting identified common needs/requirements, State and Federal agencies, along with Industry, have joined together to form the SOUTHEAST NEW MEXICO PLAYA LAKES COORDINATING COMMITTEE; and

WHEREAS, the purpose of the SOUTHEAST NEW MEXICO PLAYA LAKES COORDINATING COMMITTEE is to organize an interactive partnership of State and Federal Government agencies, with industry, for the mutual benefit of each; and

WHEREAS, this partnership will benefit all participants by:

* Sharing scarce skills and disciplines
* Coordination of data gathering
* Fostering of communication
* Fostering well thought-out decisions
* Building awareness of the potential economic significance of decisions made

NOW, THEREFORE, we, the undersigned, hereby declare our commitment to the purposes and objectives of the SOUTHEAST NEW MEXICO PLAYA LAKES COORDINATING COMMITTEE and pledge our efforts and cooperation in resolution of playa lakes problems.

[signature] 5/17/93
Date

Date

Date

Date

Date

Date

Date

Date

Date

## SOUTHEAST NEW MEXICO PLAYA LAKE
## COORDINATING COMMITTEE
## MAILING LIST

Ms. Jami Baily
Deputy Director
Oil, Gas, & Minerals Division
State Land Office
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Santa Fe, NM 87504-1148
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Ms. Judith Espinosa
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Santa Fe, NM 87502
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Mr. Bill LeMay
Director
Oil Conservation Division
New Mexico Energy, Minerals,
and Natural Resources Dept.
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Mr. Bill Montoya
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Ms. Jennifer Fowler-Propst
Field Supervisor
NM Ecological Services Field Office
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Mr. Walt Thayer
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P. O. Box 712
Carlsbad, NM 88220
Phone: **887-2871, FAX: 887-0589**

Mr. Marvin Watts
Eddy Potash Company
P. O. Box 31
Carlsbad, NM 88220
Phone: **887-2844, FAX: 885-0374**

New Mexico Oil and Gas Association
Attention: Mr. Frank Yates
Yates Petroleum Corporation
105 S. Fourth St.
Artesia, NM 88210
Phone: **748-1471, FAX: 746-2604**

Planning Group

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FAX (505) 622-9042

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FAX (505) 883-7876

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FAX (505) 622-9042

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Interim Mitigation/Remediation Workgroup

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FAX (505) 887-0374

Frank Gray
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Midland, TX 79702
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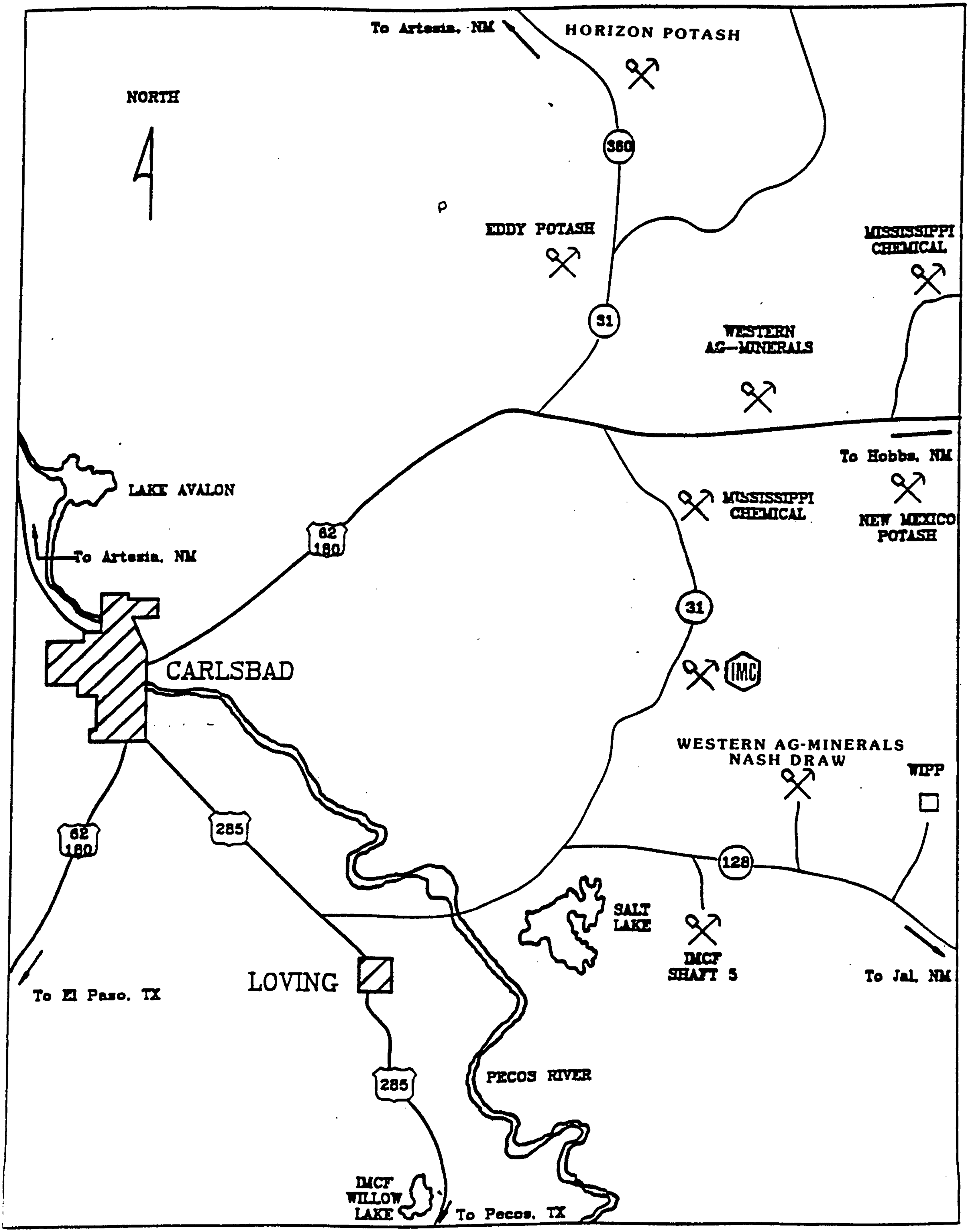
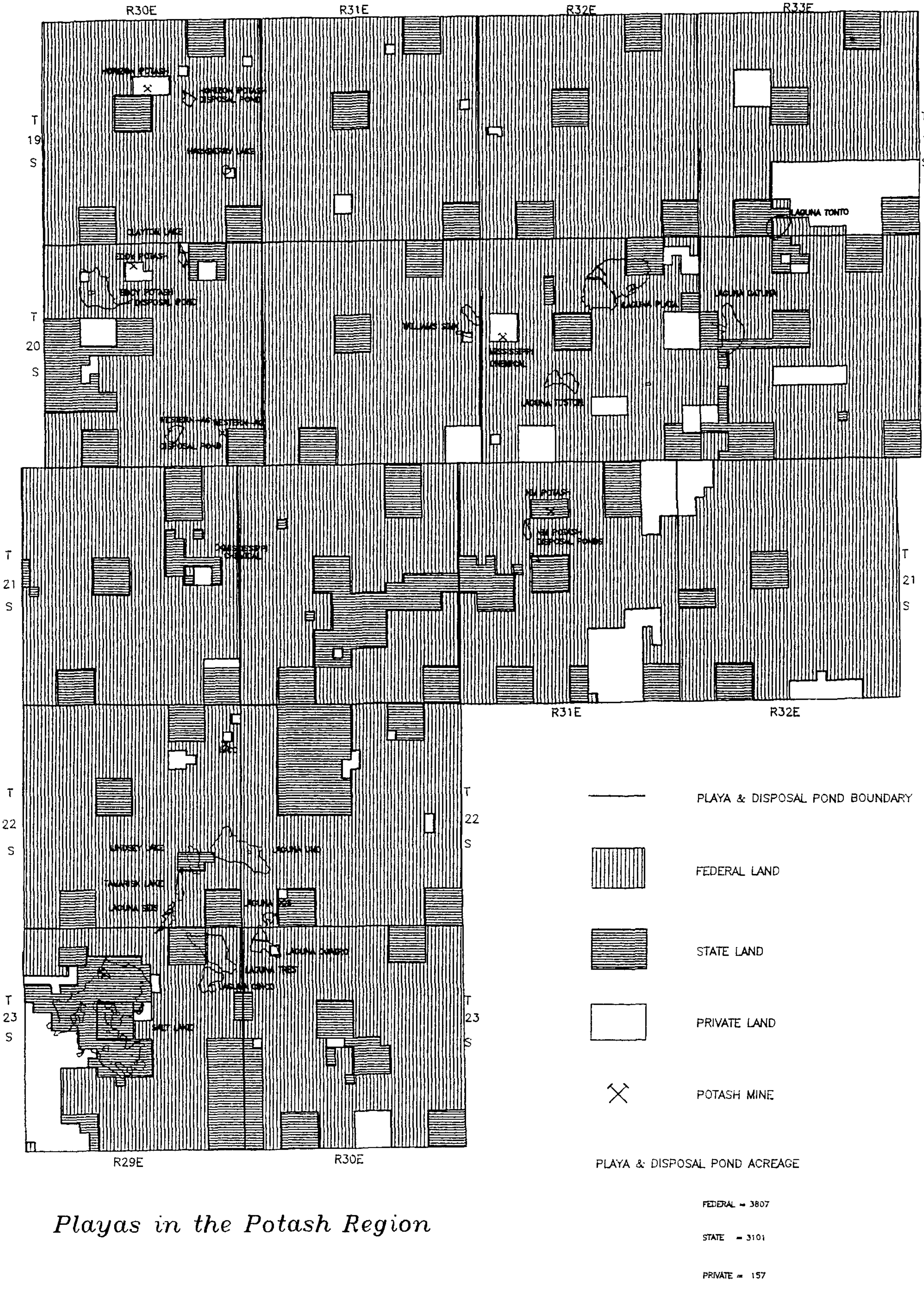
FAX (915) 688-4891

Tony Herrell
Bureau of Land Management
620 E. Greene
Carlsbad, NM 88220
(505) 887-6544
FAX (505) 885-9264 or 887-0419




**CURRENT POTASH MINE OPERATORS**




*Playas in the Potash Region*

SCALE 1: 90000

SOUTHEAST NEW MEXICO PLAYA LAKES COORDINATING COMMITTEE

INVESTIGATION/MITIGATION ACTION PLAN

JULY 20, 1993

## INVESTIGATION/MITIGATION ACTION PLAN

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# SOUTHEAST NEW MEXICO PLAYA LAKES COORDINATING COMMITTEE

## INVESTIGATION/MITIGATION ACTION PLAN

### I. HISTORICAL OVERVIEW

Potash mining and intensive mineral development in southeastern New Mexico has existed for over 60 years. This area is known as the Secretary's Potash Area and has been utilized intensively for development of mineral resources including potash, oil and gas. Development of oil and gas resources started in the mid to late 1920's and potash mining activity originated in the early 1930's. Environmental consequences were given little consideration during the early periods of mineral development in the semiarid regions of the southwest. Natural resources available for industrial purposes were utilized for development. This was a common practice at the time and not considered harmful.

Environmental awareness became a major concern in the 1970's and has continued through to the present with law, regulation and policy standards becoming part of everyday activity for small business, industry and state and federal agencies. An Environmental Assessment Record (EAR) was prepared for the potash mines in the mid 1970's. The primary focus of this effort was water quality and did not address the affects on wildlife. In the early 1990's bird mortality was discovered by the US Fish and Wildlife Service on some of the playa lakes in the Secretary's Potash Area in southeast New Mexico. Wildlife mortality was primarily associated with three playa lakes, Salt Lake (aka Laguna Grande del Sal), Laguna Toston, and Laguna Gatuna. Of the three playa lakes, only Laguna Toston received water from potash mining activities. Laguna Gatuna was historically used by the Oil and Gas Industry and Laguna Grande del Sal is currently used for commercial salt extraction.

The U.S. Fish and Wildlife Service and New Mexico Department of the Environment initiated studies in the Secretary's Potash Area. The Bureau of Land Management (BLM) and the potash industry provided historic water data from mining and mineral development. Federal, state and industry concerned about the past uses of the playa lakes and possible environmental effects met in Albuquerque, New Mexico, at an interagency forum in March 1993. That meeting lead to the formation of an interagency organization known as the Southeast New Mexico Playa Lakes Coordinating Committee. The goals and objectives of this committee were to resolve wildlife mortality problems through investigations and mitigative action.

Since March 1993, by direction of the interagency committee, a planning group supported by two workgroups (research and interim mitigation/remediation) have been developing the objectives needed to continue investigation/mitigation actions in the playa lakes region.

# II. ACTION PLAN

## A. CAUSES OF MORTALITY

1. Pathological, Physiological and/or Physical Mortality Factors - The primary objective as defined by the workgroups is to determine the cause(s) of death to wildlife. At various playa lake sites throughout the area or other locations of a similiar nature, establish pathological studies such as confinement areas with captively raised birds to evaluate percent and magnitude of mortality, causes of mortality and percentage of unaccounted losses to pond bottoms. Body chemistry analysis would be conducted on all birds during the study to determine changes in body condition and isolate compounds causing mortality. This work would also include literature review of similiar occurences. May include off-site laboratory trials with game farm mallards exposed to reconstituted water matching chemistry of playa lakes. Laboratory testing requires a considerable amount of time and accounts for portions of the timeframes. Studies of this nature would normally cover a two to four year period with cost ranging from $250,000 to $500,000.

2. Literature Review and Summary - In development of research related initiatives, a review and summation of previously quantified information is essential to establishing the levels of knowledge that currently exist and a basis for further investigations. Both workgroups felt that a literature review and summary of information on water quality, hydrology, playa lake ecology, bird mortality, potash and oil and gas industry operations would assist all playa lake related research efforts. A literature review and summary of the playa lakes region would be expected to take from six months to a year to complete at a cost of $25,000 to $50,000.

3. Extent of Problem Areas and Site-Specific Differences - The Secretary's Potash Area/playa lake region covers approximately 500,000 acres and contains numerous playa lakes. A significant amount of wildlife mortality has been observed at three playa lakes; Laguna Toston, Laguna Gatuna, and Salt Lake. Data has not been systematically collected to determine the amount, timing, and areal extent of wildlife use and mortality on other playa lakes within the Secretary's Potash Area. It is unknown whether the higher mortality levels of the three playa lakes are due to industrial impacts, natural variation among playa lakes, disproportionately high use by wildlife, more frequent observations of these playa lakes, or a combination of these factors and others. Research on diurnal, seasonal and long-term variation in playa lake habitat, wildlife use, and mortality are essential information for solving the wildlife mortality problem. Methods may include (but are not limited to): bi-annual aerial census of bird use, evaluation of playa lakes for water chemistry, wildlife use, human impacts,

history, plant/animal communities, monitoring of bird behavior, banding of waterfowl and use of Geographic Information System (GIS) to overlay and interpret data. A survey of a significant number (20) of playa lakes within the region would require from three to four years to complete at a cost of $250,000 to $500,000.

B. MITIGATION/REMEDIATION

1. Interim Mitigation

a. Laguna Toston Determent Activities - In 1991/1992 a significant amount of wildlife mortality was observed occurring on Laguna Toston. In cooperation with the BLM, New Mexico Potash Corporation began interim mitigation by conducting determent activities on Laguna Toston. Determent activities used on Laguna Toston and at other locations throughout the United States have included netting, flagging, decoys, noise makers and the use of boats to deter birds from loafing on the lakes. Due to the size of the lakes in the Secretary's Potash Area, noise makers and boats have shown to be the most successful in determent of waterfowl. Technical assistance was solicited from the New Mexico Department of Game and Fish. Interim mitigation is proposed to continue at Laguna Toston during the periods of peak use (October thru April) or other periods as needed. A bird-handling permit from the U.S. Fish and Wildlife Service would be obtained by New Mexico Potash Corporation so that birds showing signs of illness can be captured, cared for and released into favorable habitat. Interim mitigation would begin again at Laguna Toston in the fall of 1993, with New Mexico Potash Corporation upgrading its boat capabilities (size and h.p. rating) and hiring an attendant for the facility. The interim mitigation measures would have an estimated one time cost in 1993 of approximately $60,000 and an annual recurring cost of about $30,000.

b. On-Site Mitigation at Laguna Toston - It is not known whether development of on-site alternative habitat would draw more wildlife to the area and/or be beneficial to wildlife that would continue to use the area. Both Workgroups and the Planning Group recommend on-site development of alternative habitat and its evaluation in the investigative process (#3 - Extent of Problem Areas) to determine its effects. Moist soil management techniques or small fresh water lakes would be created to provide food and fresh water sources for wildlife. On-site development would initially take place adjacent to Laguna Toston on approximately a four-acre area. The site can be developed starting in the fall of 1993 by flooding the area. Moist soil management would begin in the spring of 1994. New Mexico Potash Corporation would be cooperating in the development of this project by providing the fresh water and constructing the site. Initial cost would be approximately $8000 and require an annual commitment of up to four acre feet of water. This is the only test site currently being considered for development. Other sites exist in the area and could be developed at a later date, if this site is successful.

2. Monitoring/Evaluation - The effects of interim mitigation activities are an essential part of the investigation/mitigation action plan and would be monitored and evaluated at Laguna Toston as part of the causes of mortality studies (#3 - Extent of Problem Areas). All the playa lakes, including Laguna Toston would be evaluated using the same criteria. New Mexico Potash Corporation personnel tending Laguna Toston would record the data.

3. Long Term Mitigation/Remediation

a. Off-Site - Off-site alternative habitat development could possibly be another long term solution in or around the Secretary's Potash Area. This alternative could be addressed through an off-site mitigation process. Alternative habitat enhancement has been one of the tools available to achieve compensation for unavoidable project related resource losses. If the investigation plan reveals that bird mortality is naturally occurring, other mitigative measures may be considered.

b. On-Site - The factors causing wildlife mortality in the Secretary's Potash Area are unknown at this time. The investigation plan is designed to identify causative factors responsible for wildlife mortality, and at that time, mitigation and/or remediation actions would be determined, assessed and implemented.

INVESTIGATION/MITIGATION ACTION PLAN

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Environmental awareness became a major concern in the 1970's and has continued through to the present with law, regulation and policy standards becoming part of everyday activity for small business, industry and state and federal agencies. An Environmental Assessment Record (EAR) was prepared for the potash mines in the mid 1970's. The primary focus of this effort was water quality and did not address the affects on wildlife. In the early 1990's bird mortality was discovered by the US Fish and Wildlife Service on some of the playa lakes in the Secretary's Potash Area in southeast New Mexico. Wildlife mortality was primarily associated with three playa lakes, Salt Lake (aka Laguna Grande del Sal), Laguna Toston, and Laguna Gatuna. Of the three playa lakes, only Laguna Toston received water from potash mining activities. Laguna Gatuna was historically used by the Oil and Gas Industry and Laguna Grande del Sal is currently used for commercial salt extraction.

The U.S. Fish and Wildlife Service and New Mexico Department of the Environment initiated studies in the Secretary's Potash Area. The Bureau of Land Management (BLM) and the potash industry provided historic water data from mining and mineral development. Federal, state and industry concerned about the past uses of the playa lakes and possible environmental effects met in Albuquerque, New Mexico, at an interagency forum in March 1993. That meeting lead to the formation of an interagency organization known as the Southeast New Mexico Playa Lakes Coordinating Committee. The goals and objectives of this committee were to resolve wildlife mortality problems through investigations and mitigative action.

Since March 1993, by direction of the interagency committee, a planning group supported by two workgroups (research and interim mitigation/remediation) have been developing the objectives needed to continue investigation/mitigation actions in the playa lakes region.

## II. ACTION PLAN

### A. CAUSES OF MORTALITY

1. Pathological, Physiological and/or Physical Mortality Factors - The primary objective as defined by the workgroups is to determine the cause(s) of death to wildlife. At various playa lake sites throughout the area or other locations of a similiar nature, establish pathological studies such as confinement areas with captively raised birds to evaluate percent and magnitude of mortality, causes of mortality and percentage of unaccounted losses to pond bottoms. Body chemistry analysis would be conducted on all birds during the study to determine changes in body condition and isolate compounds causing mortality. This work would also include literature review of similiar occurences. May include off-site laboratory trials with game farm mallards exposed to reconstituted water matching chemistry of playa lakes. Laboratory testing requires a considerable amount of time and accounts for portions of the timeframes. Studies of this nature would normally cover a two to four year period with cost ranging from $250,000 to $500,000.

2. Literature Review and Summary - In development of research related initiatives, a review and summation of previously quantified information is essential to establishing the levels of knowledge that currently exist and a basis for further investigations. Both workgroups felt that a literature review and summary of information on water quality, hydrology, playa lake ecology, bird mortality, potash and oil and gas industry operations would assist all playa lake related research efforts. A literature review and summary of the playa lakes region would be expected to take from six months to a year to complete at a cost of $25,000 to $50,000.

3. Extent of Problem Areas and Site-Specific Differences - The Secretary's Potash Area/playa lake region covers approximately 500,000 acres and contains numerous playa lakes. A significant amount of wildlife mortality has been observed at three playa lakes; Laguna Toston, Laguna Gatuna, and Salt Lake. Data has not been systematically collected to determine the amount, timing, and areal extent of wildlife use and mortality on other playa lakes within the Secretary's Potash Area. It is unknown whether the higher mortality levels of the three playa lakes are due to industrial impacts, natural variation among playa lakes, disproportionately high use by wildlife, more frequent observations of these playa lakes, or a combination of these factors and others. Research on diurnal, seasonal and long-term variation in playa lake habitat, wildlife use, and mortality are essential information for solving the wildlife mortality problem. Methods may include (but are not limited to): bi-annual aerial census of bird use, evaluation of playa lakes for water chemistry, wildlife use, human impacts,

history, plant/animal communities, monitoring of bird behavior, banding of waterfowl and use of Geographic Information System (GIS) to overlay and interpret data. A survey of a significant number (20) of playa lakes within the region would require from three to four years to complete at a cost of $250,000 to $500,000.

B. MITIGATION/REMEDIATION

1. Interim Mitigation

a. Laguna Toston Determent Activities - In 1991/1992 a significant amount of wildlife mortality was observed occurring on Laguna Toston. In cooperation with the BLM, New Mexico Potash Corporation began interim mitigation by conducting determent activities on Laguna Toston. Determent activities used on Laguna Toston and at other locations throughout the United States have included netting, flagging, decoys, noise makers and the use of boats to deter birds from loafing on the lakes. Due to the size of the lakes in the Secretary's Potash Area, noise makers and boats have shown to be the most successful in determent of waterfowl. Technical assistance was solicited from the New Mexico Department of Game and Fish. Interim mitigation is proposed to continue at Laguna Toston during the periods of peak use (October thru April) or other periods as needed. A bird-handling permit from the U.S. Fish and Wildlife Service would be obtained by New Mexico Potash Corporation so that birds showing signs of illness can be captured, cared for and released into favorable habitat. Interim mitigation would begin again at Laguna Toston in the fall of 1993, with New Mexico Potash Corporation upgrading its boat capabilities (size and h.p. rating) and hiring an attendant for the facility. The interim mitigation measures would have an estimated one time cost in 1993 of approximately $60,000 and an annual recurring cost of about $30,000.

b. On-Site Mitigation at Laguna Toston - It is not known whether development of on-site alternative habitat would draw more wildlife to the area and/or be beneficial to wildlife that would continue to use the area. Both Workgroups and the Planning Group recommend on-site development of alternative habitat and its evaluation in the investigative process (#3 - Extent of Problem Areas) to determine its effects. Moist soil management techniques or small fresh water lakes would be created to provide food and fresh water sources for wildlife. On-site development would initially take place adjacent to Laguna Toston on approximately a four-acre area. The site can be developed starting in the fall of 1993 by flooding the area. Moist soil management would begin in the spring of 1994. New Mexico Potash Corporation would be cooperating in the development of this project by providing the fresh water and constructing the site. Initial cost would be approximately $8000 and require an annual commitment of up to four acre feet of water. This is the only test site currently being considered for development. Other sites exist in the area and could be developed at a later date, if this site is successful.

2. Monitoring/Evaluation - The effects of interim mitigation activities are an essential part of the investigation/mitigation action plan and would be monitored and evaluated at Laguna Toston as part of the causes of mortality studies (#3 - Extent of Problem Areas). All the playa lakes, including Laguna Toston would be evaluated using the same criteria. New Mexico Potash Corporation personnel tending Laguna Toston would record the data.

3. Long Term Mitigation/Remediation

a. Off-Site - Off-site alternative habitat development could possibly be another long term solution in or around the Secretary's Potash Area. This alternative could be addressed through an off-site mitigation process. Alternative habitat enhancement has been one of the tools available to achieve compensation for unavoidable project related resource losses. If the investigation plan reveals that bird mortality is naturally occurring, other mitigative measures may be considered.

b. On-Site - The factors causing wildlife mortality in the Secretary's Potash Area are unknown at this time. The investigation plan is designed to identify causative factors responsible for wildlife mortality, and at that time, mitigation and/or remediation actions would be determined, assessed and implemented.

# PHASE I SITE INVESTIGATION REPORT FOR THE B & E, INC. TUZLU KOPEK DISPOSAL FACILITY


RECEIVED

JAN 21 1993

OIL CONSERVATION DIV.
SANTA FE


*Prepared for:*

B & E, Inc.
Eddy County, New Mexico

*Prepared by:*


Remediation Technologies, Inc.
Austin, Texas


RETEC Project No.: 3-1017

January 1993

RETEC
REMEDIATION
TECHNOLOGIES INC

# PHASE I SITE INVESTIGATION REPORT FOR THE B & E, INC. TUZLU KOPEK DISPOSAL FACILITY

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# 1.0 INTRODUCTION

Presented in this report are the results of the Phase I environmental investigation at the B & E, Inc. (B & E) Tuzlu Kopek disposal facility at E/W NESE Section 6 T 225 R 30E Eddy County, New Mexico. The Phase I investigation was implemented in accordance with the objectives and tasks outlined in the document Work Plan to Conduct Phase I Environmental Investigation at the B & E Tuzlu Kopek Disposal Facility, prepared by Remediation Technologies, Inc. (RETEC) in September 1992. That document will be referred to herein as the Work Plan.

The Work Plan was prepared in response to a Bureau of Land Management (BLM) letter to Mr. Phil Withrow of B & E (January 23, 1992) requiring a final resolution of disposal activities. Specifically, the letter, which is included in Appendix A, called for the removal and remediation of two trespass pits on public land.

## 1.1 SITE HISTORY

The site is a primary exploration and production waste disposal facility located at E/W NESE Section 6 T 225 R 30E Eddy County, New Mexico (Figure 1-1). The facility accepted produced waters and brine fluids from oil and gas wells and other residues from the cleanout of frac tanks. The site was operated by B & E from 1982 until 1989, at which time the BLM discovered that a portion of the disposal facility was constructed on public land owned by the BLM. The BLM immediately requested that all pit operations on public land be discontinued. B & E immediately complied with this request.

Although the BLM (January 23, 1992) letter addressed two pits on public land, B & E submitted the Work Plan, which addressed three pits, and subsequently implemented the Phase I investigation outlined in that plan. That Work Plan is included as Appendix B of this document.

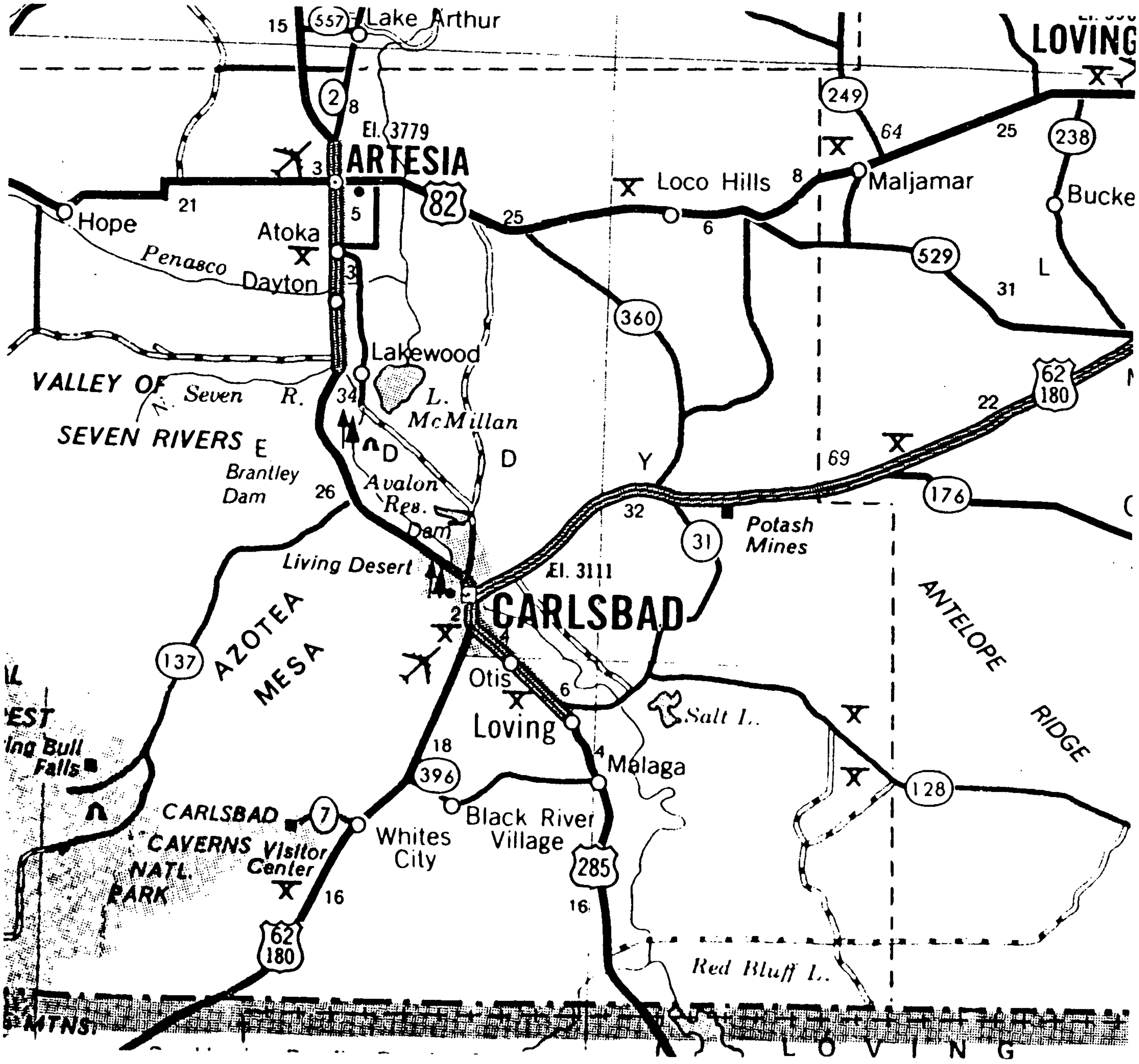


FIGURE 1-1
B & E TUZLU KOPEK SITE LOCATION MAP

The unlined earthen pits (Figure 1-2) addressed in the investigation have the following approximate dimensions, based on measurement from the inside edge of the pit berms:

| Pit Number | Length (feet) | Width (feet) | Area (acres) |
|---|---|---|---|
| 1 | 108 | 71 | 0.18 |
| 2 | 191 | 90 | 0.39 |
| 3 | 218 | 110 | 0.55 |

The depth of each of the pits varies, but is generally between 8 to 9 feet.

## 1.2 PREVIOUS INVESTIGATIONS

Geohydrology Associates, Inc. of Albuquerque, New Mexico conducted two separate studies of the hydrology of the Laguna Tres area of Eddy County, New Mexico. The documents generated from those studies are entitled Hydrologic Assessment, Laguna Tres Area, Eddy County, New Mexico (1982), and Reassessment of Hydrologic Conditions, Laguna Tres Area, Eddy County, New Mexico (1986). Both documents are included in Appendix C of this report. The Geohydrology studies were requested by B & E to determine the effects that might result from discharge of oil-field brines into existing brine lakes. A third study was performed by E.L. Reed & Associates, Inc. (July, 1985).

Other studies of the region include a previous Geohydrology Associates, Inc. detailed study conducted in 1979 which identified sources of brine entering the regional groundwater system and a study by Gilkey and Stotelmeyer (1965) which covered, in detail, the water supplies of the Nash Draw area. The earliest known studies of the area include those performed by Robinson and Lang (1938), Thomas (1963), and Mower and others (1964).

## 1.3 PHASE I SITE INVESTIGATION OBJECTIVES

The objectives of the Phase I site investigation were outlined in Section 1.2 of the Work Plan and generally addressed the areas of concern identified in the BLM letter to Mr. Withrow (January, 1992), as listed in Section 1.1 of the Work Plan. The objectives of the

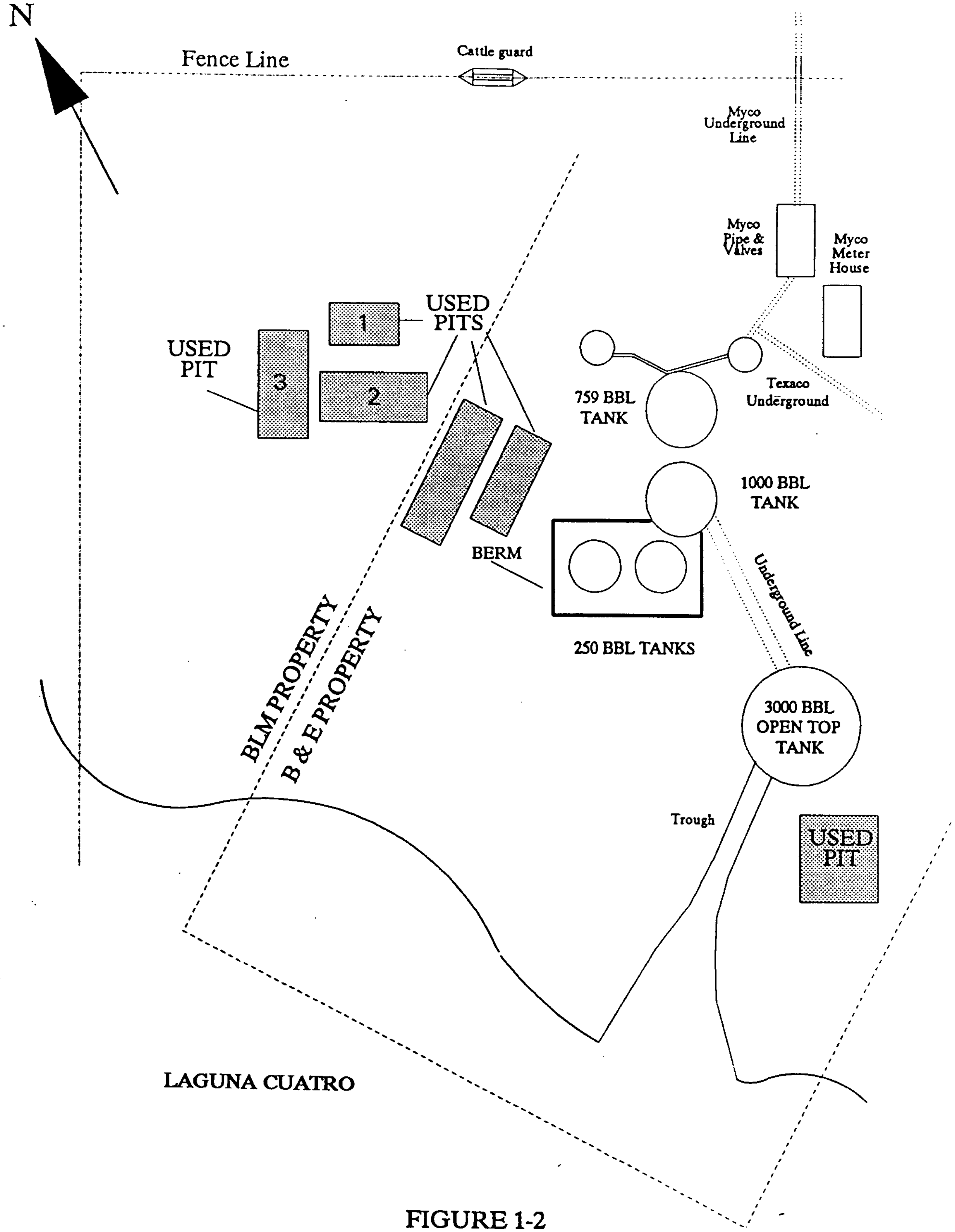


FIGURE 1-2
DETAIL OF B & E TUZLU KOPEK SITE
(Source: B & E Inc., Work Order #H89-06.126, Keystone - Houston)

Work Plan also satisfied the guidelines of the New Mexico Oil Conservation Division (OCD), as was practicable.

The objectives of the Phase I investigation were:

1. Conduct a site investigation at the disposal pits to identify the waste characteristics and volume and to determine the vertical and horizontal extent of waste constituent migration.

2. Develop a site specific Qualitative Human Health Risk Evaluation and site specific Ecological Risk Assessment.

3. Conduct a feasibility study to determine the most appropriate remedial alternative for site restoration.

Submittal of this report satisfies the above objectives.

# 2.0 PHASE I INVESTIGATION APPROACH

The Phase I investigation approach was structured to satisfy the objectives stated in Section 1.3. Section 2.1 describes the sampling and analytical program designed to characterize the waste pit materials. Section 2.2 discusses the activities designed to determine the horizontal and vertical extent of affected soils below and surrounding the three waste pits. Section 2.3 describes the basic tasks that were implemented in order to characterize the type of environmental receptors that can be observed at the Tuzlu Kopek disposal facility site.

## 2.1 PIT WASTE CHARACTERIZATION

In order to determine the constituents of interest (COI) and the extent of migration of those constituents from the three pits, pit waste sampling activities were conducted on site. All sampling was conducted in accordance with discussions with the BLM, and as set forth in the Standard Operating Procedure (SOP) included in Appendix D.

### 2.1.1 Pit Waste Characterization - Overall Composite

One overall pit composite waste sample was collected consisting of material from each of the three pits. Sludge/soil material was collected from the four different quadrants of each of the three pits and composited in a clean stainless steel mixing bowl. The soil was collected from the four locations within each pit with a hand trowel and spoon in a depth representative fashion over the interval of 0 to 1 foot. This overall composite sample was equally representative of the material present in the three different pits.

The overall composite sample was submitted to the laboratory for analyses for the following parameters:

- Appendix IX Constituents, excluding analyses for dioxins, herbicides, and pesticides, and
- Toxicity Characteristics Leachate Procedure (TCLP) - all metals.

### 2.1.2 Pit Waste Characterization - Individual Composites

Pit waste samples were collected from each pit at a frequency of four samples per pit using a hand trowel and spoon in the same fashion as described above (Section 2.1.1), and composited in a stainless steel mixing bowl to create one composite sample from each pit. The four discrete samples were collected from the four quadrants of each pit, as illustrated in Figure 2-1.

The individual pit waste composite samples were submitted to the laboratory for analyses for the following parameters:

- benzene, toluene, ethylbenzene, and xylenes (BTEX) (SW-846 Method 8020),
- metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver),
- total petroleum hydrocarbons (TPH), and
- ignitability, reactivity, and corrosivity.

BTEX and the metals constituents listed above represent the commonly detected constituents in oil and gas exploration and production wastes and are included in the New Mexico Water Quality Control Commission (NMWQCC) water quality standards. Testing for ignitability, reactivity, and corrosivity is required to determine whether the pit waste material can be hauled off site to an authorized nonhazardous waste disposal facility.

### 2.1.3 Background Soils Characterization

Soil samples were collected from two areas unimpacted by B & E's activities, as illustrated in Figure 2-2. These background samples were analyzed for the following parameters:

- BTEX (SW-846 Method 8020),
- metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver),
- calcium, magnesium, and iron, and
- TPH.

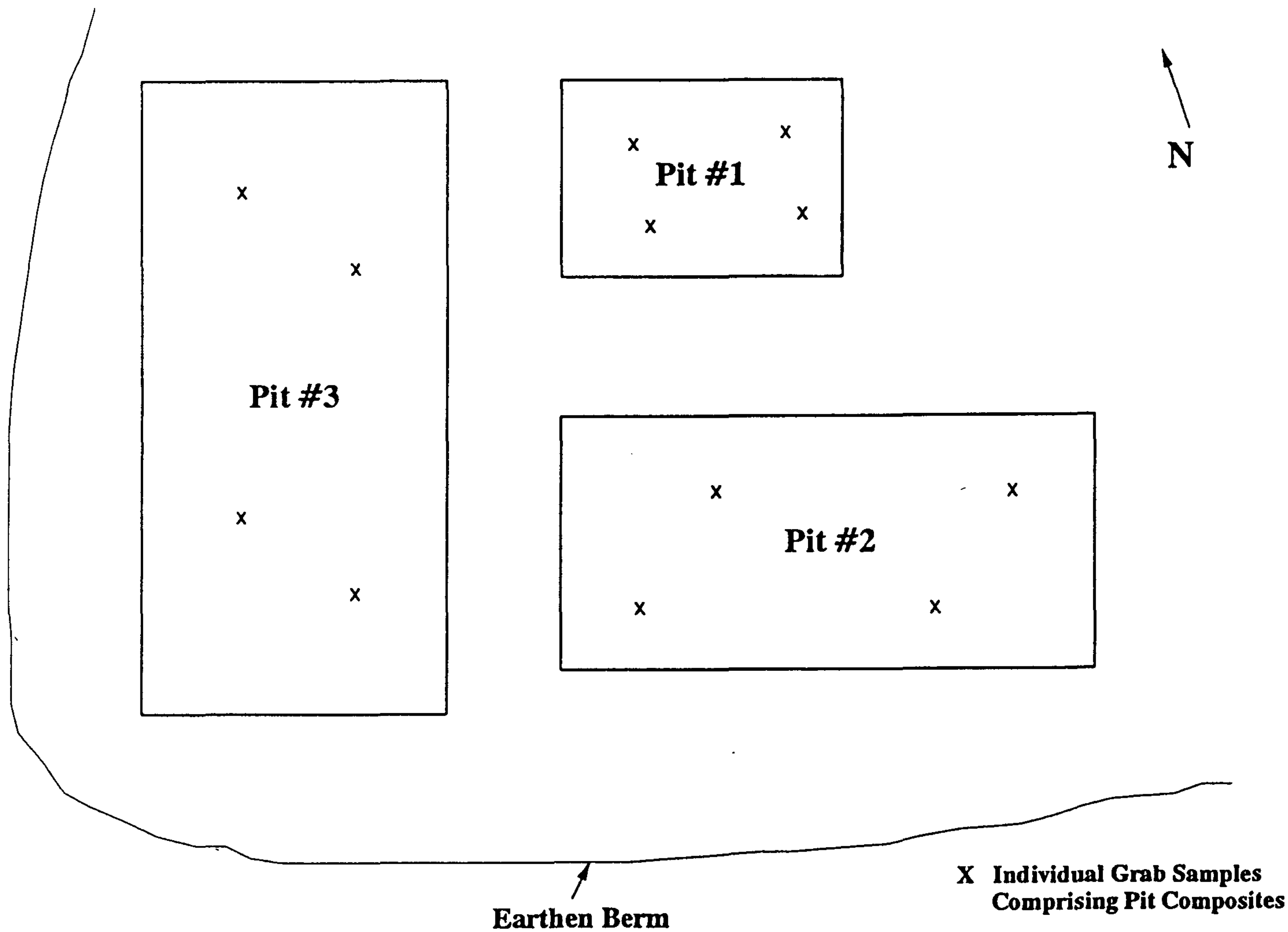


FIGURE 2-1
PIT COMPOSITE SAMPLE LOCATIONS

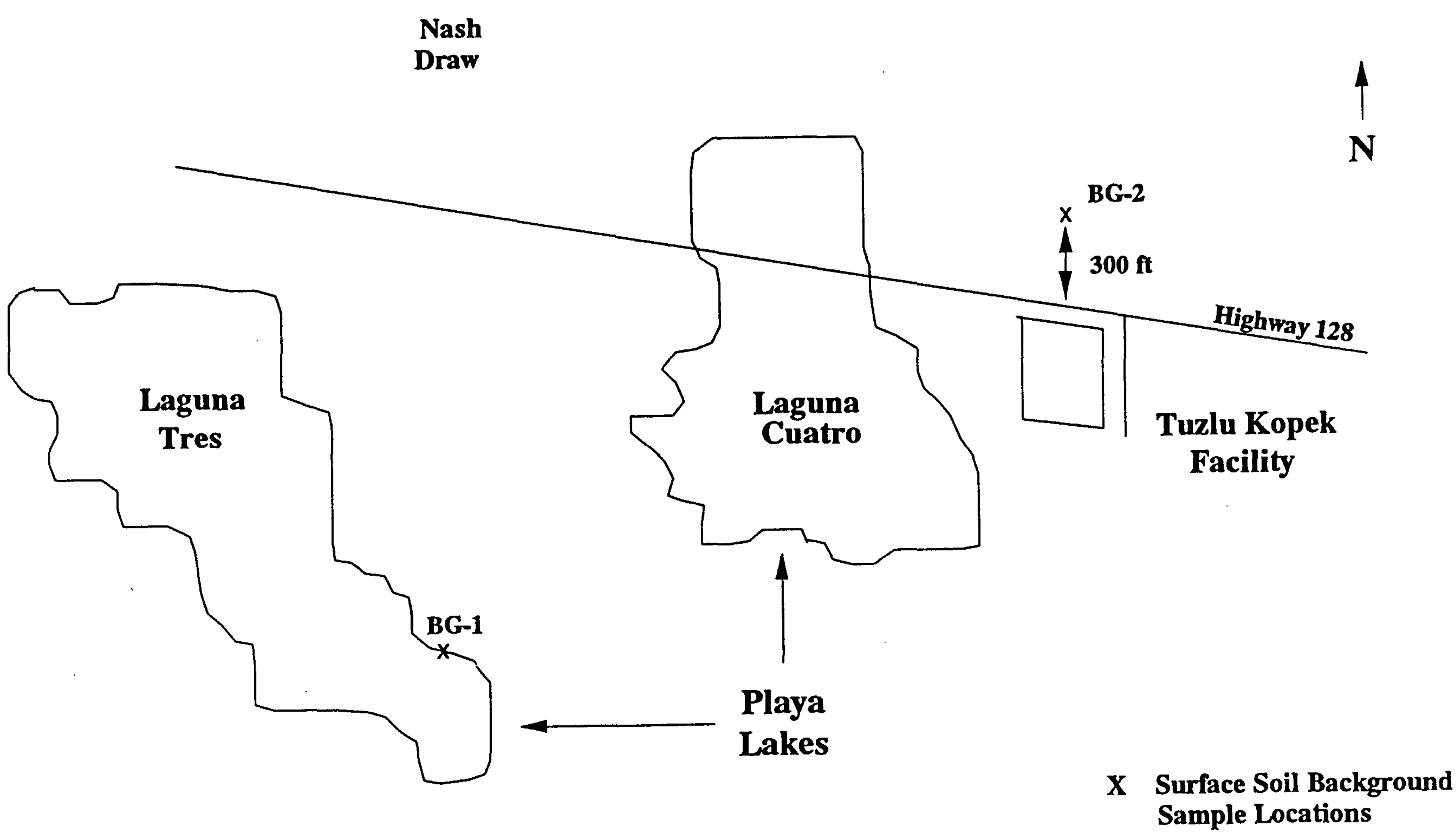


FIGURE 2-2
BACKGROUND SAMPLE LOCATION MAP

These analytical data were used to compare to the pit waste characterization data as well as to evaluate risk-based closure criteria.

The background samples were collected with a hand-trowel and spoon as depth-representative samples over the 0 to 1-foot depth interval at the two specified locations. One of the soil samples (BG-1) was collected at the water's edge of the Laguna Tres playa lake. This sample represents an area affected by the seasonal influences of the playa lake system. This sample was a fairly wet (possibly saturated) surface soil. The second sample (BG-2) was collected at a location approximately 300 feet north-east of the fence, which lies parallel and directly to the north of Highway 128. This location is well-distanced from any areas impacted by the seasonal influences and fluctuations of the playa lake system. Therefore, this sample represented the undisturbed dry caliche soil.

## 2.2 IDENTIFY HORIZONTAL AND VERTICAL EXTENT OF AFFECTED SOILS

The horizontal and vertical extent of impact to the soils by the source material in the three pits was determined by excavating trenches with a backhoe and defining the extent by visual observations and use of an HNu photoionization detector (PID) calibrated to benzene response to determine the presence of volatile organics.

### 2.2.1 Determination of Horizontal Extent of Contamination

The horizontal extent of affected soils was determined by excavating trenches in a horizontal direction from each pit. Figure 2-3 illustrates the location of the six trenches which were excavated to make these determinations. The trenches were excavated to the extent at which no visibly affected soils were observed. Samples were collected at one foot increments in an effort to determine the distance from the pits at which a soil headspace level of 100 ppm through HNu measurement would be reached, and the distance at which background levels would be reached. These samples were subjected to the HNu headspace measurement technique, as described in the field headspace analysis technique outlined in Guidelines for Surface Impoundment Closure, (New Mexico Oil Conservation Division (OCD), 1991). Those guidelines are included in Appendix E. The collected samples were placed into a clean jar of 16 ounces in volume (approximately 0.5 L) and immediately covered with aluminum foil. Using the outlined procedure, headspace organics measurements were made with the PID.

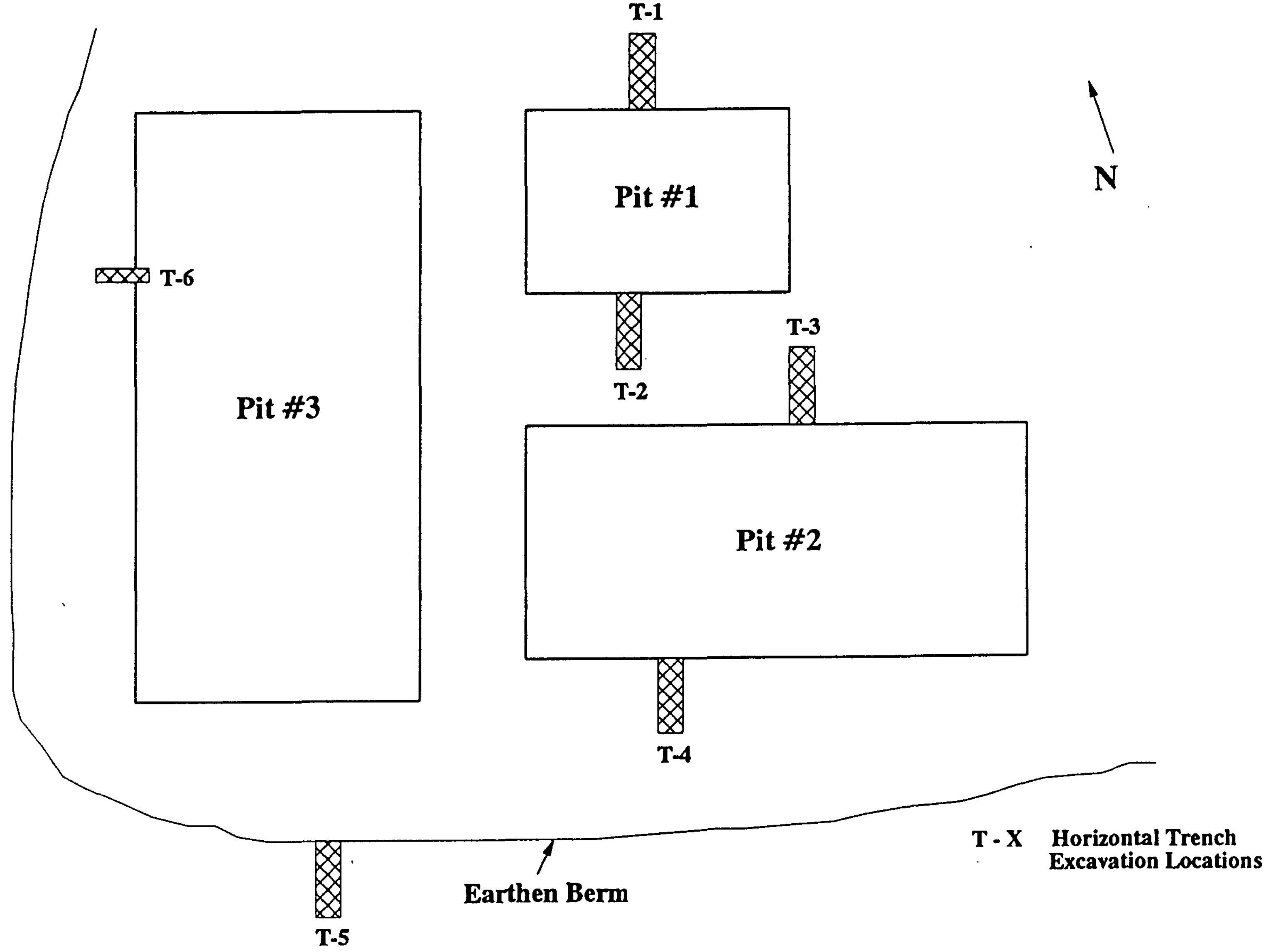


FIGURE 2-3
HORIZONTAL TRENCH LOCATIONS

When a PID response equal to background was determined, the respective samples were collected from each trench and submitted to the laboratory for confirmation analyses. The confirmation analyses included those parameters or constituents detected in the individual pit waste characterization analyticals. Consequently, these samples were assayed for the following parameters:

- BTEX, and
- TPH.

### 2.2.2 Determination of Vertical Extent of Contamination

One trench was initially excavated at the approximate center of each of the three waste disposal pits, as illustrated in Figure 2-4. The Work Plan outlined a plan to excavate the trenches to the depth at which no visible contamination is observed. Soil samples were collected from each trench at depth intervals and subjected to the field headspace analysis. The vertical extent of contamination at each pit was determined by the depth to field-determined (PID) uncontaminated soils in the trenches.

The Work Plan specified excavation and sampling at 1-foot depth intervals to the depth at which headspace background readings were determined (per BLM guidelines), or to the depth at which groundwater was encountered. Additionally, the depth at which a headspace reading of approximately 100 ppm was measured was recorded, with excavation beyond that point specified in the OCD guidelines.

A background headspace organics level was determined by placing soil from a background sampling location into a jar and measuring the PID response of the jarred soils according to the OCD guidelines. The soil sample was collected from the background location lying 300 feet to the northeast of the Highway 128 fence described in Section 2.1.3 and illustrated in Figure 2-2.

When a PID response equal to background was determined, samples were collected from each trench and submitted to the laboratory for confirmation analyses. If background could not be reached prior to encountering groundwater, the confirmation sample was to be

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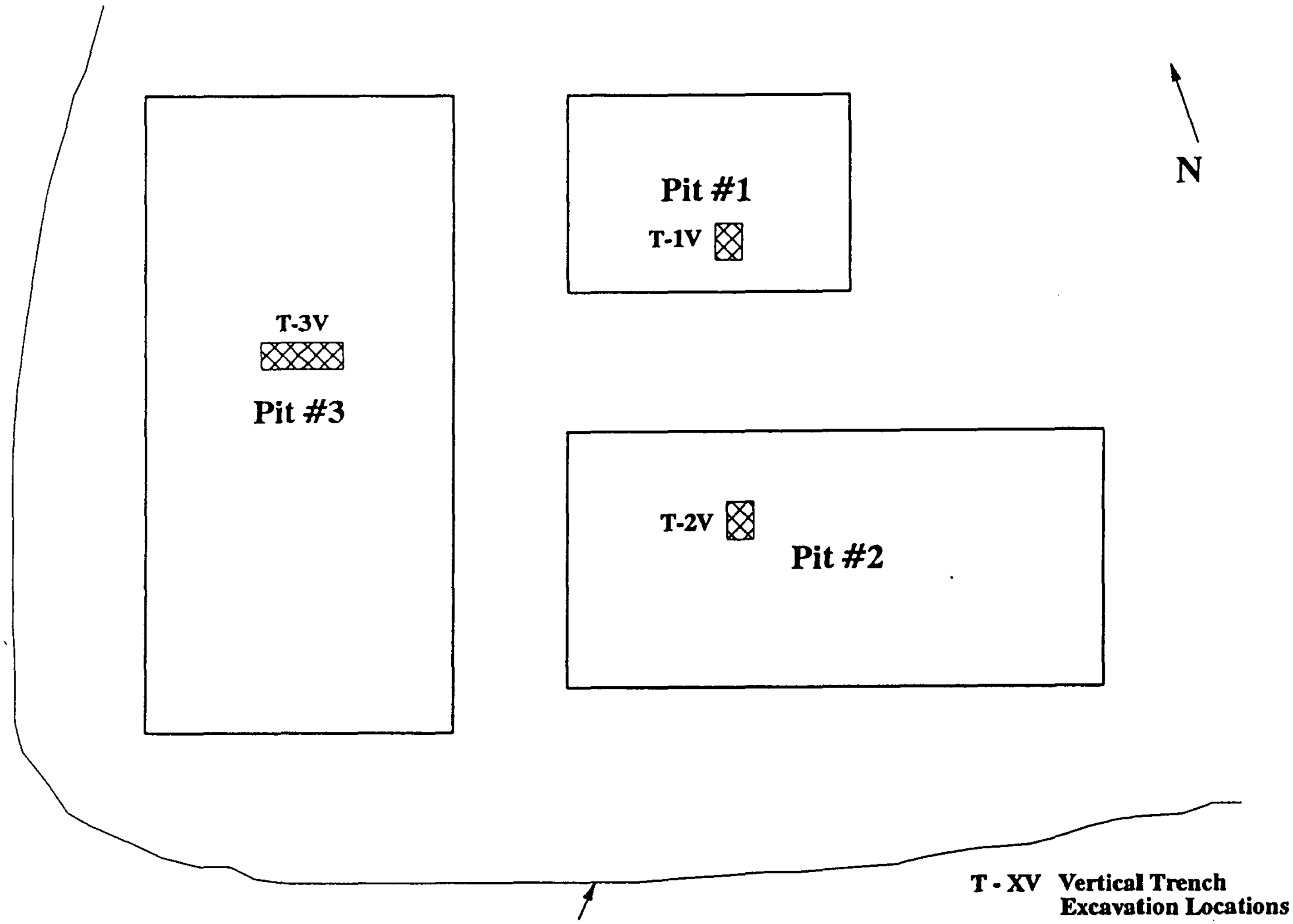


FIGURE 2-4
VERTICAL TRENCH LOCATIONS

collected at a point immediately above the groundwater in the trench. The confirmation analyses included those parameters or constituents detected in the individual pit waste characterization analyticals. Consequently, these samples were assayed for the following parameters:

- BTEX, and
- TPH.

## 2.3 OBSERVATIONS FOR SITE-SPECIFIC ENVIRONMENTAL RECEPTORS

RETEC field personnel made a complete walk of the site to observe and record indicators of flora and fauna that may be considered in the Ecological Risk Assessment. Examples of such indicators include the presence of animal or plant life and animal tracks. Additionally, RETEC site personnel discussed with B & E site personnel, the occurrence or existence of wildlife in the vicinity of the B & E facility.

# 3.0 GEOLOGIC AND HYDROGEOLOGIC CHARACTERIZATION

Comprehensive summaries concerning the regional geology and hydrogeology of the site investigation vicinity are attached in Appendix C and include Hydrologic Assessment, Laguna Tres Area, Eddy County, New Mexico, Geohydrologic Associates, Inc., May, 1982; Evaluation of Southern Nash Draw for Potential Disposal of Brine Water, Eddy County, New Mexico, Ed L. Reed & Associates, Inc., July, 1985; and Reassessment of Hydrologic Conditions Laguna Tres Area, Eddy County, New Mexico, Geohydrologic Associates, Inc., January, 1986. A brief summary of the regional geology and hydrogeology, as presented in these documents, is included in the sections below.

## 3.1 CURRENT SITE CONDITIONS

This Phase 1 site investigation addresses three pits located on BLM land (see Figure 1-2), which were constructed and utilized in the past by B & E for the disposal facility for the treatment and disposal of exploration and production waste (E&P waste). Although these pits remain open, they have not received waste material since August 1989.

Adjacent to the BLM property under investigation are the majority of the components of the Tuzlu Kopek facility including two additional pits and treatment systems for the separation of oil phase, aqueous phase, and solid phase waste material associated with E&P waste.

## 3.2 REGIONAL GEOLOGY AND TOPOGRAPHY

The regional geology in the investigation vicinity is characterized by two formations, the Rustler Formation exposed at the surface, and the Salado Formation located immediately below the Rustler. The Rustler is subdivided into the Lower Member, the Culebra Dolomite, the Tamarisk Member, the Magenta Member, and the uppermost Forty-niner Member (Geohydrology Associates, Inc., May, 1982).

### 3.2.1 Salado Formation

The Salado Formation is the major influence on regional topography in the Nash Draw in Eddy County. The Salado consists primarily of halite and potassium mineral with minor clastic, dolomite, and anhydrite (E.L. Reed & Associates, Inc., July, 1985). The dissolution associated with these salt deposits lead to collapse structures which formed the Nash Draw depression.

The Salado, which is generally free of circulating water, acts as an aquiclude, separating the fresher water of the underlying Castile Formation from the brines in the overlying Rustler Formation.

The Salado and Rustler Formation are separated by a basal leached zone of insoluble residue approximately 60 feet thick. This basal zone consists of a rubble of brecciated limestone and insoluble clastics which collapsed following the dissolution of the underlying salt deposits. The characteristics of the basal zone allow for the movement of groundwater. This groundwater is of poor quality, high in total dissolved solids, and known as the "brine aquifer".

### 3.2.2 Rustler Formation

The Lower Member of the Rustler Formation ranges in thickness from 60 to 120 feet and consists primarily of siltstone and fine-grained sandstones containing localized amounts of gypsum, anhydrite, and halite. Overlying the Lower Member is the Culebra Dolomite Formation, which consists of dolomite rubble containing saline water within the Nash Draw. The Culebra Dolomite Formation is approximately 30 feet in thickness.

The Tamarisk Member, which consists of anhydrite, gypsum, and siltstone, overlies the Culebra. Tamarisk deposits and rubble are blanketed by a thin layer of silt and clay that has washed down from the rim of the Nash Draw. Tamarisk rubble is the principal outcrop in most of the southwestern region of the Nash Draw. As such, the Tamarisk Member receives most of the brine from the potash and oil field disposal operations.

Overlying the Tamarisk Member are the Magenta Member and Forty-niner Member, both of which have been removed from the inner part of the Nash Draw through erosion. Evidence of their past presence may be seen as erosional remnants of rubble in the bottom of the Nash Draw. The study by E. L. Reed & Associates (1985) suggests that the Magenta and Forty-niner Members are still present in the Nash Draw, with the Magenta outcropping within the bluffs on either side of the Nash Draw.

According to E.L. Reed & Associates (1985), a thin layer of alluvium and caliche may be found locally in various areas in and near the Nash Draw. However, their study also concluded that neither Triassic nor Quaternary deposits are important to the geohydrology of the southern region of the Nash Draw.

The Nash Draw, which is the principal surface feature in this region of Eddy County, is an undrained depression resulting from regional differential solution of evaporitic deposits in the upper Salado and/or lower Rustler Formations. The solution of these deposits resulted in the large-scale collapse of these members, as evidenced by the depression resulting in the salt lakes (playas) in the region.

Rocks exposed along the margins of the Nash Draw dip toward the depression forming the series of salt lakes of which Laguna Tres is a member. This same phenomenon was observed in the Clayton Basin farther north. Localized doming due to hydration of anhydrite to gypsum has been documented, which coupled with sinkhole formation, influences the regional groundwater movement.

## 3.3 REGIONAL HYDROGEOLOGY

The hydrology of the Nash Draw region has been studied and characterized in two separate studies performed by Brokaw, et al., (1972) and Geohydrology Associates, Inc. (1979). Those studies illustrated that the regional hydrology has been impacted by the collapse of Nash Draw and Clayton Basin. The regional groundwater hydrology has been further complicated by significant discharge from local potash refineries.

The groundwater movement east of the Pecos River in Eddy County is predominantly from north to south (Hendrickson and Jones, 1952). As discussed by E.L. Reed & Associates (1985), groundwater appears to flow locally toward Nash Draw starting with Laguna Uno and then southwestward toward Salt Lake through the series of lakes located within the draw. Further, that report states that water flow through the series of Nash Draw lakes occurs via groundwater flow as opposed to surface flow citing the lack of surface hydrologic connection. The report further states that the water surface in the lakes actually represents the surface of the groundwater table.

## 3.4 CHANGE IN REGIONAL CHARACTERISTICS

The regional surface hydraulic and hydrologic characteristics have changed in the Nash Draw over the past thirty to forty years, as confirmed through discussions with local land owners and historical information.

Through a personal communication with Mr. Jay Mobley (Personal Communication, December 29, 1992), a County Land Commissioner who has owned the land immediately adjacent to the disposal pits of concern in this report since 1962, it was learned that the Laguna Cuatro playa lake surface level has risen dramatically since 1962. This rise does not correlate with a dramatic climatic change in the region, suggesting that the source of water is from human industrial operations. The studies previously cited in this section illustrated that the release of brine water from the B & E disposal facility would not potentially have an adverse hydrologic effect on the region (Geohydrology Associates, Inc.).

Figure 3-1 illustrates the approximate location of the corral and windmill. These facilities served the ranching operations that were allowed during the past thirty years. Clearly, these facilities were constructed on dry land, but now exist within the influence of the Laguna Cuatro playa lake.

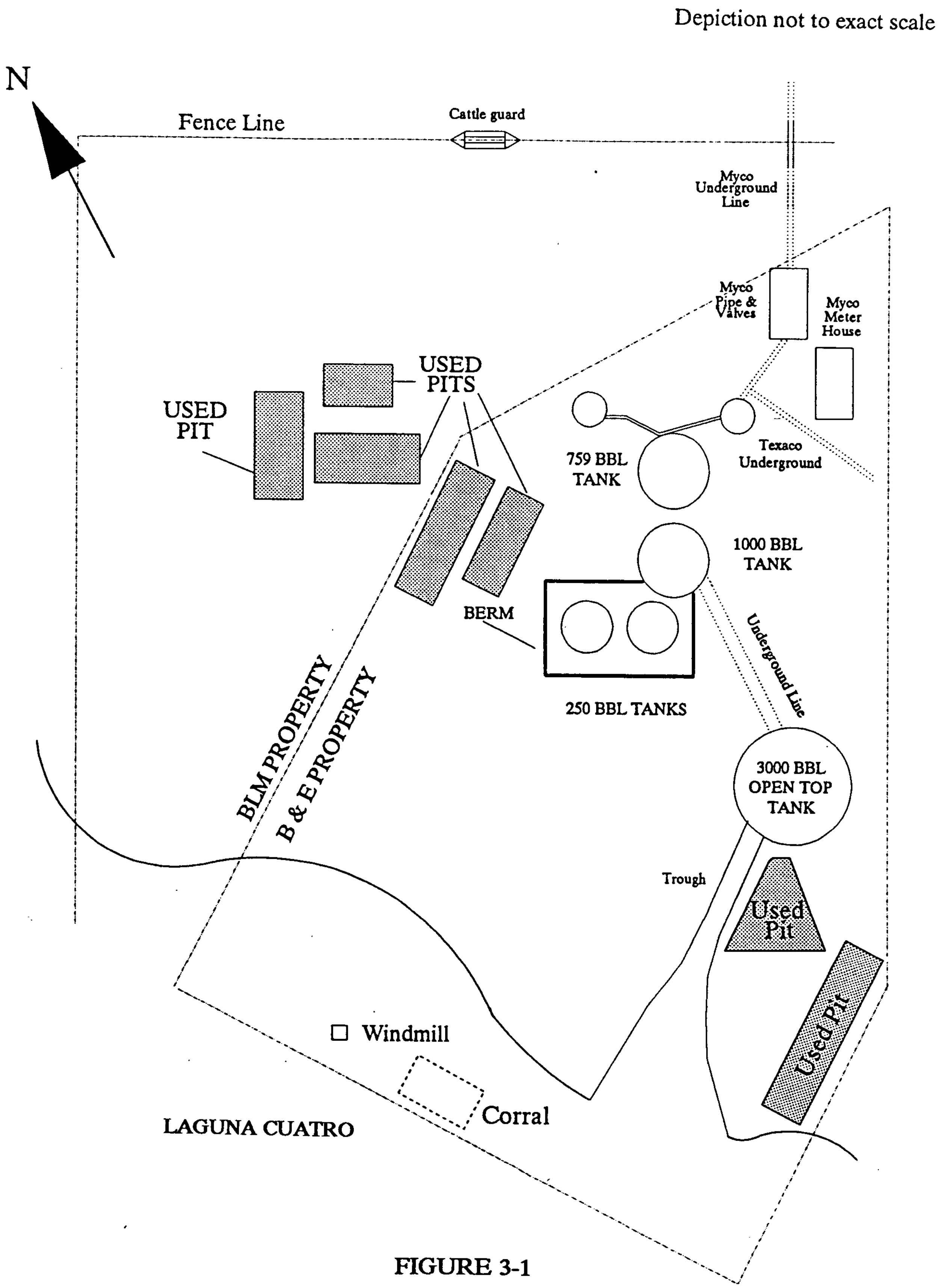


FIGURE 3-1

SITE MAP DEPICTING LOCATION OF CORRAL/WINDMILL

# 4.0 SLUDGE/SOIL CHARACTERIZATION

This section is divided into four subsections covering information provided by the site investigation. Section 4.1 is a background soils characterization. Section 4.2 is a pit source material contaminant characterization. Section 4.3 is a review of the horizontal and vertical investigation data to evaluate the extent of contamination. Section 4.4 is a summary of the investigation data and observations.

The analytical program specified that the overall pit waste composite sample would first be subjected to an Appendix IX analysis in order to fully characterize the material in the pits. The individual pit composite samples would then be subjected to analyses for the parameters detected in the overall pit composite. The horizontal and vertical extent samples were to be assayed for only those constituents identified in the individual pit composite samples. As such, it was expected that this set of parameters would be a subset of the overall pit composite.

## 4.1 BACKGROUND SOILS CHARACTERIZATION

### 4.1.1 Field Observations

Two background samples were collected at the locations specified in Figure 2-2. Background sample #1 was collected at the water's edge of the Laguna Tres playa lake. The sample was collected over the 0 (surface) to 1 foot depth interval. The surface soil was saturated due to a shallow layer of standing water in Laguna Tres playa lake. The soil was generally a tannish-brown colored soil with a thin layer (0.25 inches) of whitish precipitate salts covering the surface. The topmost soil (1 inch) from this sample location was hard and resistant to puncture with the sampling spoon, probably due to the crusted salt layer. Stakes were driven in the soil at both sample locations to assist in identifying the sample location, should this be necessary in the future.

Background sample #2 was collected at a location 300 feet north of Highway 128, which runs adjacent to the site along the north edge. The soil collected at this location was very dry and powdery with a whitish cream appearance. This sample location was elevated from the playa lake system and the Tuzlu Kopek disposal facility.

### 4.1.2 Analytical Data

The analytical data for the two background samples are listed in Table 4-1. The laboratory data reports are included in Appendix F. Full volatiles and semivolatiles analyses were not performed on the background samples, as these compounds were not detected above the laboratory quantitation limits in the overall pit composite sample. However, these samples were assayed for TPH, BTEX, and total metals.

The average background level of TPH, as measured through the Freon extraction procedure (Method 418.0), was 21.5 mg/kg. All of the BTEX constituents were reported as less than 0.02 mg/kg. Of the metals constituents assayed, magnesium was detected at the greatest level of (2,400 mg/kg) in the Laguna Tres background sample.

## 4.2 PIT SOURCE MATERIAL CHARACTERIZATION

The source material located in the three disposal pits was characterized by field observations of odor, texture, and visual appearance. Additionally, the site investigation involved a sampling program to gain an accurate chemical characterization of the sludge material.

The source material in Pits #1 and #2 has the general appearance of an oily petroleum sludge, whereas the source material in pit #3 is limited to slight staining of pit floor and side soils. As such, Pit #3 is basically an open pit with no visual contamination present, with the exception of localized light staining of floor and sidewall soils.

### 4.2.1 Field Observations

<u>Pits #1 and #2</u>

The source materials in Pits #1 and #2 were very similar in color, odor and consistency. This material resembled an oily petroleum sludge of blackish brown color, which when disturbed or removed, released a strong petroleum hydrocarbons odor. These sludges also released an odor indicative of hydrogen sulfide gas. The presence of both petroleum hydrocarbons and hydrogen sulfide ($H_2S$) was verified through measurements with an HNu and hand-held $H_2S$ detector, respectively. The physical consistency of this sludge

## TABLE 4-1
## BACKGROUND SAMPLES

| Parameter (mg/kg) | BG-1 (Laguna Tres) | BG-2 (Across Hwy) |
|---|---|---|
| Total Petroleum Hydrocarbons (TPH) | 30 | 13 |
| **Volatiles** | | |
| Benzene | <0.02 | <0.02 |
| Toluene | <0.02 | <0.02 |
| Ethylbenzene | <0.02 | <0.02 |
| m,p-Xylene | <0.02 | <0.02 |
| o-Xylene | <0.02 | <0.02 |
| **Metals - Totals** | | |
| Arsenic | 2.4 | 0.610 |
| Barium | 8 | 9.5 |
| Cadmium | 0.85 | 0.32 |
| Calcium | 56,000 | 110,000 |
| Chromium | 2 | <1 |
| Iron | 620 | 190 |
| Lead | 21 | 6.9 |
| Magnesium | 2,400 | <100 |
| Mercury | <0.005 | <0.005 |
| Selenium | 0.390 | <0.040 |
| Silver | 0.510 | 0.010 |

material was that of a highly viscous semi-solid material. Some debris such as rocks and wooden objects were observed in the sludge.

Pit #3

No actual source material is identifiable in Pit #3, as was observed in Pit #1 and #2. Pit #3 was excavated for disposal purposes but utilized on a limited basis. As such, only localized light visual staining of floor and sidewall soils exists in this pit. Generally, pit floor and sidewall soils were visibly clean caliche soils. Standing water exists toward the southern end of the pit, creating saturated soils in this area. Slight visual staining of the sidewall soils was observed in isolated areas, particularly on the eastern wall close to Pits #1 and #2.

### 4.2.2 Analytical Results

Overall Pit Composite

The sampling program provided in the Work Plan specified the collection of one overall pit composite sample consisting of material from all three pits. This sample was analyzed for Appendix IX constituents, with the exception of pesticides, herbicides, and dioxins. Additionally, this sample was analyzed for TCLP metals and TPH.

The analytical results are included in Tables 4-2 (a), (b), and (c) of this report, with the laboratory data reports included in Appendix F. The volatiles and BTEX data confirm that the source material in the pits has been weathered, as these pits have remained open throughout their service and post-service lives. Due to such weathering, the level of every Appendix IX volatile constituent was reported as below the laboratory practical quantitation limit (PQL). The BTEX constituents, which were evaluated through SW-846 Method 8020 in separate analysis, were reported at levels above the Practical Quantitation Levels (PQLs). The BTEX constituents were also reported at levels above those found in the background samples, which were all reported as <0.02 mg/kg.

The levels of semivolatiles were reported as below the laboratory PQL for every constituent on the SW-846 Method 8270 analytical list. The reported PQL levels are the result of the complex matrices of the source material samples.

The metals data for the overall pit composite illustrate that the source material is well within the TCLP regulatory levels for the eight regulated metal constituents. On a totals basis, the metals chromium, iron, lead, and magnesium were detected at levels above those found in the background samples. Some of these metals, such as chromium, iron and magnesium, are typically found in spent drilling fluids (solid phase) and might, therefore, be expected in the B & E source material samples.

## Individual Pit Composites (Pit #1 and #2)

As stated above, only those parameters detected in the overall composite sample were assayed in the individual pit composites, as well as any subsequent samples. Therefore, the individual pit composites were analyzed for TPH, BTEX, and total metals. Additionally, these samples were analyzed for hazardous characteristics (reactivity, corrosivity, and ignitability) in order to verify that the sludges are not characteristically hazardous. All analytical data are reported in Table 4-3.

The individual pit data indicate that all of the BTEX constituents are present at levels above background. The compound xylene is reported as meta, para-xylene (together) and ortho-xylene. Pit #1 source material contains the highest levels of the BTEX constituents, with ethylbenzene and m,p-xylene predominating at 160 mg/kg each. The highest reported BTEX constituent in the Pit #2 source material composite sample was m,p-xylene, at 49 mg/kg.

Of the metal constituents in Pit #1 and #2 samples, only chromium and lead were reported at levels above the background levels (Table 4-3).

Samples from Pits #1 and #2 were determined to be nonhazardous for the characteristics of reactivity (cyanide, and sulfide), corrosivity, and ignitability. The cyanide and sulfide reactivity criteria for hazardous wastes are 250 and 500 mg/kg, respectively. The corrosivity criteria is that the material's pH must be greater than 12.5 or less than 2.0.

## Individual Pit Composite (Pit #3)

Of the BTEX constituents, only ethylbenzene and m,p-xylenes were reported at levels greater than those found in the background samples. The ethylbenzene level was reported as 0.051 mg/kg and the m,p-xylene level was reported as 0.027 mg/kg. All of the metal constituents assayed were reported at levels in the same general range reported for the

## TABLE 4-2(a)
## OVERALL PIT COMPOSITE

| BTEX/Volatile Compound | | Results (mg/kg) | BTEX/Volatile Compound | | Results (mg/kg) |
|---|---|---|---|---|---|
| Benzene | | 1.9 | m,p-Xylene | | 48 |
| Ethylbenzene | | 49 | o-Xylene | | 18 |
| | | | Toluene | | 0.26 |
| 1,1,1,2-tetrachloroethane | < | 0.25 | Bromodichloromethane | < | 0.25 |
| 1,1,1-trichloroethane | < | 0.25 | Bromoform | < | 0.25 |
| 1,1,2,2-tetrachloroethane | < | 0.25 | Bromomethane | < | 0.25 |
| 1,1,2-trichloroethane | < | 0.25 | c-1,3-dichloropropene | < | 0.25 |
| 1,1-dichloroethane | < | 0.25 | Carbon disulfide | < | 0.25 |
| 1,1-dichloroethene | < | 0.25 | Carbon tetrachloride | < | 0.25 |
| 1,2,3-trichloropropane | < | 0.25 | Chlorobenzene | < | 0.25 |
| 1,2-dibromo-3-chloropropane | < | 0.25 | Chloroethane | < | 0.25 |
| 1,2-dibromoethane | < | 0.25 | Chloroform | < | 0.25 |
| 1,2-dichlorobenzene | < | 0.25 | Chloromethane | < | 0.25 |
| 1,2-dichloroethane | < | 0.25 | Dibromochloromethane | < | 0.25 |
| 1,2-dichloropropane | < | 0.25 | Dibromomethane | < | 0.25 |
| 1,3-dichlorobenzene | < | 0.25 | Ethyl methacrylate | < | 0.25 |
| 1,4-dichloro-2-butene | < | 0.25 | Isobutanol | < | 0.25 |
| 1,4-dichlorobenzene | < | 0.25 | Methacrylonitrile | < | 0.25 |
| 1,4-dioxane | < | 5.0 | Methyl methacrylate | < | 0.25 |
| 2-butanone (MEK) | < | 5.0 | Methylene chloride | < | 0.25 |
| 2-chloroethyl vinyl ether | < | 0.25 | Propionitrile | < | 0.25 |
| 4-methyl-2-pentanone (MIBK) | < | 0.25 | t-1,2-dichloroethene | < | 0.25 |
| Acetone | < | 5.0 | t-1,3-dichloropropene | < | 0.25 |
| Acetonitrile | < | 0.25 | Tetrachloroethene | < | 0.25 |
| Acrolein | < | 5.0 | Trichloroethene | < | 0.25 |
| Acrylonitrile | < | 5.0 | Trichlorofluoromethane | < | 0.25 |
| Allyl chloride | < | 5.0 | Vinyl chloride | < | 0.5 |

## TABLE 4-2(b)
## OVERALL PIT COMPOSITE

| Semivolatile Parameters | | Result (mg/kg) | Semivolatile Parameters | | Result (mg/kg) |
|---|---|---|---|---|---|
| 1,2,4,5-Tetrachlorobenzene | < | 40 | Chrysene | < | 40 |
| 1,2,4-Trichlorobenzene | < | 40 | Di-n-butyl phthalate | < | 40 |
| 1,2-Dinitrobenzene | < | 40 | Di-n-octylphthalate | < | 40 |
| 1,3,5-Trinitrobenzene | < | 40 | Diallate | < | 40 |
| 1,4-Naphthoquinone | < | 40 | Dibenz(a,h)anthracene | < | 40 |
| 1,4-Phenylenediamine | < | 40 | Dibenzofuran | < | 40 |
| 1-Naphthylamine | < | 40 | Diethylphthalate | < | 40 |
| 2,3,4,6-Tetrachlorophenol | < | 80 | Dimethoate | < | 80 |
| 2,4,5-Trichlorophenol | < | 40 | Dimethylphthalate | < | 40 |
| 2,4,6-Trichlorophenol | < | 40 | Dinoseb | < | 80 |
| 2,4-Dichlorophenol | < | 40 | Diphenylamine | < | 40 |
| 2,4-Dimethylphenol | < | 40 | Disulfoton | < | 40 |
| 2,4-Dinitrophenol | < | 40 | Ethyl methanesulfonate | < | 80 |
| 2,4-Dinitrotoluene | < | 40 | Ethyl parathion | < | 40 |
| 2,6-Dichlorophenol | < | 40 | Famphur | < | 80 |
| 2,6-Dinitrotoluene | < | 40 | Fluoranthene | < | 40 |
| 2-Acetylaminofluorene | < | 80 | Fluorene | < | 40 |
| 2-Chloronaphthalene | < | 40 | Hexachlorobenzene | < | 40 |
| 2-Chlorophenol | < | 40 | Hexachlorobutadiene | < | 40 |
| 2-Methylnaphthalene | < | 40 | Hexachlorocyclopentadiene | < | 40 |
| 2-Methylphenol | < | 40 | Hexachloroethane | < | 40 |
| 2-Naphthylamine | < | 40 | Hexachlorophene | < | 80 |
| 2-Nitroaniline | < | 200 | Hexachloropropene | < | 40 |
| 2-Nitrophenol | < | 40 | Indeno(1,2,3-cd)pyrene | < | 40 |
| 2-Picoline | < | 200 | Isophorone | < | 40 |
| 3&4-Methylphenol | < | 40 | Isosafrole | < | 40 |
| 3,3'-Dichlorobenzidene | < | 80 | Kepone | < | 80 |
| 3,3'-Dimethylbenzidine | < | 400 | Methapyrilene | < | 400 |
| 3-Methylcholanthrene | < | 40 | Methyl parathion | < | 40 |
| 3-Nitroaniline | < | 200 | Methylmethanesulfonate | < | 40 |
| 4,6-Dinitro-2-methylphenol | < | 200 | N-Nitrosodi-n-butylamine | < | 40 |
| 4-Aminobiphenyl | < | 80 | N-Nitrosodi-n-propylamine | < | 40 |
| 4-Chloro-3-methylphenol | < | 80 | N-Nitrosodiethylamine | < | 80 |
| 4-Chloroaniline | < | 80 | N-Nitrosodimethylamine | < | 40 |
| 4-Chlorophenyl phenyl ether | < | 40 | N-Nitrosodiphenylamine | < | 40 |
| 4-Nitroaniline | < | 80 | N-Nitrosomethylethylamine | < | 400 |
| 4-Nitrophenol | < | 200 | N-Nitrosomorpholine | < | 80 |
| 4-Nitroquinoline 1-oxide | < | 80 | N-Nitrosopiperidine | < | 80 |
| 5-Nitro-o-toluidine | < | 40 | N-Nitrosopyrrolidine | < | 80 |
| 7,12-Dimethylbenz(a)anthracene | < | 40 | Naphthalene | < | 40 |

TABLE 4–2(b)
OVERALL PIT COMPOSITE
(Continued)

| Semivolatile Parameters | | Result (mg/kg) | Semivolatile Parameters | | Result (mg/kg) |
|---|---|---|---|---|---|
| a,a–Dimethylphenethylamine | < | 400 | Nitrobenzene | < | 40 |
| Acenaphthene | < | 40 | O,O,O–Triethylphosphorothioate | < | 40 |
| Acenaphthylene | < | 40 | o–Toluidine | < | 40 |
| Acetophenone | < | 40 | p–Dimethylaminoazobenzene | < | 40 |
| Aramite | < | 80 | Pentachloronitrobenzene | < | 80 |
| Benzo(a)anthracene | < | 40 | Pentachlorophenol | < | 200 |
| Benzo(a)pyrene | < | 40 | Phenacetin | < | 80 |
| Benzo(b&j&k)fluoranthene | < | 40 | Phenanthrene | < | 40 |
| Benzo(ghi)perylene | < | 40 | Phenol | < | 40 |
| Benzyl alcohol | < | 80 | Phorate | < | 40 |
| bis(2–Chloroethoxy)methane | < | 40 | Pronamide | < | 40 |
| bis(2–Chloroethyl)ether | < | 40 | Pyrene | < | 40 |
| bis(2–Chloroisopropyl)ether | < | 40 | Pyridine | < | 40 |
| bis(2–Ethylhexyl)phthalate | < | 40 | Safrole | < | 40 |
| Bromophenyl phenyl ether | < | 40 | Tetraethyldithiopyrophosphate | < | 400 |
| Butyl benzyl phthalate | < | 40 | Thionazine | < | 400 |
| Chlorobenzilate | < | 40 | | | |

# TABLE 4-2(c)
# OVERALL PIT COMPOSITE

| Metals | | | |
|---|---|---|---|
| **Parameter** | **Total (mg/kg)** | **TCLP (mg/L)** | **TCLP Rg Level (mg/L)** |
| Aluminum | 2600 | | |
| Antimony | < 0.06 | | |
| Arsenic | 4.0 | < 0.5 | 5.0 |
| Barium | 9.6 | 0.66 | 100.0 |
| Beryllium | 0.25 | | |
| Cadmium | 0.89 | < 0.1 | 1.0 |
| Calcium | 130000 | | |
| Chromium | 49 | < 0.5 | 5.0 |
| Cobalt | 4.1 | | |
| Copper | 31 | | |
| Iron | 12000 | | |
| Lead | 110 | < 0.5 | 5.0 |
| Magnesium | 10000 | | |
| Manganese | 130 | | |
| Mercury | 0.05 | < 0.005 | 0.2 |
| Nickel | 11 | | |
| Potassium | 71 | | |
| Selenium | 0.26 | < 0.1 | 1.0 |
| Silver | 0.065 | < 0.1 | 5.0 |
| Sodium | 8100 | | |
| Thallium | < 0.02 | | |
| Tin | < 0.10 | | |
| Vanadium | 12 | | |
| Zinc | 120 | | |
| **Other Parameters** | | | |
| Cyanide | < 0.2 | | |
| Fluoride | 2.3 | | |
| Sulfide | 30 | | |

Note: Light shading indicates metals for which TCLP standard exists.

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## TABLE 4–3
## INDIVIDUAL PIT COMPOSITE SAMPLES

| Parameter (mg/kg) | Pit #1 Composite | Pit #2 Composite | Pit #3 Composite |
|---|---|---|---|
| Total Petroleum Hydrocarbons (TPH) | 51000 | 30000 | 690 |
| **Volatiles** | | | |
| Benzene | 5.1 | 3.3 | <0.02 |
| Toluene | 0.38 | 11 | <0.02 |
| Ethylbenzene | 160 | <0.2 | 0.051 |
| m,p–Xylene | 160 | 49 | 0.027 |
| o–Xylene | 61 | 22 | <0.02 |
| **Metals – Totals** | | | |
| Arsenic | 3.6 | 2.9 | 1.5 |
| Barium | 23 | 37 | 11 |
| Cadmium | 1.8 | 1.7 | 0.4 |
| Chromium | 140 | 53 | 3.1 |
| Lead | 170 | 140 | 17 |
| Mercury | 0.180 | 0.200 | <0.005 |
| Selenium | 0.058 | 0.120 | 0.120 |
| Silver | 0.018 | 0.034 | <0.004 |
| **Hazardous Characteristics** | | | |
| Reactivity – Cyanide | <0.2 | <0.2 | <0.2 |
| Reactivity – Sulfide | 22 | 8.1 | 3.6 |
| Corrosivity – pH | 8.8 | 8.5 | 8.2 |
| Ignitability | NI | NI | NI |

NI – Not ignitable

background samples. As was the case with the Pit #1 and #2 composite samples, the Pit #3 material was determined to be nonhazardous for the characteristics of reactivity, corrosivity, and ignitability.

## 4.3 EXTENT OF SOURCE MATERIAL AND AFFECTED SOILS

The Work Plan specified that a determination of the volume of wastes and visibly contaminated soils at the three pits will be made. Therefore, the horizontal and vertical extent of impact from the three pits was determined by visual observations and by using a photoionization detector calibrated to benzene response to determine the presence of volatile organics. Trench logs illustrating the depth and extent of stained material encountered are included in Appendix G (Horizontal Trenches) and Appendix H (Vertical Trenches).

Confirmation samples were collected to determine the horizontal and vertical extent of contamination, as determined by headspace analyses of jarred samples with an HNu, and analytical data from confirmation samples. Confirmation samples were collected and analyzed for TPH and any indicator parameters detected in the pit samples.

The Work Plan specified that four horizontal trenches and three vertical trenches would be excavated from the three pits (Work Plan, Figure 2-3). However, two additional horizontal trenches were excavated to adequately determine the horizontal migration of organics from the pit source material. The first additional trench was added to the area between Pits #1 and #2 and the second additional trench was added to the area outside and to the south of Pit #3. Three vertical trenches were excavated as specified in the Work Plan.

Confirmation samples were collected from these trenches and subjected to analyses for BTEX and TPHs, the only parameters quantified in the pit composite samples. The Horizontal Trench confirmation sample data are included in Table 4-4.

### 4.3.1 Horizontal Extent of Contamination

Figure 4-1 illustrates the six horizontal trench locations with the confirmation sampling locations included. The data listed in Table 4-4 suggest that the BTEX constituents were all generally below the laboratory PQLs in all horizontal trench confirmation samples. This result was expected; these samples were collected at the horizontal extent from the respective pits at which a background HNu reading, as well as no visual staining, were observed.

The TPH data listed in Table 4-4 also suggest that levels of TPH were only slightly above those detected in the background samples. The highest recorded values were for the T-4 and T-5 samples at 53 mg/kg in both samples. In comparison, the background values were 30 and 13 mg/kg in BG-1 and BG-2 samples, respectively.

The horizontal trenches were excavated such that the trench depths and respective sample depths were approximately equal to the sludge depths in the adjacent pits. The trench logs (Appendix G) list the field headspace data at the corresponding distance from the pit edge. Additionally, the confirmation sample location is indicated by a solid square in the trench logs.

Visual observations were recorded in the field log book in order to fully document site conditions. These observations have been transferred into the trench logs and include all information such as depth at which groundwater was encountered, the presence of nonaqueous phase liquids, the color and odor of stained soils, and the general consistency and type of soils.

The various information in the trench logs reveal that the soil in the trenches exhibited hydrocarbon staining at horizontal distances of 1 to 9 feet from the pit edges. In the process of excavating horizontal trench T-4, light nonaqueous phase liquid (LNAPL) was discovered on the surface of the groundwater. Field headspace readings, as measured with an HNu, generally achieved background (approximately zero) at a distance of 5 to 12 feet from the edge of the pit berms. Excavation of trench T-4 was terminated at a distance of 12 feet from its starting point because of the presence of LNAPL on the surface of the groundwater, which appeared at a depth of approximately 10.5 feet. The continuation of the trench in the southeasterly direction was not pursued, as the presence of LNAPL was already confirmed at this depth. Additionally, the depth and unstable nature of the sandy trench soils created a health and safety hazard for site workers.

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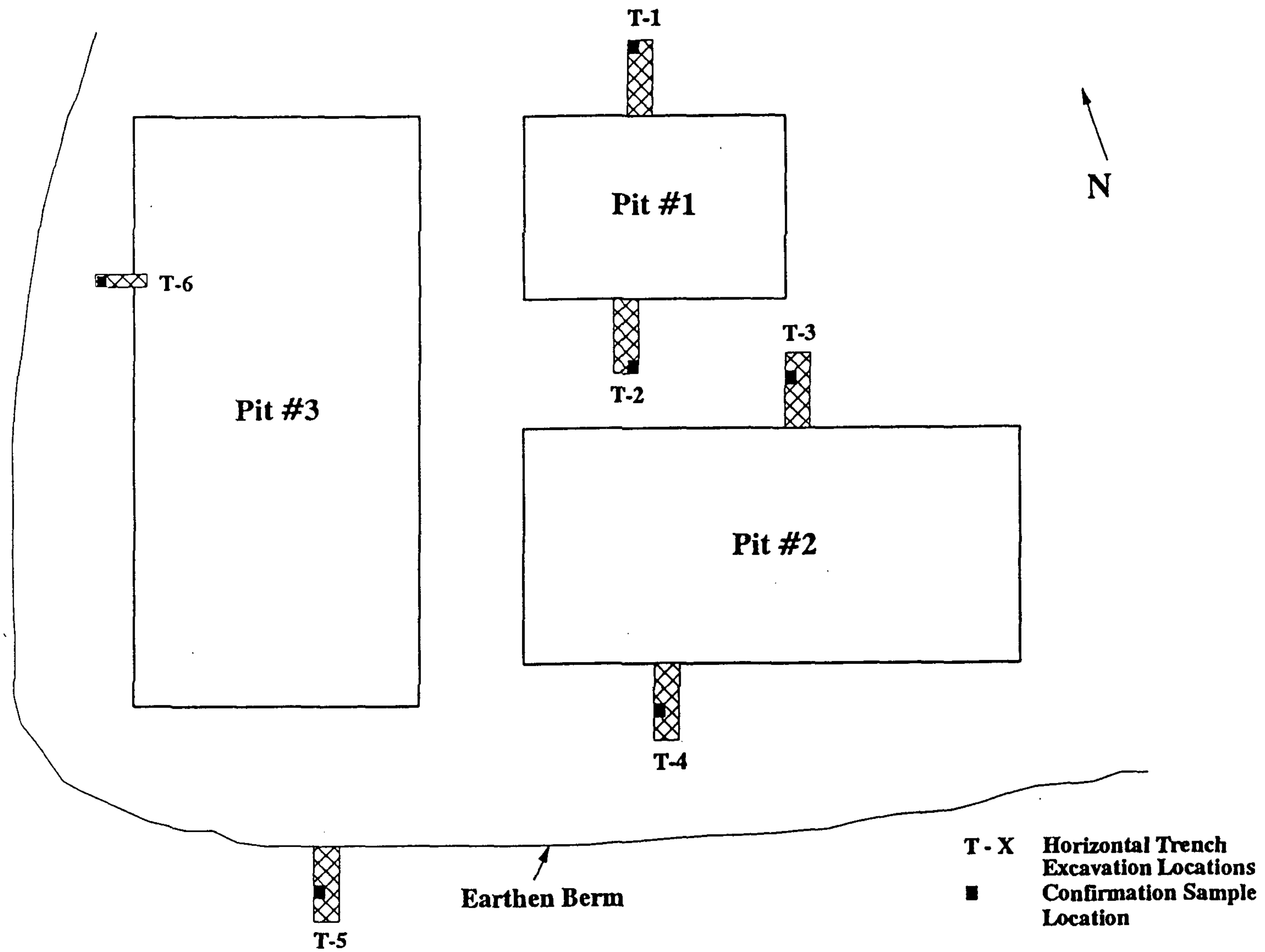


FIGURE 4-1
HORIZONTAL TRENCH LOCATIONS
(WITH CONFIRMATION SAMPLES)

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## TABLE 4–4

## HORIZONTAL TRENCH CONFIRMATION SAMPLE DATA

| Trench # | Parameter (mg/kg) | | | | | TPH (mg/kg) |
|---|---|---|---|---|---|---|
| | Benzene | Toluene | Ethylbenzene | m,p–xylene | o–xylene | |
| T–1 | 0.083 | < 0.02 | 0.052 | < 0.02 | 0.041 | 41 |
| T–2 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 38 |
| T–3 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 49 |
| T–4 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 53 |
| T–5 | NA | NA | NA | NA | NA | 53 |
| T–6 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 45 |

NA denotes that sample was not assayed for this parameter.

### 4.3.2 Vertical Extent of Contamination

Figure 4-2 illustrates the location of the vertical trenches with respect to the pits. One trench was excavated as close to the visual center of each waste pit as was possible. The trenches were excavated to the depth at which groundwater was encountered below each of the pits; background headspace HNu measurements were not achieved prior to reaching this depth in any of the three pits.

The data listed in Table 4-5 illustrate that, with the exception of m,p-xylene, all BTEX constituents were generally reported by the laboratory at or below the method detection limits. Toluene and ethylbenzene were both reported at a level slightly above background (0.021 mg/kg) in one sample each in vertical trench confirmation samples. The laboratory PQLs for the BTEX analyses in the vertical extent samples were reported at the same level (<0.02 mg/kg) in the background samples. The TPH data for the vertical trench samples were in the same range as that provided by the background samples (<35 mg/kg).

All visual observations made during the excavation activities were recorded in the field log book and are included in the trench logs in Appendix H of this report. Generally, the logs indicate that groundwater was encountered prior to reaching background readings through HNu measurement of organics with the HNu field instrument. Additionally, a light sheen was observed on the surface of the groundwater in each of the three vertical trenches.

## 4.4 ANALYTICAL DATA AND VISUAL OBSERVATIONS SUMMARY

### 4.4.1 Analytical Data

The analytical data from the site investigation generally indicate that the level of TPH was three to four orders of magnitude greater in Pit #1 and #2 sludges than in area background soils. The level of TPH reported in Pit #3 sludges was only 690 mg/kg, reflecting the fact that this pit received very little waste material throughout the Tuzlu Kopek facility's active life. The level of TPH recorded in the horizontal and vertical trench confirmation samples was not significantly different from that found in the background samples.

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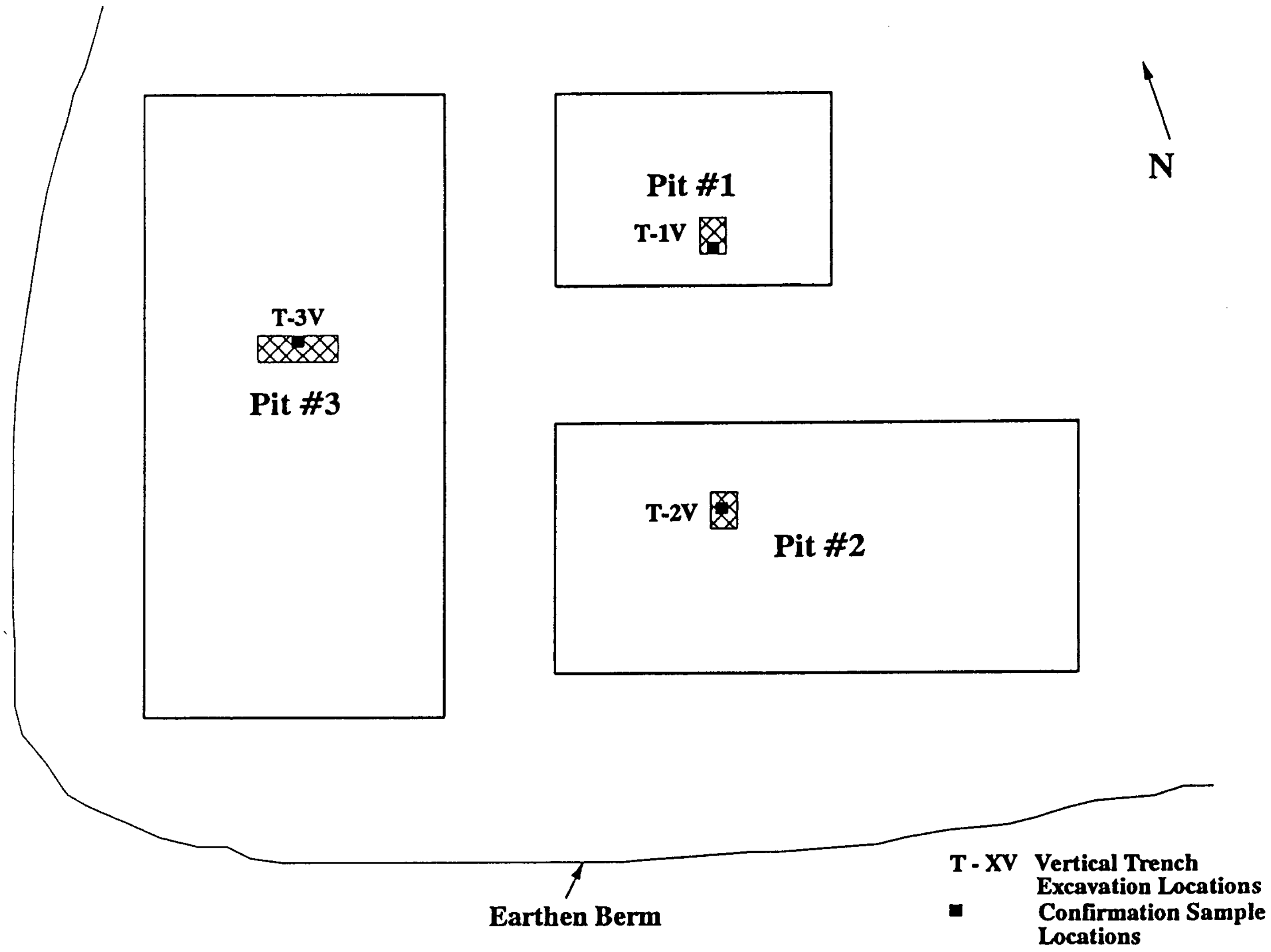



FIGURE 4-2
VERTICAL TRENCH LOCATIONS
(WITH CONFIRMATION SAMPLES)

TABLE 4-5

VERTICAL TRENCH CONFIRMATION SAMPLE DATA

| Trench/Pit # | Parameter (mg/kg) | | | | | TPH (mg/kg) |
|---|---|---|---|---|---|---|
| | Benzene | Toluene | Ethylbenzene | m,p-xylene | o-xylene | |
| 1 | < 0.02 | < 0.02 | < 0.02 | 0.031 | < 0.02 | 35 |
| 2 | < 0.02 | < 0.02 | 0.021 | 0.033 | < 0.02 | 10 |
| 3 | < 0.02 | 0.021 | < 0.02 | < 0.02 | < 0.02 | < 10 |

The analytical data indicate that the following constituents were reported at levels above background in at least one, and possibly several of the composite pit samples and/or confirmation samples collected in the horizontal and vertical trenches:

Organics

(1) benzene
(2) ethylbenzene
(3) toluene
(4) xylene

Inorganics

(1) chromium
(2) iron
(3) lead
(4) magnesium

All samples were assayed for BTEX constituents. Of the BTEX constituents, ethylbenzene and the xylenes (m,p-xylene and o-xylene) were reported most often and at the highest levels. The highest reported value was 160 mg/kg for ethylbenzene and m,p-xylene, both reported in the Pit #1 composite sample.

The overall pit and individual pit composite samples were assayed for total metals, whereas the overall pit composite sample was subjected to TCLP metals analysis also. The data verified that the source material meets the TCLP metals criteria for nonhazardous classification.

### 4.4.2 Sludge and Affected Soil Volumes

Pit #1

Pit #1 contains approximately 611 cubic yards of petroleum sludge material. Based on reaching an HNu field headspace measurement of approximately background in the horizontal direction and groundwater in the vertical direction, the total volume of material (sludge and soil) is approximately 4,000 cubic yards.

## Pit #2

Pit #2 contains approximately 1,295 cubic yards of petroleum sludge material. Based on reaching an HNu field headspace measurement of approximately background in the horizontal direction and groundwater in the vertical direction, the total volume of material (sludge and soil) is approximately 1,814 cubic yards.

## Pit #3

Pit #3 contains very little petroleum sludge material. However, based on reaching an HNu field headspace measurement of approximately background in the vertical direction and assuming that only one half of the pit floor has affected material, the total volume of material (sludge and soil) is approximately 266 cubic yards.

# 5.0 GROUNDWATER PATHWAY ANALYSIS

## 5.1 PHYSICAL AND CHEMICAL CHARACTERISTICS OF DETECTED WASTE CONSTITUENTS

Based on the pit source material and confirmation soil sampling program, the following COIs were identified:

<u>Volatile Organics</u>

benzene
toluene
ethylbenzene
m,p-xylene
o-xylene

Although not detected at levels of concern, the following metals constituents were evaluated in this groundwater pathway analysis:

<u>Metals</u>

chromium
iron
lead
magnesium

The evaluated parameters are pertinent to the evaluation of the fate of these metal constituents in the environment regarding their ability to enter the food chain. Therefore, the information provided is relevant to Section 7.0, the Ecological Risk Assessment.

The physical and chemical properties of these waste constituents were reviewed and are summarized in Table 5-1. Pertinent information included the following characteristics:

- physical state of the constituent (solid, liquid, or gas),
- viscosity,
- dissociation constant (pKa),
- density,
- water solubility,
- partitioning ratio (Henry's Law Constant),

## TABLE 5-1

## PHYSICAL/CHEMICAL CHARACTERISTICS FOR DETECTED CONSTITUENTS

| Constituent | State(1) @ 20C | Visc.(1) (Cp) | pKa | Specific Gravity (1) | Water Sol.(2) (mg/L) | Henry's Law Constant(3) (atm-m3/mol) | Partition(2) Coefficient (octanol/water) | B.P. (C) (2) | M.P. (C) (2) | F.P. (C) (2) |
|---|---|---|---|---|---|---|---|---|---|---|
| Benzene | l | $0.652^{20}$ | N/A | 0.8765 | 1780 | 5.50E-3 | 2.28 | 80.0 | 5.5 | -11.1 |
| Toluene | l | $0.590^{20}$ | N/A | 0.8669 | 512 | 6.68E-3 | 2.69 | 110.6 | -95 | NA |
| Ethylbenzene | l | $0.691^{17}$ | N/A | 0.8670 | 152 | 6.44E-3 | 3.15 | 136.2 | -95 | NA |
| o-xylene | l | $0.810^{20}$ | N/A | 0.8802 | 175 | 5.27E-3 | 2.77 | 144.4 | -25.0 | NA |
| m-xylene | l | $0.620^{20}$ | N/A | 0.8642 | i | 5.20E-3 | 3.20 | 139.0 | -50.5 | 25.0 |
| p-xylene | l | $0.648^{20}$ | N/A | 0.8611 | 198 | 5.27E-3 | 3.15 | 138.4 | 13.0 | 25.0 |
| Chromium | s | NA | N/A | 7.20 | # | NA | NA | 2642 | 1900 | NA |
| Iron | s | NA | N/A | 7.86 | # | NA | NA | 2750 | 1535 | NA |
| Lead | s | NA | N/A | 11.3437 | # | NA | NA | 1740 | 327.4 | NA |
| Magnesium | s | NA | N/A | 1.74 | # | NA | NA | 1107 | 648.8 | NA |

(1) Handbook of Chemistry and Physics, 62nd Edition.
(2) Soil Transport and Fate Database.
(3) Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF) - Air Emission Models.
(4) Treatability Database, U.S. EPA Risk Reduction Engineering Laboratory, Cincinnati, Ohio.
BP Boiling Point
MP Melting Point
FP Flash Point
pKa Dissociation constant
# Water solubility is a function of pH, temperature, and concentrations of other constituents
NA Not available
N/A Not applicable
i Insoluble in water
s Solid
l Liquid

Note: The stated values were selected from a range of data that are dependent on the method and conditions of measurement.

Viscosity superscript is temperature at which viscosity was measured.

- octanol/water partition coefficient,
- boiling point,
- melting point, and
- flash point.

These properties were evaluated to survey the migration and dispersal characteristics of the source material constituents.

As indicated by the information in Table 5-1, there is a general lack of data regarding the partitioning characteristics (octanol/water partition coefficient) of elemental metal constituents. Therefore, the cation exchange capacity (CEC), which is a measure of the quantity of readily exchangeable cations neutralizing negative charge in a soil, can be used to evaluate the general capacity of the soil to attenuate these metals constituents.

Analysis of Pit #1 soil collected at a depth of 9.5 to 10.0 feet indicated that these underlying soils have a CEC of approximately 243 meq/100g. This CEC suggests that metals immobilization (attenuation) in the soils will be high, reducing the potential for off-site migration.

## 5.2 MIGRATION AND DISPERSAL CHARACTERISTICS OF DETECTED WASTE CONSTITUENTS

The migration and dispersal characteristics of the waste constituents were evaluated by identifying the potential for biological, chemical and physical transformation and/or degradation of the constituents by biodegradation, hydrolysis, photolysis, and oxidation.

### 5.2.1 Assessment of Biodegradation Potential

The BTEX constituents are readily biodegradable in the soil and aqueous environment, as evidenced by the numerous biodegradation studies performed to-date, illustrating relatively low half-lives for these constituents. The constituent half-life, which is the time required to reduce the concentration by 50 percent, is a useful parameter for determining the biodegradability of the organic constituents. The shorter the half-life, the more amenable the constituent is to biodegradation. Biodegradation studies have repeatedly illustrated the relatively high biodegradability of the BTEX constituents when compared to multi-ringed aromatic compounds. The BTEX constituents, which have a one-ringed aromatic structure, are more susceptible to biodegradation than the multi-ringed compounds, partly due to their higher solubilities, which provide for a higher bioavailability.

### 5.2.2 Assessment of Immobilization Due to Hydrolysis

Hydrolysis is responsible for the numerous ionized forms of metals in aqueous solution. The free ionized metal often does not dominate in the distribution, particularly at neutral to alkaline pH. Hydrolysis influences metals retention in soils. Generally, as soil pH increases, the overall concentration of a metal in solution decreases. The native soils in the region of the Tuzlu Kopek disposal facility are characterized by the presence of caliche, which is rich in calcium carbonate. The native soils will, therefore, have a neutral to alkaline pH, providing for the immobilization of metals in the soil.

### 5.2.3 Assessment of Photodegradation Potential

Aromatic compounds are susceptible to sunlight induced photolytic oxidation in the atmosphere and in liquid solution. However, photodegradation is attenuated rapidly with depth such that photolysis of volatile constituents would be limited only to surface layers exposed to sunlight. Below the soil surface, the photodegradation potential of the waste constituents is very low.

Benzene and toluene, which were identified as COIs in the Tuzlu Kopek site source material, are single-ringed aromatic compounds. As such, they will undergo photolytic oxidation in the surface material and soils.

### 5.2.4 Assessment of Oxidation/Reduction Potential

For organic constituents, free-radical oxidation processes are not expected to be a major mechanism for removal of the constituents from the soils. For metals, oxidative conditions, as opposed to reduced conditions, generally promote the presence of metallic species that are immobilized. Oxidation/reduction (redox) reactions are not of significant importance for lead. However, redox reactions may be important for chromium, iron, and magnesium. A discussion of these metals follows.

## Chromium

Chromium may exist as chromium(VI) or chromium(III). Chromium(VI) is the more toxic of the two forms. However, chromium(VI) is readily reduced to chromium(III) by soil microorganisms. Chromium(III) is the more stable form of chromium and is adsorbed to soil particles or precipitated under neutral to alkaline, aerobic, unsaturated soil conditions. Therefore, chromium may be mobile at the lower depths in the pit waste material contained in Pits #1 and #2 because of the possibility of anaerobic conditions.

## Iron

The reactions of iron in soils are dependent on both the electropotential and alkalinity of the soils and on the stage of oxidation of the iron compounds involved. One general rule concerning the mobilization and fixation of iron is that oxidizing and alkaline conditions promote the precipitation of iron, whereas acidic and reducing conditions promote the solution of iron compounds. In soils, iron generally occurs in the form of oxides and hydroxides as precipitated particles or associated with the surfaces of other minerals. The alkaline nature of the caliche soils at the Tuzlu Kopek facility suggests that iron will generally exist in a precipitate form, as opposed to a soluble form.

## Magnesium

Magnesium exists in soil environments under the same general conditions as does the macronutrient calcium; the ion can be released from soils through the cation exchange process. As such, some magnesium enters the environment directly from the soil minerals by weathering. However, magnesium is easily adsorbed to the colloidal sized particles of the soil matrix, rendering the metal immobile. As with the other metal constituents, the immobile precipitate forms of magnesium will predominate.

## Lead

Lead, which primarily occurs in the terrestrial environment as $Pb^{+2}$, is reported to be the least mobile of the heavy metals. Lead may precipitate as one of the hydroxide, phosphate, or carbonate precipitates at high pH. Additionally, high pH environments promote the formation of the stable Pb-organic complexes. As stated above, the Tuzlu Kopek soils fall into the neutral to alkaline pH range, providing immobilization of soils.

Generally, lead will be highly immobilized in the soil environment because of the relative insolubility of adsorbed and precipitated ions of lead in soils.

In general, the two most important mechanisms leading to immobilization of metals in soils are adsorption and fixation. The former mechanism is primarily a function of a soil's CEC, which depends on the clay and organic matter content of the soil as well as the soil pH. Soil from this region of New Mexico has a relatively high CEC 243 meq/100g and neutral to alkaline pH conditions.

The formation of insoluble metal compounds (e.g., hydroxides, carbonates, and phosphates), reversion of metal constituents into the soil mineral lattice, and association with soil organic ligands are the primary means of metal fixation in soils. Reversion is a slow process that can often take months or years to accomplish. Therefore, cation exchange processes are an important means of retaining the metals for a sufficient length of time to permit reversion to occur. The solubility of metal constituents in soils is highly dependent on the identity of the metallic species as well as pH and redox conditions of the soil. The precipitation of metal hydroxides increases with increasing soil pH, and the neutral to alkaline nature of the soil tends to promote the retention of metals.

## 5.3 ASSESSMENT OF MIGRATION AND DISPERSAL CHARACTERISTICS

In summary, the migration and dispersal characteristics of the waste constituents vary depending on the constituent. The volatile BTEX compounds have high solubilities and are, therefore, a readily available substrate for biological degradation.

The waste metal constituents are immobilized within the site soils at the neutral to alkaline conditions provided by the calcium carbonate composition. Additionally, the high CEC values of the native soils provide additional metals immobilization.

# 6.0 QUALITATIVE HUMAN HEALTH RISK EVALUATION

The Qualitative Human Health Risk Evaluation is based on the guidelines provided in the New Mexico Environmental Department's memorandum entitled "Risk Assessment Calculations", which is included in Appendix I. The New Mexico document references the U.S. EPA document, Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A. The Ecological Risk Assessment is included in this report as Section 7.0.

The Qualitative Human Health Risk Evaluation was conducted to establish remedial criteria which assist in determining whether remediation activities at the Tuzlu Kopek disposal facility may be minimized or eliminated. As part of this Qualitative Human Health Risk Evaluation, potential migration pathways and receptors were identified. The agency risk assessment guidance, which utilizes a more conservative exposure assessment, was then used to calculate site-specific remedial criteria.

The Qualitative Human Health Risk Evaluation was completed in several steps:

1. Potential sources of hazard (surface pits) were identified.

2. Potential affected media and Chemicals of Interest (COI) for the risk assessment were identified.

3. Potential receptors and exposure pathways were identified, based on consideration of present and future land use scenarios.

4. Potential target receptors were selected.

5. Remedial criteria were identified by calculating risk-based levels for the COI in affected media.

Calculation of the risk-based levels for the COI was achieved through the New Mexico Environmental Department's "Risk Assessment Calculations" guidance memorandum for carcinogenic and noncarcinogenic constituents, as required by the BLM in their letter to B & E, Inc dated January 23, 1992 (Appendix A).

In the process of calculating risk-based acceptable levels and Hazard Indices, discrepancies in the New Mexico Environmental Department's guidance memorandum were discovered. The corrected equations and units were utilized in this report, with corrections to the guidance memorandum included in Appendix I.

## 6.1 POTENTIAL SOURCES OF HAZARD

The disposal units of interest are the three formerly active pits. Pits #1 and #2 received a majority of the material disposed at the Tuzlu Kopek facility. Pit #3, although not utilized as extensively, exhibited limited BTEX levels in the sludges, as evidenced by the levels recorded in the Pit #3 composite sample.

## 6.2 POTENTIAL AFFECTED MEDIA AND COI

The media which serve as a potential source for COI are the pit sludge and affected soil. The sludge and affected soil associated with each pit cannot be separated, as staining of the pit wall soils precludes discerning between the two media types at each pit.

The COI for this Qualitative Risk Evaluation were derived from a review of the disposal pit composite sample analytical data (Section 4.0). The COI which will be utilized in the Qualitative Risk Evaluation include all of the BTEX constituents, with xylene's three individual isomers (ortho, meta, para) combined into one overall constituent (total xylenes). Section 5.0 of this document reviewed the migration and dispersal characteristics of the COIs and Table 5-1 summarized the pertinent physical and chemical properties of those constituents.

## 6.3 EXPOSURE ASSESSMENT

Exposures are dependent upon the existence of a pathway, which starts at a source, ends at a receptor medium and has an intake mechanism associated with the receptor. This section evaluates the potential receptors and exposure pathways for the present and future land use scenarios.

### 6.3.1 Present Land Use Scenario

Potential current on-site receptors include B & E, Inc. facility maintenance personnel that engage in short-term on-site activities. These employees have received Health and Safety training to work under conditions that may subject them to both acute and chronic exposure. These individuals would be exposed to COI in soils and sludges. Access to the disposal facility pits is restricted by a fence with locked gate, preventing other individuals from entering the site. However, BLM employees performing land management activities on adjacent land, and possibly hunters utilizing public lands (BLM), may potentially enter the site, receiving short-term exposure. Potential exposure to these individuals, as well as any visitors to the site, is extremely limited, as the site has been enclosed by a fence and is bordered by a playa lake (Laguna Cuatro) on its southwestern side. The only visitors expected are those BLM employees associated with the near-term closure activities.

### 6.3.2 Future Land Use Scenario

Potential future on-site human receptors would be limited to the occasional BLM employee performing land management activities and possibly hunters utilizing BLM land. These individuals may potentially be exposed to the COI in the soils and sludges. All identified human receptors are adults. Further, potential exposures would be short-term for all identified receptors.

### 6.3.3 Summary

In summary, the potential receptors identified for the Tuzlu Kopek site are limited to BLM employees performing land management activities and to hunters utilizing these public lands. Both potential receptors are adults. These receptors would receive infrequent exposure to site contaminants and exposure would occur on a short-term basis.

## 6.4 INTAKE ROUTES

The intake route evaluated for the Qualitative Risk Evaluation is incidental oral ingestion of surface soils/sludges. The groundwater in the vicinity of the Tuzlu Kopek facility is not a potable water source, precluding the need to consider the ingestion of groundwater as an intake route.

## 6.5 DEVELOPMENT OF REMEDIAL CRITERIA

The remedial criteria were developed as risk-based concentration levels of COI for defining the type and extent of remedial activities that would be necessary at the facility for protection of human health and the environment; the New Mexico Environmental Department guidance memorandum was used to calculate these remedial criteria. This Qualitative Human Health Risk Evaluation was developed in conjunction with the Ecological Risk Assessment, which is presented in Section 7.0.

The following site-specific information was previously identified in this Qualitative Human Health Risk Evaluation:

- media of potential concern,
- COI, and
- probable present and future land use.

The "media of potential concern" were identified as pit soils/sludges, and the "constituents of interest" were identified as BTEX. Both the probable present and future land use scenarios assume that occasional short-term exposure to adult individuals would occur. Those individuals would be BLM employees and hunters using public (BLM) land.

The New Mexico guidance specifies that calculation of the acceptable concentration for carcinogens is based on a 70 kg adult consuming 100 mg of soil per day. Additionally, the guidance specifies that the calculation for noncarcinogens is based on a 10 kg child ingesting 200 mg soil per day. The previously-mentioned exposure assessment indicates that the potential for human exposure to site contaminants would be much less than these guidance requirements. Therefore, the calculations provide conservative remedial criteria.

For this Qualitative Risk Evaluation, a carcinogenic effects target risk level of $10^{-6}$ was utilized for carcinogens (benzene) in the media (pit sludge/soil). This level is consistent with that recommended in the New Mexico Environmental Department's guidance.

### 6.5.1 Carcinogens

Only one carcinogen, benzene, was identified as a COI. The acceptable residual soil concentration, C, is calculated based on the reference dose factor (RfD) and the amount of soil assumed ingested by the individual on a daily basis. The acceptable risk, R, is $10^{-6}$. The carcinogenic slope factor, SF, can be found in the Integrated Risk Information Service

(IRIS) data base. The New Mexico guidance requires calculation of the acceptable concentrations based on the oral intake (ingestion) pathway alone.

The New Mexico guidance specifies calculation of the acceptable concentration based on a 70 kg adult consuming 100 mg of soil daily. Therefore, the daily intake will be 1.42 mg soil per kg body weight per day. The acceptable concentration will, therefore, be the following:

$$C = R/\{SF \text{ (kg body wt-day/mg cont) X } 1.42 \text{ (mg soil/kg body wt-day)}\}$$

As listed in Table 6-1, the slope factor (SF) for benzene is 0.029 kg body wt-day/mg contaminant. When applied to the above equation for acceptable concentration of carcinogenic compounds, the result is 24.3 mg benzene/kg soil, based on an acceptable risk factor of $10^{-6}$.

### 6.5.2 Noncarcinogens

Ethylbenzene, toluene, and xylene have all been included in the calculation of noncarcinogenic compound concentrations. Therefore, the calculation for noncarcinogenic effects considers the additive effect of the individual constituents, as measured through the Hazard Index (HI). The xylene isomers have been combined into one compound (xylene) because one reference dose factor (RfD) exists for this compound, as opposed to one for each isomer.

The New Mexico Environmental Department guidance states that the standard RCRA model assumes noncarcinogenic effects in a child of 10 kg ingesting 200 mg soil/day, which is equal to 20 mg soil/kg body weight per day. The identified on-site and off-site human receptors for the migration pathways are adults (70 kg). Thus, the assumption that a child is the receptor provides an added factor of safety in the calculation of the HI.

The Total Hazard Index ($HI_{tot}$) is calculated in the following manner:

$$HI_{tot} = CDI_1/RfD_1 + CDI_2/RfD_2 + \text{etc.}$$

where: CDI = chronic daily intake of the noncarcinogen
CDI = daily soil intake times the concentration of individual constituent

The Total Hazard Index must be less than 1.

Table 6-2 lists the data utilized in the calculation of the HI for the different pit composite samples. The HI values are listed in the last column of data of Table 6-2.

Alternatively, the acceptable concentration, C, for individual noncarcinogens can be calculated based on the reference dose information and an assumed daily intake, which according to the New Mexico guidance, will be based on a 10 kg child ingesting 200 mg soil/day. According to the guidance, the oral intake reference dose data should be used. The acceptable concentration of individual constituents is given by the following equation:

$$C = \text{RfD(mg cont/kg body weight-day)/20 (mg soil/kg body weight-day)}$$

Table 6-3 summarizes the calculation of the acceptable noncarcinogenic constituent levels.

## 6.6 SUMMARY OF HUMAN HEALTH RISK EVALUATION CALCULATIONS

The qualitative risk assessment equations described above were used to calculate the risk assessment concentration levels for the COI. Both carcinogenic and noncarcinogenic risk concentration levels were calculated.

### 6.6.1 Carcinogens (Benzene)

The data in Table 6-1 for the single carcinogen of interest, benzene, represents a risk level of $10^{-6}$. The risk assessment is limited to consideration of a single exposure route, through oral ingestion of site soils. The acceptable benzene level derived through this calculation is 24.3 mg/kg soil. No single sample collected during the site investigation exhibited benzene levels above this acceptable value.

### 6.6.2 Noncarcinogens (Ethylbenzene, Toluene, Xylenes)

The Hazard Index (HI) data listed in Table 6-2 for all of the individual composite samples were well below 1.0, indicating that the concentration of the three COIs does not exceed the acceptable HI level of 1.0. The horizontal and vertical extent of contamination soils contained much lower levels of the BTEX constituents. Therefore, the calculated Hazard Indices (HI) would be even lower than the individual pit composite sample Hazard Indices (HI). Table 6-3 lists individual remedial criteria for the three noncarcinogens on the list of COI.

TABLE 6–1

CALCULATED REMEDIAL CRITERIA – CARCINOGENS

| Parameter (mg/kg) | Acceptable Cancer Risk Level | Daily Intake DI (mg soil/kg B.W.–day) | Cancer Slope Factor SF (kg B.W.–day/mg cont) | Acceptable Concentration C (mg cont/kg soil) |
|---|---|---|---|---|
| Benzene | 0.000001 | 1.42 | 0.029 | 24.28 |

TABLE 6–2

CALCULATED HAZARD INDICES – NONCARCINOGENS

| Parameter (mg/kg) | Concentration of Contaminant (mg/kg) | Daily Intake DI (mg soil/kg B.W.–day) | Chronic Daily Intake CDI (mg cont/kg B.W.–day) | Reference Dose Factor, RfD (mg cont/kg B.W.–day) | Hazard Index HI (unitless) |
|---|---|---|---|---|---|
| **Pit #1 Composite** | | | | | |
| ethylbenzene | 160 | 20 | 3.200E–03 | 0.1 | 3.200E–02 |
| toluene | 0.38 | 20 | 7.600E–06 | 0.2 | 3.800E–05 |
| xylene (o, m, p)* | 221 | 20 | 4.420E–03 | 2 | 2.210E–03 |
| Total Hazard Index | | | | | 0.0342 |
| **Pit #2 Composite** | | | | | |
| ethylbenzene | 0.2 | 20 | 4.000E–06 | 0.1 | 4.000E–05 |
| toluene | 11 | 20 | 2.200E–04 | 0.2 | 1.100E–03 |
| xylene (o, m, p)* | 71 | 20 | 1.420E–03 | 2 | 7.100E–04 |
| Total Hazard Index | | | | | 0.0019 |
| **Pit #3 Composite** | | | | | |
| ethylbenzene | 0.051 | 20 | 1.020E–06 | 0.1 | 1.020E–05 |
| toluene | 0.02 | 20 | 4.000E–07 | 0.2 | 2.000E–06 |
| xylene (o, m, p)* | 0.047 | 20 | 9.400E–07 | 2 | 4.700E–07 |
| Total Hazard Index | | | | | 0.00001 |

* Value is summation of the m,p–xylene and o–xylene values reported by analytical laboratory.

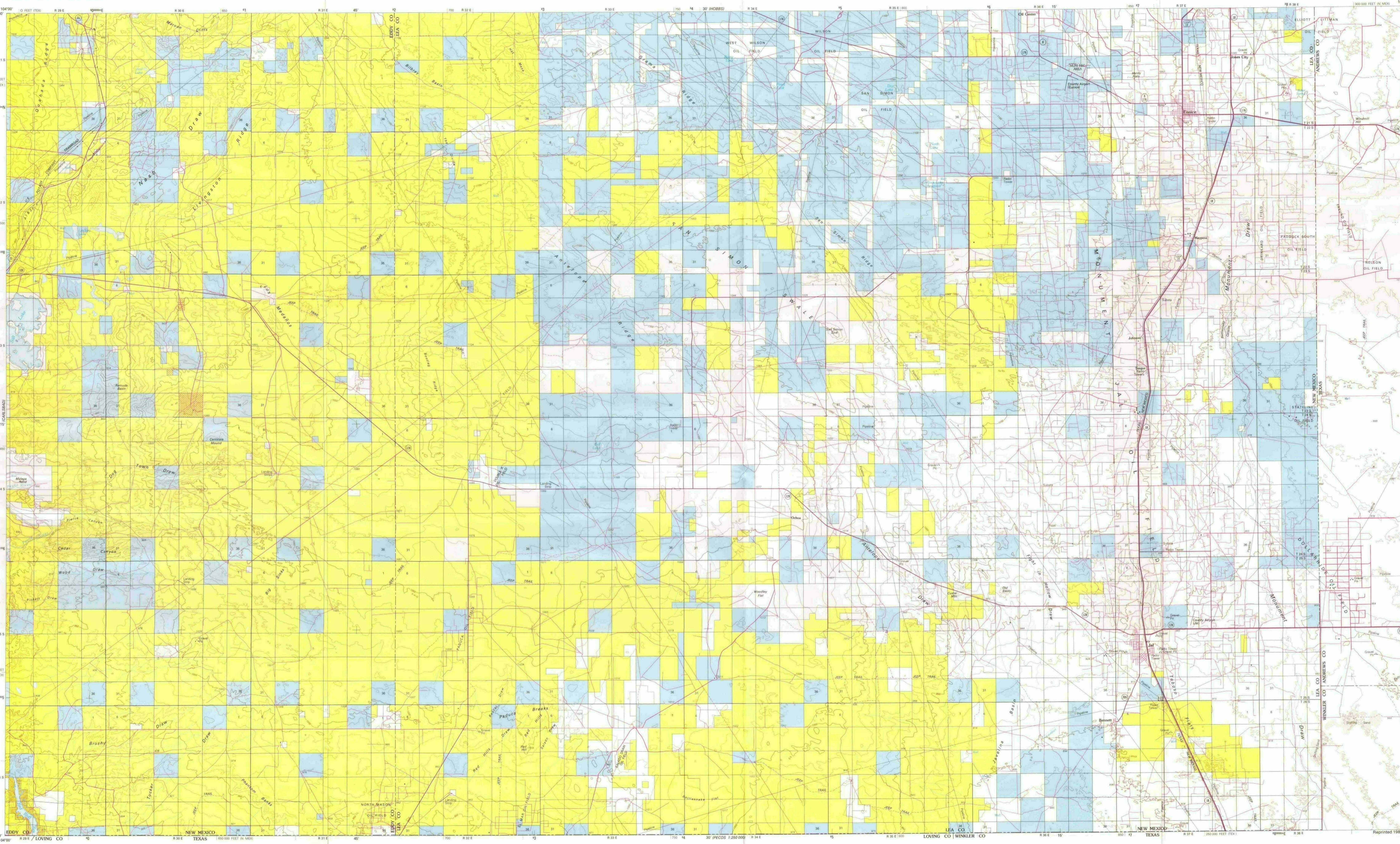
## TABLE 6–3

## CALCULATED REMEDIAL CRITERIA – NONCARCINOGENS

| Parameter (mg/kg) | Daily Intake DI (mg soil/kg B.W.–day) | Reference Dose Factor, RfD (mg cont/kg B.W.–day) | Acceptable Concentration C (mg cont/kg soil) |
|---|---|---|---|
| ethylbenzene | 20 | 0.1 | 5.000E+03 |
| toluene | 20 | 0.2 | 1.000E+04 |
| xylene (o, m, p) | 20 | 2 | 1.000E+05 |

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

# JAL QUADRANGLE
NEW MEXICO – TEXAS
1:100 000-SCALE SERIES (TOPOGRAPHIC)




INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1986

## BUREAU OF LAND MANAGEMENT

### LAND STATUS LEGEND

- Public Lands (Administered By Bureau of Land Management) . . . . .
- Oregon & California Lands (O&C Lands) Coos Bay Wagon Road (CBWR) . . . . NONE
- National Forest . . . . . . . . . . . . . . NONE
- National Grasslands . . . . . . . . . . . NONE
- National Parks and Monuments . . . . NONE
- Indian Lands or Reservations . . . . . . NONE
- Military Reservations and Withdrawals Corps of Engineers . . . . . . . . . . . NONE
- Wildlife Refuges . . . . . . . . . . . . . NONE
- Bankhead-Jones Land Use Lands (L.U. Lands) . . . . . . . . . . . . . . . . NONE
- Tennessee Valley Authority . . . . . . . NONE
- Patented Lands . . . . . . . . . . . . . .
- State Lands . . . . . . . . . . . . . . . .
- Water and Power Resources Service . NONE
- Power Withdrawals and Classifications . . . . . . . . . . . . . .
- Federal Agency Protective Withdrawals . . . . . . . . . . . . . . . NONE
- Public Water Reserves . . . . . . . . . .
- Department of Energy (DOE) . . . . . . . . . . . . . . . . . . .
- Oregon & California Lands (O&C Lands) Administered By US Forest Service . . . . . . . . . . . . . . . . . . . NONE
- Radio & Air Facilities . . . . . . . . . . NONE
- Miscellaneous . . . . . . . . . . . . . . . NONE
- State, County, City, Wildlife, Park and Outdoor Recreation Areas . .
- Acquired Lands (By Administering Agency) . . . . . . . NONE

### NOTE TO MAP USERS

The surface and minerals management status overprints are published as general planning and management tools. Some of the lands, surface and mineral rights, may have been shown as patented lands due to the lack of information available to BLM with respect to the nature of acquisition. Tracts less than 40 acres are usually omitted because of the map scale. Access through private lands may be restricted. The official land records in the respective offices of the Bureau of Land Management or other responsible Federal agencies should be checked for up-to-date status on any specific tract of land. Inadequacies in the BLM maps should be reported to the respective Bureau of Land Management offices from which the maps were obtained.


Edited and published by the Bureau of Land Management
Base map prepared by the U.S. Geological Survey
Compiled from USGS 1:24 000 and 1:62 500-scale topographic maps dated 1939–1973. See index for dates of individual maps
Partially revised from aerial photographs taken 1972 and 1975 and other source data. Revised information not field checked
Map edited 1978

Projection and 10 000-meter grid, zone 13
Universal Transverse Mercator
50 000-foot grid ticks based on New Mexico coordinate system, east zone and Texas Coordinate system, north central zone. 1927 North American datum

Surface Management Status by BLM, 1981


### MAP INDEX

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | | 2 | | 3 | | 4 | 5 |
| | | | | | | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |

1. Nash Draw – 1939 (Photorevised – 1965)
2. Hat Mesa – 1963 (Photorevised – 1972)
3. Oil Center – 1963
4. Eunice – 1969
5. Eunice NE – 1969
6. Rattlesnake Canyon – 1969
7. Eunice SE – 1969
8. Pierce Canyon – 1968
9. Big Sinks – 1968
10. Paduca Breaks NW – 1973
11. Bell Lake – 1973
12. Woodley Flat – 1973
13. Custer Mountain – 1973
14. Jal NW – 1969
15. Jal NE – 1969
16. Ross Ranch – 1968
17. Phantom Banks – 1968
18. Paduca Breaks West – 1973
19. Paduca Breaks East – 1973
20. Andrews Place – 1973
21. Javelina Basin – 1973
22. Jal – 1969
23. Jal SE – 1969

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF MAP

SCALE 1:100 000

KILOMETERS

MILES

FEET

CONTOUR INTERVAL 10 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
To convert meters to feet multiply by 3.2808
To convert feet to meters multiply by 0.3048


This map complies with national map accuracy standards
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR RESTON, VIRGINIA 22092
and
BLM STATE OFFICE, SANTA FE, NM 87501


NEW MEXICO

QUADRANGLE LOCATION

### LEGEND

- Perennial stream, lake . . . . . . . . . .
- Intermittent stream, lake . . . . . . . . .
- Village or locality . . . . . . . . . . . .
- Landmark structure . . . . . . . . . . . .

### ROAD CLASSIFICATION

- Primary highway, hard surface . . . . . . . . . . . . . . . .
- Secondary highway, hard surface . . . . . . . . . . . . . .
- Light-duty road, hard or improved surface . . . . . . . .
- Street or other road . . . . . . . . . . . . . . . . . . . . . . . .
- Trail . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

Interstate route   U.S. route   State route

## JAL, NEW MEXICO – TEXAS
SW / 4 HOBBS (NI 13-12) 1:250 000-SCALE MAP

N3200—W10300/30x60

1978
SURFACE MANAGEMENT STATUS

# 7.0 ECOLOGICAL RISK ASSESSMENT

The Ecological Risk Assessment has been implemented based on interim final guidance provided in a March 1989 document entitled Environmental Evaluation Manual, issued as Office of Solid Waste Management (OSWER) Directive 9285.7-01. The BLM intended for that document to be used as a guideline for the Tuzlu Kopek site Ecological Risk Assessment.

The results of the Ecological Risk Assessment, combined with the Qualitative Human Health Risk Assessment, have been used to assess the appropriate level of remedial action necessary for the site.

## 7.1 OBJECTIVES

The objectives of the Ecological Risk Assessment were the following:

1. Document the actual or potential adverse ecological effects of contaminants from the Tuzlu Kopek site pit sludges/soils.
2. Develop remedial criteria.

The analytical data provided by the site investigation were used in conjunction with literature information to establish the qualitative impact that might occur to the site ecology.

## 7.2 SCOPE OF ECOLOGICAL RISK ASSESSMENT

This section provides a summary of the scope of the information that was collected in the study. A complete description of the sampling and analytical program was included as Section of 2.0 of this report, and the results of the program were presented in Section 4.0. This section also provides a description of the time period and seasonal aspects of the investigation.

### 7.2.1 Summary of Site Investigation Analytical Data

The site investigation included sampling and analysis of background soils, disposal pit sludge, and affected soils. Background soils were analyzed to evaluate any potential impact that might have occurred through the Tuzlu Kopek disposal facility operation by providing a basis for comparison to the disposal pit analytical data. Disposal pit sludges were identified as a potential source of environmental impacts; the constituents present in the pit sludges were, therefore, characterized in terms of the relevant organic and inorganic constituents. Affected soils were analyzed for constituents detected in the pit sludge samples to evaluate the vertical and horizontal extent of impact from the facility operations.

### 7.2.2 Sampling Program Time Frame

The Tuzlu Kopek site investigation was conducted from September 21 through September 24, 1992. As such, the samples were collected during the early fall in southeastern New Mexico. Immediately following sample collection, the samples were delivered to the analytical laboratory for analyses.

The analytical data provide a characterization of the site conditions during the period for which the samples were taken. The data do not provide a characterization of the site conditions over an extended period of time.

## 7.3 TUZLU KOPEK SITE DESCRIPTION

### 7.3.1 Summary of Facility Description and History

A detailed description of the B & E Tuzlu Kopek disposal facility was presented in Section 1.0 of this report. A BLM topographical map of the Jal Quadrangle, which encompasses the Tuzlu Kopek facility is included as Plate 1. The disposal facility pits of concern in this report cover an area of approximately 2.5 acres (1 ha). The primary exploration and production waste sludges in the pits are characterized by levels of petroleum hydrocarbons, primarily BTEX. These contaminants are almost exclusively confined to the disposal pits.

### 7.3.2 Summary of Regional Geology and Hydrogeology

As discussed in Section 3.0 of this report and in the Geohydrology Associates reports, the facility lies within the Nash Draw, which is the principal surface feature in the region of Eddy County. The Nash Draw is topographically characterized by collapse structures resulting in depressions. The regional geology is characterized by the existence of two major formations, the Salado Formation, which lies directly below the overlying Rustler Formation. The Salado Formation, which consists primarily of halite and potassium minerals with minor clastics, dolomite, and anhydrite, is the major cause for the regional topography in the Nash Draw in Eddy County.

The Nash Draw is an undrained depression resulting from regional differential solution of evaporitic deposits in the Salado and the overlying Rustler Formation. The solution of these deposits resulted in the large-scale collapse of these members, as evidenced by the depression resulting in the regional playa lakes, of which Laguna Cuatro and Laguna Tres are members.

A thin layer of alluvium and caliche may be found locally in various areas in and near the Nash Draw. Caliche soils are characterized by the evaporitic accumulation of calcium carbonate under climatic conditions characterized by a moisture deficiency during all seasons. Figure 7-1 is a map illustrating the regional geologic formations.

Groundwater movement east of the Pecos River in this region is predominantly from north to south. The regional hydrology has been impacted by the collapse of the Nash Draw and Clayton Basin, but also further influenced by the local potash refinery operations.

The Tuzlu Kopek disposal facility lies at the northeastern edge of Laguna Tres, on a ridge (Livingston Ridge) at a slight incline from the playa lake. As of September 21, 1992, the water's edge of Laguna Cuatro was approximately 300 feet (91 m) away from the closest portion of the disposal facility (Pit #3). A portion of the facility, primarily the three disposal pits of concern in this document, lie on BLM land. The nearest uniquely protected lands are the State Park known as the Living Desert Museum (20 miles or 32 km), and the Carlsbad Caverns National Park (30 miles or 48 km).

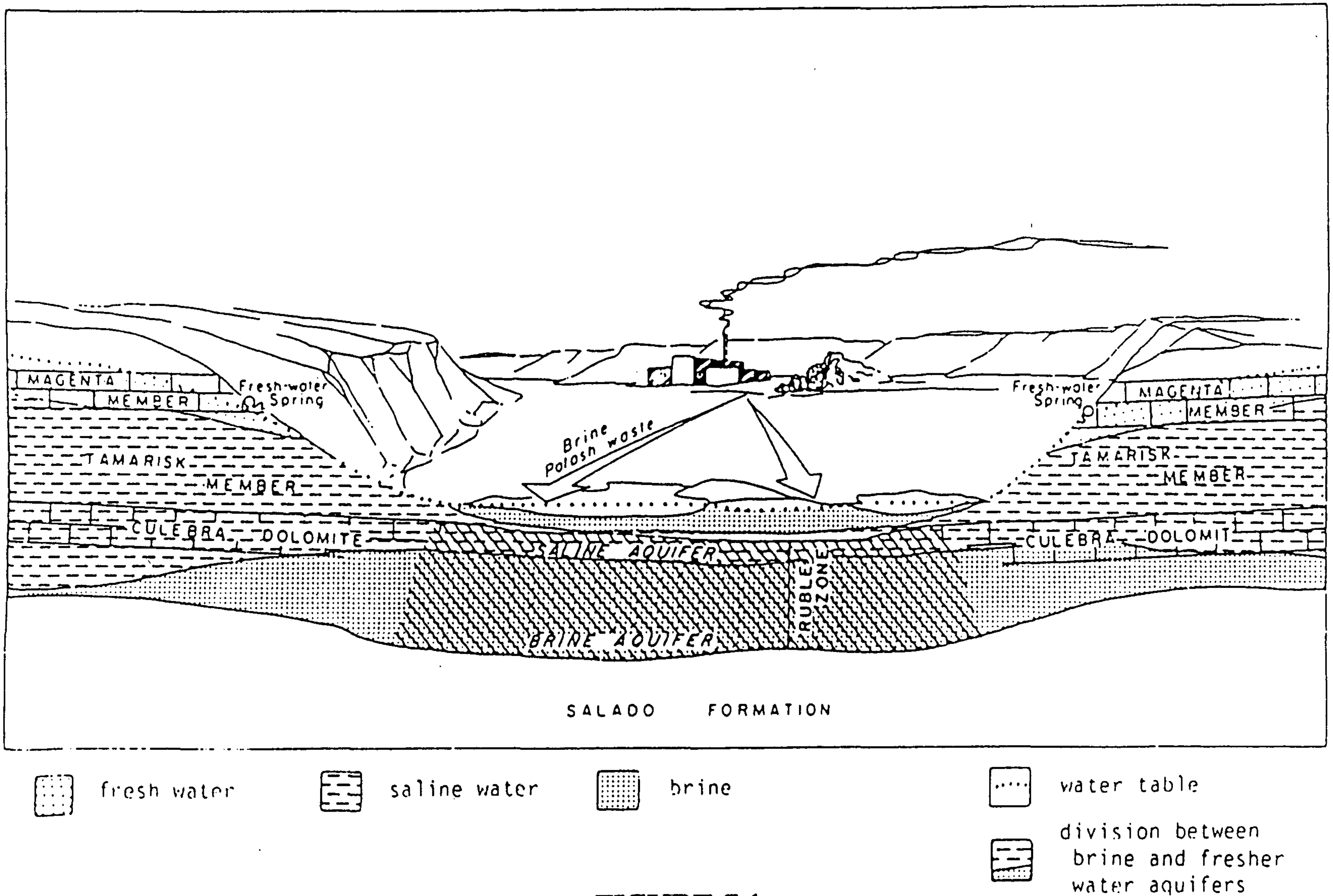



FIGURE 7-1
REGIONAL GEOLOGIC FORMATIONS

From: Geohydrology Associates, Inc. (1986)

### 7.3.3 Area Ecosystem and Populations

The site lies within a transition region between Chihuahuan Desert (desert grassland) and the short-grass prairie of the Southern Great Plains (DOE/EIS-0026-FS-Executive Summary). As such, floral characteristics of both exist in this region. Some of the typical vegetation include sand sagebrush, dune yucca, and mesquite.

Normal annual rainfall, as documented over the 30-year period from 1961 to 1991, is 13.32 inches in Carlsbad, New Mexico, and 16.78 inches in Hobbs, New Mexico (National Climatic Data Center). The disposal facility lies approximately 20 miles from Carlsbad and 55 miles from Hobbs, New Mexico.

The semiarid climate of the region makes water a limiting factor for any animal populations. Therefore, the amount and seasonal nature of rainfall influences plant productivity and the resultant food supply available for wildlife. Significant fluctuations in the abundance and distribution of plants and wildlife occur.

Through discussions with the U.S. Fish & Wildlife Service (Personal Communication, December 9, 1992), there are no documented endangered species, unique to this area of New Mexico. Eddy County lies within the New Mexico portion of the Central Flyway (Figure 7-2), which is surveyed yearly for sightings of migratory waterfowl. Selected water areas are overflown and ducks and geese are counted in a random fashion. The Central Flyway information for 1992 (U.S. Fish and Wildlife) reveals no information suggesting that surface water bodies within the New Mexico portion of the Central Flyway have been detrimentally impacted by disposal operations of the nature at the Tuzlu Kopek facility. The document is very general, and serves as a source of information for determining relative abundances of waterfowl and their distributions on the wintering grounds. Through personal communications with both the U.S. Fish & Wildlife Service and the New Mexico Department of Game & Fish (Personal Communication, December 14, 1992), it was learned that there are no documented studies pertaining to the environmental impact of the oil and gas or disposal operations in the playa lakes region of New Mexico. Therefore, no data exist demonstrating adverse impact from the operations at Tuzlu Kopek, or similar facilities on the playa lakes. However, the New Mexico Department of Game & Fish has documented concentrations of agricultural chemicals in shore birds from the region.

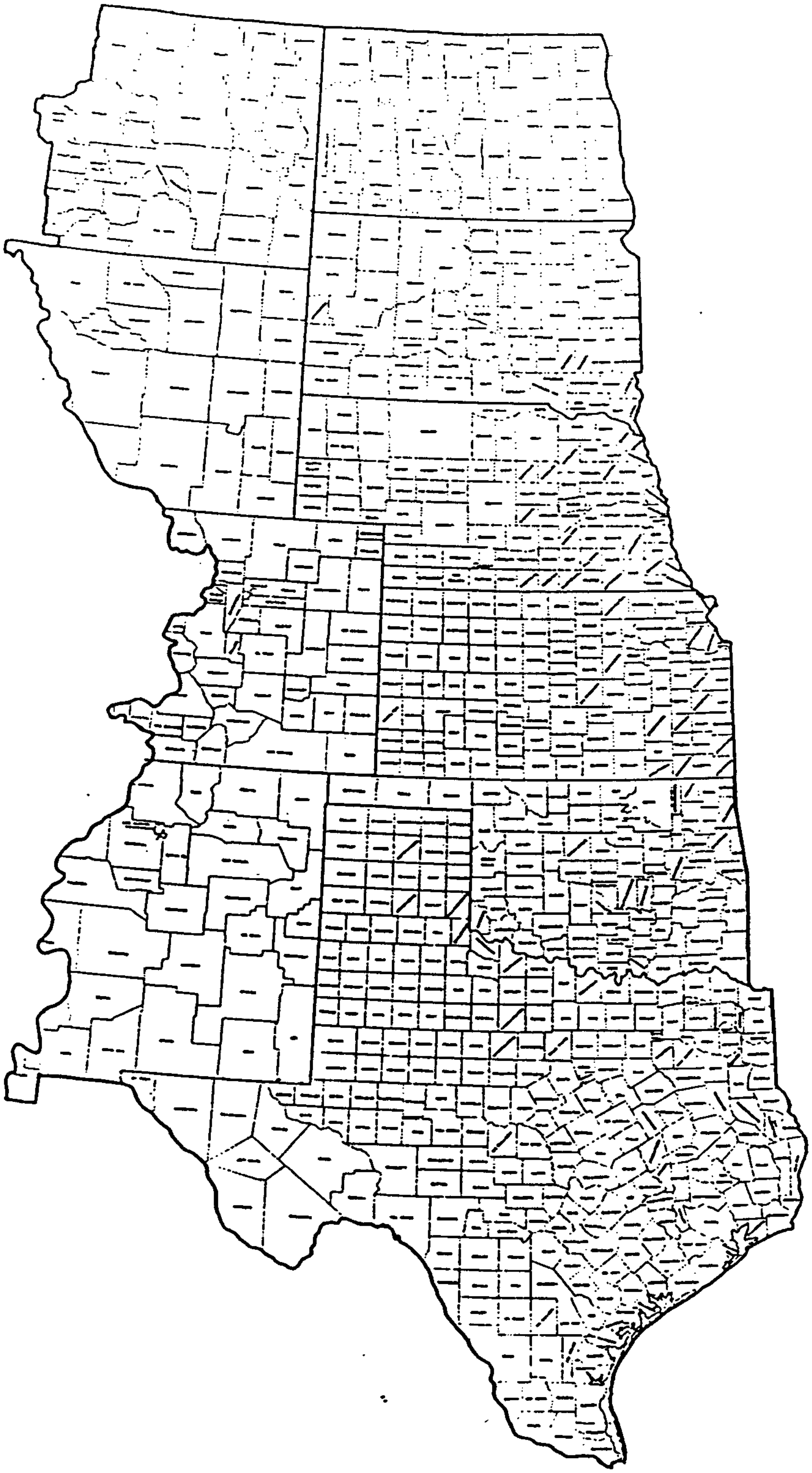


FIGURE 7-2
CENTRAL FLYWAY

Source: U.S. Fish and Wildlife Service
Albuquerque, New Mexico (July, 1992)

The DOE/EIS Executive Summary document (DOE/EIS-0026-FS-Executive Summary), which was prepared for the Los Medanos Waste Isolation Pilot Plant (WIPP) site lying five miles to the east, reported no endangered species within the site area. That study covered the 72-square-mile area of the Los Medanos site.

The Los Medanos study documented thirty-nine mammal species representing five mammalian orders, many of which are restricted to specific habitats. Among the species reported were the desert-cottontail, the black-tailed jackrabbit, and the coyote, which was the most frequently sighted predator. Two big-game species, the mule deer and the pronghorn, were also reported.

The reptiles documented in that study included the side-blotched lizard, the western box turtle, the western whiptail lizard, as well as several species of snakes. The report states that amphibians are restricted by the availability of aquatic habitat. Diversity between the Los Medanos site and the Tuzlu Kopek site may exist due to the proximity of Tuzlu Kopek to the playa lakes.

The Los Medanos study also reported the presence of 123 species of birds representing 37 families within the study area. The densities of the birds in the study area exhibited considerable annual and seasonal variations. Common species included scaled quail, mourning dove, loggerhead shrike, pyrrhuloxia, black-throated sparrow, and western meadowlark. The presence of shore birds at the playa lakes has been confirmed through personal communication with the New Mexico Department of Game & Fish.

## 7.4 AREA LAND USE

### 7.4.1 Current Land Use

Current land use in the area of the disposal facility is restricted to the potash mining operations which lie to the west and north of the Tuzlu Kopek facility at a considerable distance. The Federal Waste Isolation Pilot Plant (WIPP) lies approximately five miles to the east of the facility. Additionally, the BLM land may be used by the general public for game hunting. These activities would probably not occur within the confines of the facility, as access to this portion of BLM land is restricted by a fence and by Laguna Cuatro.

The Los Medanos study reported that the only agricultural operations within 30 miles of that site were those operations on irrigated farmland along the Pecos River, near Carlsbad and Loving. This area is at least 12 miles from the Tuzlu Kopek facility. Some cattle grazing is allowed on area lands.

The nearest town to the site is Loving, which lies approximately 12 to 14 miles (19.3 to 22.5 km) to the west. The town of Malaga lies approximately the same distance from the site, but in a more southerly direction (Figure 1-1).

### 7.4.2 Future Land Use

Projected future land use of the region is limited to the same activities listed for the current land use. Future access to the land upon which Tuzlu Kopek lies will remain restricted by the fence and Laguna Cuatro.

## 7.5 POTENTIAL CONSTITUENTS OF CONCERN (COI)

Section 4.0 of this report included a comprehensive description of the chemical constituents detected in the analytical program. Section 5.0 provided a review of the chemical, physical, and biological aspects of those constituents. Section 6.0 was a Qualitative Human Health Risk Assessment based on those constituents.

The constituents detected in the sludge material and in some of the confirmation samples were the following:

- BTEX, and
- chromium, iron, lead, and magnesium.

All laboratory reporting and quality assurance/quality control documentation is included in Appendix F.

The Qualitative Human Health Risk Assessment was performed based on the BTEX constituents only. Section 5.0, the Groundwater Pathway Analysis, described the fate of those constituents in the environment. In particular, the BTEX constituents were reviewed with importance placed on their relative biodegradability in the environment. The detected metals, chromium, iron, lead, and magnesium, were described in terms of their ability to adsorb to solids in the soil environment. Additionally, these metals will tend to exist in a precipitated form at the neutral to alkaline pH which predominates in the regional soils.

## 7.6 POTENTIAL EXPOSURE PATHWAYS

The potential exposure pathways for the Tuzlu Kopek site receptors are identified and reviewed in this section.

Ingestion of surface soils or vegetation at the site may potentially expose local animal populations to the constituents identified in the pit sludges. The metal constituents would primarily be of concern because they have a tendency to adsorb to soils. Clearly, this pathway can be eliminated through coverage of the pits and affected site soils.

Ingestion of site vegetation, which has incorporated the identified compounds, may potentially expose animal populations to those compounds. The regional vegetation is very sparse and limited to only those species capable of thriving under the stressful conditions provided by the site climate and soils. Those conditions, characteristic of the transition region between the Chihuahuan Desert and mesquite grassland, include low annual rainfall (approximately 15 inches) and a nutrient deficient soil. Therefore, potential exposure of local animal populations through ingestion of vegetation impacted by these compounds would be limited.

Inhalation of fugitive dusts or volatile organic compounds from the pit sludges may potentially expose local animal populations to the compounds identified. Metals that adsorb to site soils, which become airborne through wind action, would be of concern for fugitive dusts. Because the site soils are highly weathered, volatiles (BTEX) emissions would be of minimal concern. This pathway can also be eliminated through coverage of the pits and affected soils.

Exposure of burrowing animals to the site soils may potentially expose on-site animal populations to the COI. The particular constituents of concern for this scenario would be partially limited to those constituents which exist in the upper layers of the site soils and sludges. Because the disposal pits have been extensively weathered, those constituents would primarily be metals. Potential for this scenario to occur can be minimized by placement of a barrier of soil over the disposal pit sludges and soils.

Ingestion of Laguna Cuatro surface water may potentially expose area animal populations to COI, if COI have migrated through the groundwater to the playa lake. However, this exposure pathway would be limited to constituents which are mobile in the groundwater. Given the high potential for immobilization of metals within the soil matrix, and the relatively low concentrations of BTEX within the pit sludges, impacts from the disposal pits on the surface water through groundwater migration is expected to be minimal.

## 7.7 CHARACTERIZATION OF RISK OR THREAT

This Phase I site investigation and the analytical data resulting from the investigation limit the characterization of risk or threat to a qualitative characterization of the probability that an adverse effect will occur.

In characterizing the threat, suggested maximum metal accumulation levels for materials left in place, published by the U.S. EPA, have been cited. Those levels, included in Table 7-1, are based on literature and studies and were developed using microbial and plant toxicity limits, animal health considerations, and soil chemistry, which reflects the soils ability to immobilize metals. None of the constituents listed in Table 7-1 are exceeded in the individual pit composite samples (Table 4-2(c)). Further, the TCLP metals results, which indicate the fate of metals constituents under leaching conditions, suggest that the metals will not leach from the pit materials into the environment at high levels. These metals data, therefore, suggest that any potential threat posed by the source material in the pits to the environment (ecosystem), either area vegetation or animal life, is very limited.

The horizontal and vertical trench confirmation sample analytical data help define the extent to which the COI have migrated from the disposal pits through the soils. The data, which were summarized in Tables 4-4 and 4-5, suggest that migration of the BTEX constituents in the horizontal and vertical directions has been limited. However, limited vertical migration of petroleum hydrocarbons from the pit source material may have occurred, based on the visual observations documented in the trench logs (Appendix G and H).

TABLE 7-1
SUGGESTED MAXIMUM METAL ACCUMULATION WHERE MATERIALS WILL BE LEFT IN PLACE AT CLOSURE

| Metal Constituent | Calculated Acceptable Soil Concentration (ppm) |
|---|---|
| Arsenic, As | 500 |
| Beryllium, Be | 50 |
| Cadmium, Cd | 3 |
| Cobalt, Co | 500 |
| Chromium, Cr | 1000 |
| Copper, Cu | 250 |
| Lithium, Li | 250 |
| Manganese, Mn | 1000 |
| Molybdenum, Mo | 3 |
| Nickel, Ni | 100 |
| Lead, Pb | 1000 |
| Selenium, Se | 3 |
| Vanadium, V | 500 |
| Zinc, Zn | 500 |

Source: USEPA, 1986.

Limited threat exists from potential releases of chemical constituents to the environment. This threat of future release can be further minimized or eliminated through selection of an appropriate site remediation technique. Pit sludge excavation and removal to an off-site landfill would completely remove the threat of future on-site COI release.

All of the remedial techniques considered for this site include pit source material coverage to provide a barrier between the chemical contaminants and the area flora and fauna. Therefore, off-site migration will be minimized to the greatest extent possible through remedial action. There are currently no site effects that warrant a recommendation for immediate remedial action, such as pit coverage.

## 7.8 CONCLUSIONS AND LIMITATIONS

In performing this Ecological Risk Assessment, the site investigation analytical data were reviewed in terms of the identified COI, based on those chemical constituents detected above background. No environmental toxicity sample analytical data were collected from the site. Such data, as bioaccumulation data, were beyond the scope of this Phase I site investigation.

As such, the conclusions of this Ecological Risk Assessment are limited to professional judgement of the potential adverse effects that may occur, based on visual observations, and a comparison of the data to published U.S. EPA metals levels. Additionally, the disposal pit analytical data has been evaluated in terms of the COI's ability to be degraded, immobilized, or migrate from the site.

The data generally indicate that the potential adverse effect to the environment will be minimal. However, if the pit source material is left in-place, unstabilized and/or uncovered, release/migration of the more mobile constituents may potentially occur.

# 8.0 PROPOSED REMEDIAL ALTERNATIVE

The evaluation of viable remediation alternatives considered technologies which are applicable to the B & E Tuzlu Kopek site based on site characteristics, source material and affected soils characteristics, and technology limitations. These technologies were evaluated within a regulatory framework to select the technology most suitable for the remediation of the site. Both on-site and off-site remediation alternatives were evaluated. Remediation alternatives for both the pit sludges and affected soils were evaluated.

Based on the Qualitative Human Health Risk Evaluation and Ecological Risk Assessment, the most appropriate remedial alternative for the site is backfilling of the three pits with pit berm soils and subsequent pit coverage. The source material within Pits #1 and #2 would be stabilized by the berm material, which is native soil. The source material in Pit #3 is of minimal volume, rendering the remediation of this pit primarily a backfilling process.

## 8.1 IMPLEMENTATION OF REMEDIAL ALTERNATIVE

The backfilling process with berm soils would be implemented in a fashion whereby the soil is well mixed with the pit source material in Pits #1 and #2. The stabilization process would substantially immobilize the metals and organics in the source material, preventing future off-site migration of these constituents.

The equipment necessary to implement pit backfilling consists of a wide-track bulldozer, a backhoe, and a grader. Additionally, a lightweight tractor may be necessary for activities associated with establishment of a vegetative cover.

The bulldozer would be used to push the berm soils into the center of each of the pits. As the berm soil is pushed into the pit, the backhoe bucket would be used for mixing of pit source material with soils. The stabilized source material would then be used as pit backfill material. This process would be implemented until the pits are completely backfilled with the berm material. Following this process, a native soil cover of at least 12 inches in thickness will be placed on the stabilized backfill material. The surface of the cover will then be graded and native vegetation established to prevent erosion.

If necessary, one or two percent by weight of lime will be added to the pit source and berm soil material during the stabilization process to serve as an inexpensive dewatering and stabilization agent. Lime would be mixed into the pit source material and soil by an operator with the backhoe bucket.

## 8.2 ADVANTAGES

The remedial alternative proposed provides for on-site stabilization of the pit source material, minimizing the future release and off-site migration of contaminants. Stabilization of the pit source material with native berm soils precludes the need to haul extensive amounts of material from an off-site source, thereby preventing any complications associated with introduction of non-native materials.

The stabilized material will be subsequently covered with native soil, minimizing infiltration of precipitation into the pit source material and leaching of contaminants from the stabilized material into the surrounding groundwater. This coverage would also provide a barrier between the stabilized material and any potential receptors that enter the site.

On-site stabilization/backfilling of the pits would preclude hauling the material off-site, thereby preventing off-site migration of contaminants during excavation and hauling. Additionally, off-site disposal would merely place the pit source material in an alternative (off-site) facility, allowing the potential for future contamination of off-site soils or groundwater.

# 9.0 REFERENCES

U.S. DOE (Department of Energy), 1980. Environmental Impact Statement, Waste Isolation Pilot Plant, DOE/EIS-0026-FS-Executive Summary.

U.S. EPA (Environmental Protection Agency), 1983. Hazardous Waste Land Treatment, Revised Edition, SW-874, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. EPA (Environmental Protection Agency), 1989. Risk Assessment Guidance for Superfund - Environmental Evaluation Manual, OSWER Directive 9285.7-01, Interim Final, March, 1989.

Haskins, Jeff, U.S. Department of Fish & Wildlife, Personal Communication, December, 1992.

Mobley, Jay, Eddy County Commissioner, Personal Communication, December, 1992.

National Climatic Data Center, Personal Communication, November, 1992.

Schmidt, Greg, New Mexico Department of Fish & Wildlife, Personal Communication, December, 1992.

APPENDIX A

APPENDIX A
BLM LETTER TO B & E, INC.
(January 23, 1992)

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397

IN REPLY REFER TO:
1703 (064)

JAN 23 1992

CERTIFIED MAIL - RETURN RECEIPT REQUESTED
P 310 150 713

B & E Inc.
Attention: Phil Withrow
P.O. Box 756
Carlsbad, New Mexico 88220

Dear Mr. Withrow:

This letter is in reference to trespass case N-77922. The case was initiated on August 14, 1989, and covers:

1) construction and use of oil residue pits on public land without authorization and;

2) disposal of produced waters affecting public lands without authorization.

These actions committed by B & E, Inc. are violations of the Federal Land Policy and Management Act (FLPMA) of 1976 (90 Stat. 2763; 43 U.S.C. 1733 and regulations found in 43 CFR 2801.3).

I want to thank you for your patience and cooperation in our effort to resolve this case. Our efforts to explore disposal and remediation options have not been successful. The Bureau of Land Management (BLM) must proceed with settlement of the trespass case. Final resolution requires the following actions:

1. removal and remediation of trespass pits;

2. investigation and remediation of affected public lands in Laguna Quatro.

TRESPASS PIT RESOLUTION

The trespass pit resolution requires three action plans and associated actions. These plans and actions are:

1. Trespass Pit Removal Action Plan for the removal of materials - the removal action plan is due March 1, 1992.

2. Trespass Pit Soil Sampling Plan for sampling of soils after removal actions are completed - the soil sampling plan is due within thirty days of completion of the removal action.

3. Trespass Pit Remedial Action Plan for remediation of the pits - the remedial action plan is due within thirty days of acceptance of the soil sampling results.

A Health and Safety Plan covering actions is required for removal and disposal of all materials in the trespass pits, sampling, and remedial actions.

Specific guidance for each action plan under Trespass Pit Resolution is described below. The BLM must approve each action plan before work begins for that plan.

1. TRESPASS PIT REMOVAL ACTION PLAN

By March 1, 1992, submit a removal action plan for the trespass pits. The following items are required in the removal action plan:

A. Removal plan for all liquids, solids, and stained soil in the trespass pits.

B. Disposal plan stating method and location for disposal of materials. Disposal on public lands is not allowed. The disposal method and location must be approved by the appropriate State or Federal regulatory agency. Transportation and disposal manifests are required.

2. TRESPASS PIT SOIL SAMPLING PLAN

Within 30 days of completion of the above removal action, submit a soil sampling plan for the trespass pits area. Sampling is required to ensure all contaminants have been removed from the trespass pits. The sampling plan shall also provide the data required for risk assessment analysis. The following items are required in the soil sampling plan:

A. The location, number, type, and depth of each sample. The minimum sample data required includes one background soil sample and four soil samples per pit.

B. Analytical data shall include, but is not limited to, Toxic Characteristic Leaching Procedure (TCLP) metals, radioactive isotopes, and constituents listed in 40 CFR 265.94 Appendix IX All analyses shall be performed according to EPA approved methods (Test Methods for Evaluating Solid Waste: Physical/Chemical Methods: EPA Document SW-846).

C. Laboratory Quality Assurance/Quality Control (QA/QC) data is required. Enclosure 1 provides guidance for this requirement.



D. Vertical and horizontal contamination data is required. These data provide volume of additional material for removal and verifies that no release to groundwater has occurred.

3. REMEDIAL ACTION PLAN

within 30 days of acceptance of the soil sampling results for the disposal pits, submit a remedial action plan. The following items are required in the remedial action plan:

A. Risk assessment analysis based on the New Mexico Environment Department's Risk Assessment Calculations for Carcinogens and Non-carcinogens (Enclosure 2). This item is required only if contaminants are found after the initial removal action is completed.

B. Pit remedial action plan based on the risk assessment analysis. Minimum requirements for remediation include filling pits with compacted soil or caliche, six inches of cover material, and restoration of vegetation.

## LAGUNA QUATRO TRESPASS RESOLUTION

The temporary continuance for discharge of water is hereby rescinded. A copy of the BLM letter dated August 15, 1989, (Enclosure 4) allowing temporary continuance is enclosed. Discharge from your facility affecting public lands at Laguna Quatro shall cease immediately.

Resolution of this trespass requires two actions. These actions are:

1. Laguna Quatro Sampling Plan for water and sediment sampling. The sampling plan is due March 1, 1992.

2. Laguna Quatro Removal and Remediation Action Plan for removal/remediation of trespass. The removal/remediation action plan is due within thirty days of acceptance of the sampling results.

A Health and Safety Plan for all actions is required. This plan shall cover all actions required for investigation, sampling, disposal, and remedial actions.

Specific guidance for the Laguna Quatro Trespass Resolution actions are described below. The BLM must approve each action plan before work begins for that plan.

1. LAGUNA QUATRO SAMPLING PLAN

By March 1, 1992, submit a sampling plan for the BLM managed sections of Laguna Quatro that have been affected by discharge from your facility. Both water and sediment samples are required.

A. The number of samples, location, and depth shall delineate the area of contamination and characterize the type of waste affecting public land. The sampling plan also provides the data required for risk assessment analysis.

B. Analytical data shall include, but is not limited to, Toxic Characteristic Leaching Procedure (TCLP) metals, radioactive isotopes, and constituents listed in 40 CFR 265.94 Appendix IX. All analyses shall be performed according to EPA approved methods (Test Methods for Evaluating Solid Waste: Physical/Chemical Methods: EPA Document SW-846).

C. Laboratory Quality Assurance/Quality Control (QA/QC) data is required. Enclosure 1 provides guidance for this requirement.

2. LAGUNA QUATRO REMOVAL AND REMEDIAL ACTION PLAN

Within thirty days of acceptance of the Laguna Quatro sampling results, submit a removal and remedial action plan.

A. The removal/remedial action required for the affected public lands at Laguna Quatro shall be based on a risk assessment analysis. The risk assessment analysis is based on the New Mexico Environment Department's Risk Assessment Calculations for Carcinogens and Non-carcinogens (Enclosure 2). Specific requirements shall be written after the BLM approves the Laguna Quatro sample results.

B. A disposal plan stating method and location for disposal of materials is required. Disposal on public lands is not allowed. The disposal method and location must be approved by the appropriate State or Federal regulatory agency. Transportation and disposal manifests are required.

Enforcement authority for these required actions is described in 43 U.S.C. 1733. The removal action plan for the trespass pits is due no later than March 1, 1992. The due date for the Laguna Quatro water and sediment sampling plan is also March 1, 1992. Subsequent action plan due dates shall be established individually (see Enclosure 3).

I appreciate your patience and cooperation in this matter. If you have any questions, please contact the District Office at (505) 622-9042.

Sincerely,

Tony L. Ferguson

Tony Ferguson
Associate District Manager

4 Enclosures:
1 - Laboratory Plan (3 pp.)
2 - Risk Assessment Calculation (2 pp.)
3 - Schedule of Action Plan Due Dates (1 p.)
4 - Letter dated 8/15/89 (2 pp.)

APPENDIX B

# APPENDIX B
# SITE INVESTIGATION WORK PLAN

# WORK PLAN TO CONDUCT PHASE I ENVIRONMENTAL INVESTIGATION AT THE B & E TUZLU KOPEK DISPOSAL FACILITY

*Prepared for:*

B & E, INC.
Carlsbad, New Mexico

*Prepared by:*

REMEDIATION TECHNOLOGIES, INC.
Austin, Texas

Prepared by ____________

Reviewed by ____________

RETEC Project No.: 3-1456

September 1992

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# LIST OF FIGURES

# 1.0 INTRODUCTION

This document is a Work Plan to conduct Phase I and Phase II activities for the environmental investigation (Phase I) and closure (Phase II) at the B & E, Inc. (B & E) Tuzlu Kopek disposal facility at E/W NESE Section 6 T 225 R 30E Eddy County, New Mexico. This Work Plan has been prepared in response to the January 23, 1992 letter from Tony Ferguson (Associate District Manager) of the United States Department of the Interior Bureau of Land Management (BLM) to Mr. Phil Withrow of B & E, Inc. (Appendix A) as well as subsequent discussions and meetings with members of BLM. A Work Plan for Phase II activities (site closure) will be prepared after the completion and evaluation of the Phase I report.

## 1.1 BACKGROUND

The site is a salt water disposal facility located at E/W NESE Section 6 T 225 R 30E Eddy County in New Mexico (Figure 1-1). The site was operated by B & E from 1982 until 1989, when the BLM discovered that part of the site is public land owned by BLM. BLM immediately requested all pit operations on public lands be discontinued until further investigation.

The BLM letter (January) required a final resolution of "unauthorized" disposal activities. Specifically, the final resolution called for the removal and remediation of the two pits on BLM land.

This Work Plan addresses the environmental investigation and closure of the <u>three</u> oil residue pits, herein referred to as "disposal pits". These earthen pits were used for the disposal of residues generated from the cleanout of frac tanks at the B & E site (Figure 1-2). Pit #1 measures approximately 40' by 60' in area. Pit #2 measures approximately 50' by 100' in area, and Pit #3 measures approximately 50' by 110' in area. The depth of all pits is approximately 8 to 10 feet. The Work Plan addresses impacts to Pit #3, as well as #1 and #2, because of the disposal and management of small amounts of waste in this pit.

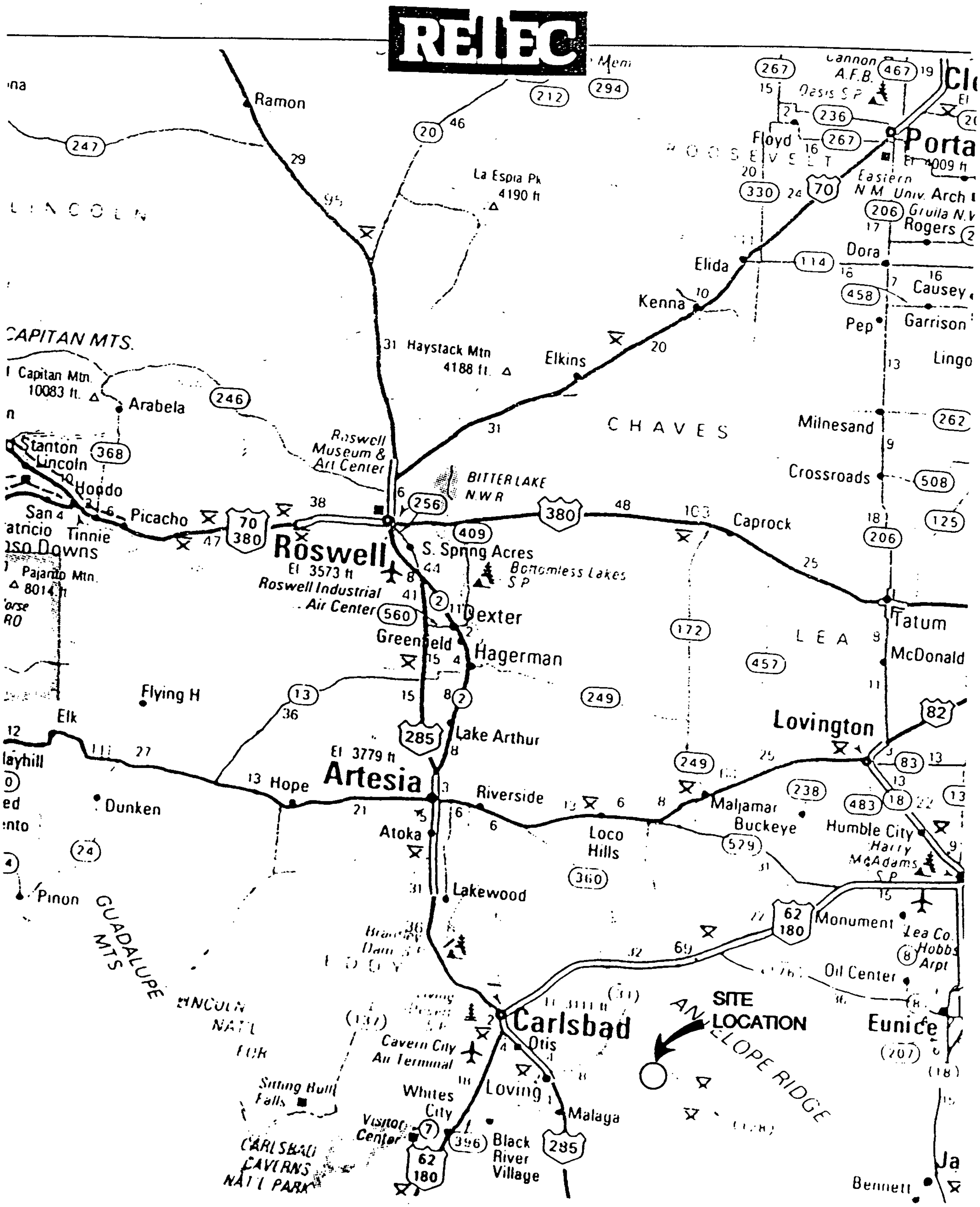



**FIGURE 1-1**
**B & E TUZLU KOPEK SITE LOCATION MAP**

REIEC

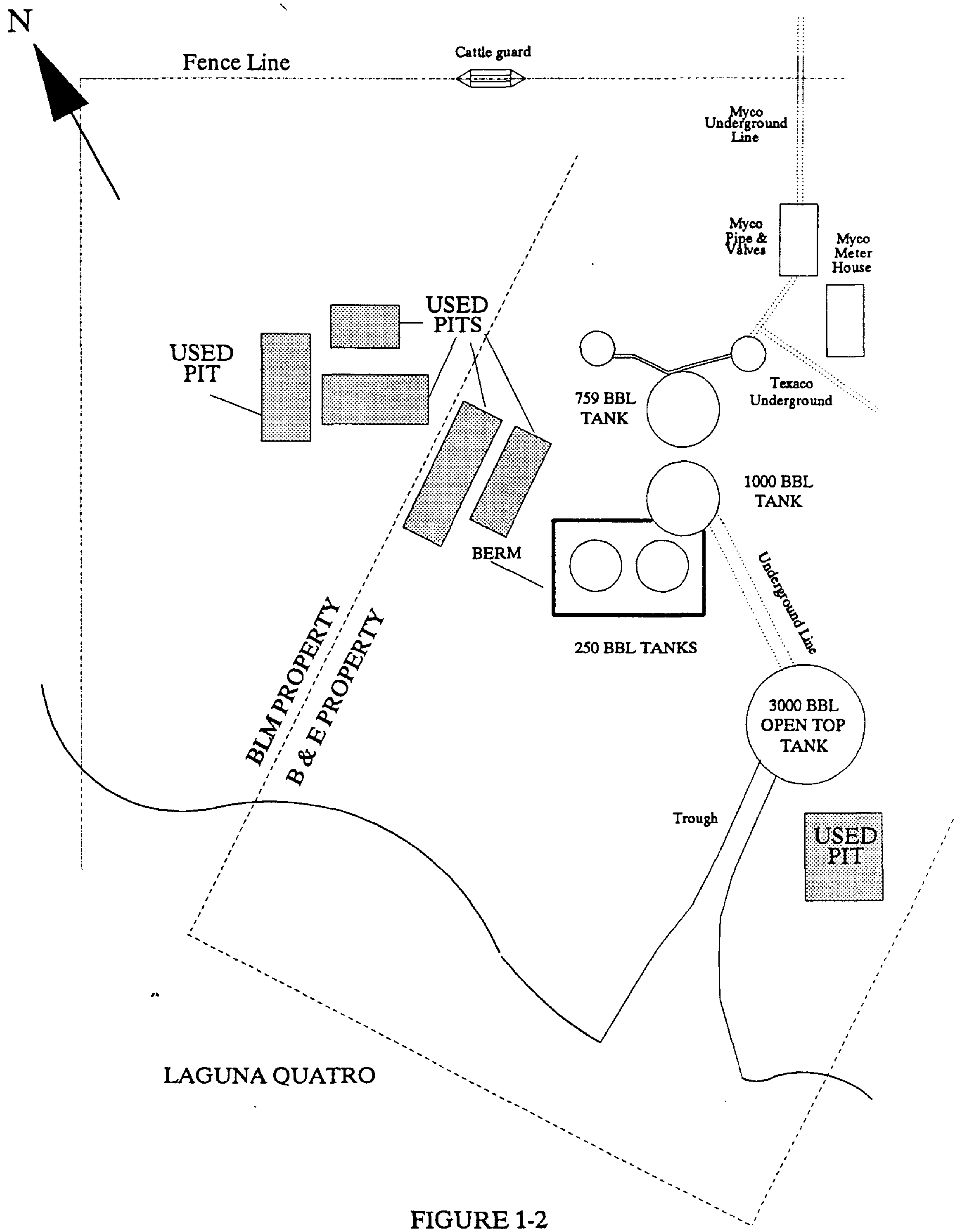



FIGURE 1-2
DETAIL OF B & E TUZLU KOPEK SITE
(Source: B & E Inc., Work Order #H89-06.126, Keystone - Houston)

## 1.2 WORK PLAN OBJECTIVES

This Work Plan will address the areas of concern identified in Section 1.1. The Work Plan will address the requirements of BLM regarding the pits as outlined in the letter dated January 23, 1992 to Mr. Phil Withrow, and the guidelines of the New Mexico Oil Conservation Division (OCD), as is practicable. The objectives of this Work Plan are:

1. Conduct a site investigation at the disposal pits to identify the waste characteristics and volume and to determine the vertical and horizontal extent of waste constituent migration, and

2. Conduct a feasibility study to determine the most appropriate remedial alternative for site restoration.

These two objectives will be presented in detail in this Work Plan. The Phase II objectives will be discussed as is practicable at this time, as evaluation of remedial alternatives will depend upon the results of the site investigation. The two objectives will be addressed in greater detail as the project progresses as part of Phase II (Closure Phase). These objectives are:

1. Formulate a remedial action plan of the chosen method(s), and

2. Perform site cleanup and restoration to the appropriate standards.

## 1.3 WORK PLAN ORGANIZATION

This Work Plan is organized into three sections. Section 1.0 is the Introduction. Section 2.0 (Approach) describes B & E's approach for conducting Phase I of the project. Section 3.0 presents the project schedule for implementing Phase I activities. Appendix B contains Standard Operating Procedures for the collection of site soil samples. Appendix C contains the New Mexico Environment Department's Risk Assessment Calculations for Carcinogens and Non-Carcinogens.

# 2.0 APPROACH

As indicated in Section 1.0, B & E proposes to conduct the entire project in two phases; Phase I will consist of the site investigation and feasibility study, and Phase II will consist of the remedial action plan and the implementation of necessary site cleanup and restoration. B & E's approach consists of a cost-effective investigation and remediation strategy which will address appropriate state and/or federal guidelines. The approach will consist of the following components:

Phase I:

1. Waste Characterization - Identification of constituents of concern (COC);
2. Site Investigation - Determination of extent of affected soils from pits on BLM land;
3. Risk Assessment - Development of clean-up standards for COCs;
4. Conduct a groundwater pathway analysis on COCs;
5. Evaluation of Remedial Alternatives; and
6. Report Preparation - Summary of site investigation results, risk assessment, and feasibility study.

Phase II:

1. Closure Plan - Preparation of site remediation and restoration plan; and
2. Closure Activities - Implementation of site remediation and restoration.

The OCD surface impoundment closure guidelines and the BLM letter dated January 23, 1992 recommend that site investigation activities be conducted after excavation and disposal of all liquids, solids, and stained soil in the pits are completed. Using this procedure, mobilization, decontamination, and demobilization of heavy equipment used for clean-up could be required several times before closure is complete, as the vertical and horizontal extent of contamination would not be identified until completion of the final sampling activity. Furthermore, alternative remedial technologies to excavation and off-site disposal may be deemed feasible based on waste characterization, contaminant migration assessment, groundwater pathway analysis, and risk assessment. Therefore, B & E proposes that site investigation, risk assessment, and feasibility study activities be conducted first to achieve more efficient remedial operations. B & E's approach for this project is illustrated in the flow diagram presented in Figure 2-1. The components of the proposed approach are detailed in the following sections.

## 2.1 WASTE CHARACTERIZATION

Prior to implementing any investigation or remediation activity, waste characterization activities are proposed. Waste characterization will be conducted on samples from the three pits. Waste characterization will identify the parameters specific to the B & E activities. The waste characterization activities will assist in determining impacts only from B & E activities.

### 2.1.1 Pit Waste Characterization - Overall Composite

One overall composite waste sample will be collected from all three pits. This sample will be collected according to the Standard Operating Procedure for soil sampling included in Appendix B. Material will be collected from the four different quadrants of each of the three pits and composited in a bucket. This sample will be equally representative of material placed in the three different pits.

The overall composite sample will submitted to the laboratory for the following analyses:

- Appendix IX Constituents, excluding analyses for dioxins, herbicides and pesticides, and

- Toxicity Characteristics Leachate Procedure - all metals constituents.

B & E believes that this set of parameters will adequately quantify the level of constituents that can reasonably be expected in these exploration and production disposal pit materials.

### 2.1.2 Pit Waste Characterization - Individual Composites

Pit samples will be collected from the three pits with a shovel at a frequency of four samples per pit at a depth of one foot below the surface of the waste. The samples from each pit will be composited to form one composite sample per pit. Sampling activities will be conducted according to Standard Operating Procedures for soil sampling included in Appendix B. Sampling depth is based on the sludge depth in the excavated trench observed during the bid walk site visit (February 18, 1992). The discrete samples, which will be composited, will be collected from the four quadrants of each pit, as illustrated in Figure 2-2.

B & E proposes to analyze the pit waste samples for those constituents detected in the overall pit composite sample. Those constituents that could be expected to appear at detectable levels are the following:

add Selenium

- Subset of Appendix IX constituents:
  metals: arsenic, barium, cadmium, chromium, lead, mercury, and silver
  volatiles organics: benzene, ethylbenzene, toluene, xylenes
  semi-volatile organics: naphthalene, phenols, and benzo(a)pyrene

These constituents are the commonly detected constituents in oil and gas exploration and production wastes, and are included in the New Mexico Water Quality Control Commission (NMWQCC) water quality standards. In addition, B & E will analyze the waste (pit) samples for ignitability, reactivity, and corrosivity. While the pit wastes are currently exempt from RCRA hazardous waste designation, the hazardous characteristics analyses are specified as all non-hazardous industrial waste disposal facilities require such characterization. Total petroleum hydrocarbons (TPH) analysis is also proposed as a gross indicator of contamination. All waste analyses will be conducted according to EPA approved methods (Test Methods for Evaluating Solid Waste: Physical/Chemical methods: EPA Document SW-846). Laboratory quality assurance and quality control (QA/QC) procedures and reporting as specified in the BLM letter will be adhered to at all times.

### 2.1.3 Background Soils Characterization

Two soil samples will be collected from areas unimpacted by B & E activities, as required in the January, 1992 BLM letter. The background sample analyses will be used to compare to waste characterization data, as well as to evaluate risk-based closure criteria.

(1)

Conduct Waste Characterization
(Subset of Appendix IX, TCLP - Metals)

↓

Identify Constituents of Concern (COCs)

↓

Conduct Site Investigation
Determine Extent of COC Migration
in Pit Soils

↓

Conduct Risk Assessment on COCs

↓

Establish Cleanup Criteria

↓

Identify and Evaluate
Remedial Alternatives

↓

Prepare Remediation/Site Restoration Plan

↓

Conduct Remediation/Site Restoration Activities

↓

Conduct Confirmation Sampling

↓

Certify Closure

**FIGURE 2-1**
**PROPOSED B & E APPROACH**
**B & E Inc, Kuzlu Topek Disposal Facility Investigation and Closure**

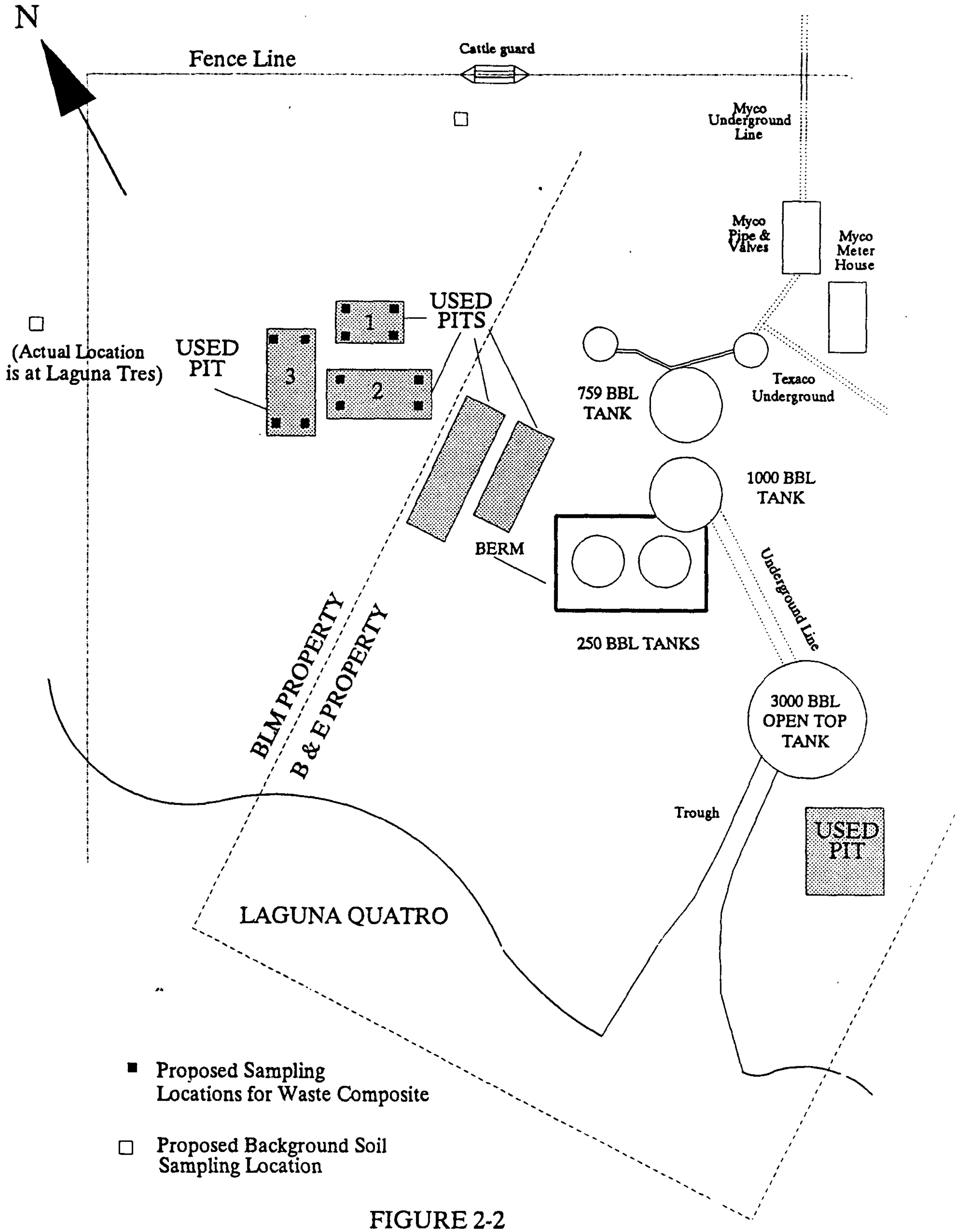



FIGURE 2-2
PROPOSED WASTE CHARACTERIZATION SAMPLING LOCATIONS

The background samples will be collected at a depth of one foot below ground surface at the locations indicated in Figure 2-2. One of the two background samples will be collected from the soil at the water's edge of the Laguna Tres playa lake. This sample represents an area unimpacted by B & E's waste disposal facility and, in terms of surface water flow, upgradient of the facility. The remaining background sample will be collected from a location which is not within the seasonal influences of the playa lake system, nor impacted by the B & E disposal facility.

Background samples will be analyzed for the set of parameters that were detected in the overall pit composite sample. As stated in Section 2.1.2, those parameters may be:

- Subset of Appendix IX constituents:
  metals: arsenic, barium, cadmium, chromium, lead, mercury, and silver
  volatile organics: benzene, ethylbenzene, toluene, xylenes
  semi-volatile organics: naphthalene, phenols, and benzo(a)pyrene

Additionally, the two background soil samples will be analyzed for total petroleum hydrocarbons (TPH) analysis. Waste characterization data from the pit soil samples will be evaluated and compared with the background soil sample data.

## 2.2 SITE INVESTIGATION

Site investigation activities will consist of two components:

1. Determination of the vertical and horizontal extent of impact from the three pits; and

2. Estimation of volume of wastes and visibly contaminated materials for remediation and/or off-site disposal.

3. General investigation of site-specific environmental receptors, including animal and plant wildlife.

Each of these activities is described in the following sections.

As recommended by the OCD, groundwater investigations will not be pursued because of the poor quality of the groundwater in this region. The total dissolved solids

(TDS) concentration in the groundwater exceeds 10,000 ppm, precluding the aquifer from being utilized as a fresh water source.

### 2.2.1 Identify Vertical and Horizontal Extent of Contamination

The volume of wastes and visibly contaminated soils at the three pits will be estimated to determine the volume required for potential excavation and remediation and/or off-site disposal. Based on the extent of staining observed in the trench excavation in one of the pits during a recent site visit (February 18, 1992), it appears that the waste thickness is approximately three to four feet. The underlying soils appear to have little visible contamination. Therefore, the horizontal and vertical extent of impact from the three pits will be determined by excavating trenches with a backhoe and defining the extent by visual observations and using a photoionization detector (PID) calibrated to benzene response to determine the presence of volatile organics.

One trench will be initially excavated in each of the three pit locations indicated in Figure 2-3. The trenches will be excavated to the depths at which no visible contamination is observed. The vertical extent of contamination at each pit will be determined by the depth to field-determined (PID) uncontaminated soils in the trenches. A soil sample will be collected from each trench at the first visibly uncontaminated depth and placed into a 0.5 liter soil jar and immediately covered with aluminum foil. Using the procedures outlined in Guidelines for Surface Impoundment Closure (New Mexico OCD, 1991), a headspace volatile organics measurement will be made using a PID. If a PID response of greater than 100 ppm is detected, the trench will be excavated to a greater depth in accordance with OCD guidelines. The depth at which this point is reached will be recorded. Samples will be collected at one-foot depth increments and subjected to field headspace analysis until a PID response equal to background is achieved (per BLM guidelines). This depth will also be recorded. The final sample from each trench will be submitted to the laboratory via overnight delivery service for confirmation analysis for the list of constituents detected in the individual pits waste characterization. As indicated in the previous section, proper laboratory QA/QC protocol will be adhered to during analysis.

The horizontal extent of affected soils at the pits will be determined by excavating trenches outside and away from each pit until no visible contamination is observed. Approximate locations of the horizontal investigation trenches are indicated in Figure 2-3. Confirmation samples will be collected as described for the vertical investigation. One confirmation sample from each trench will be submitted to the laboratory for analyses.

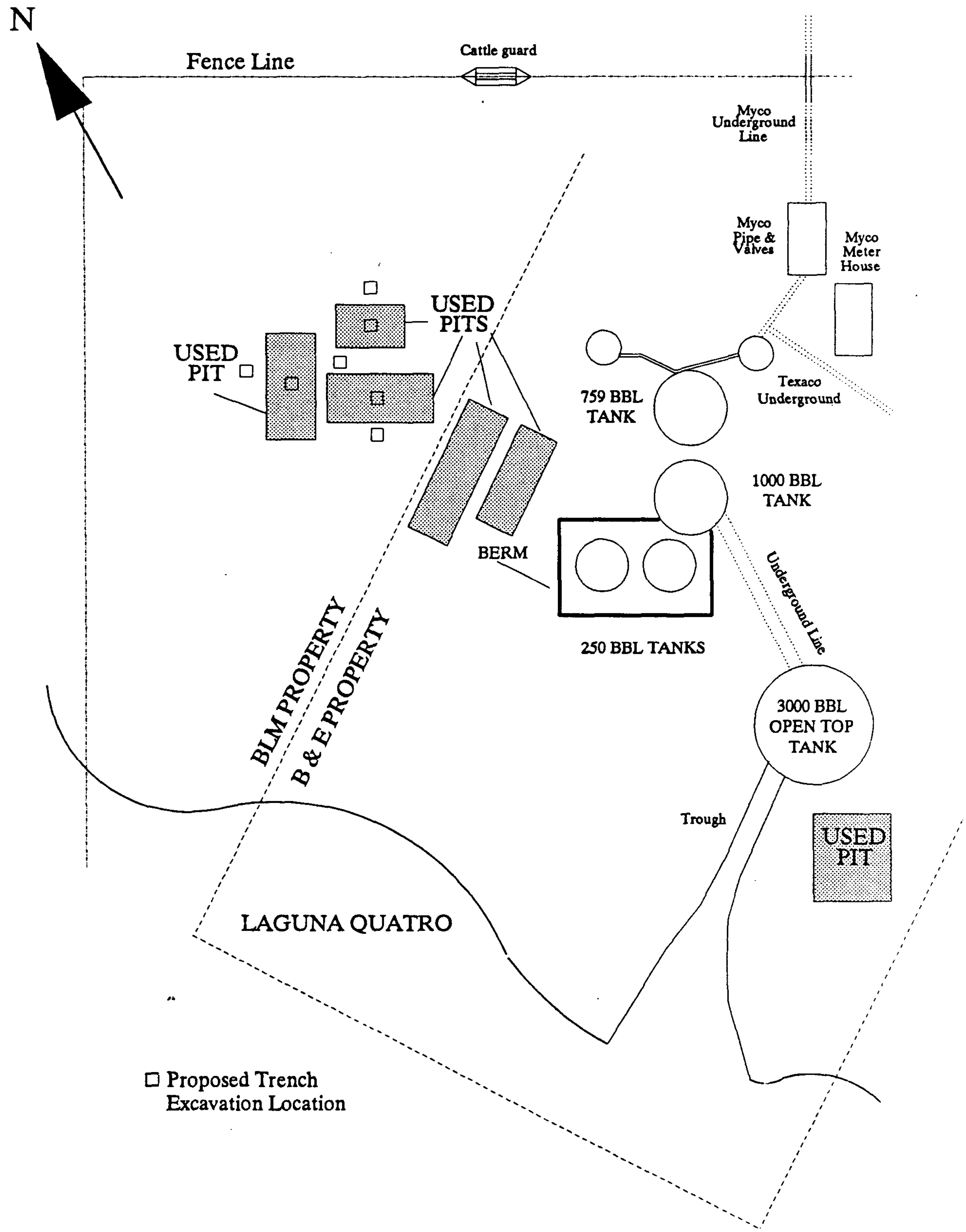



FIGURE 2-3
PROPOSED SAMPLING LOCATIONS FOR
VERTICAL AND HORIZONTAL EXTENT INVESTIGATIONS

Based on the calculation of one sample from each trench, a total of three vertical extent samples and four horizontal extent samples are anticipated for laboratory analysis. Therefore, a total of seven confirmation soil samples will be submitted to the laboratory for the vertical and horizontal investigation. Sampling equipment will be decontaminated between each use using detergent and deionized water.

### 2.2.2 Quantify Volume of Waste and Affected Materials

The total volume of waste and contaminated soils requiring remediation and/or off-site disposal will be determined from the confirmation analysis.

### 2.2.3 Investigation of Site-Specific Environmental Receptors

While on-site, RETEC field personnel will observe the site for visual signs of environmental receptors. These receptors include animal and plant life. The results of this site review will be utilized in the ecological risk assessment, which will be performed in conjunction with the risk assessment calculations and site investigation report.

A complete walk of the site will be made by the field personnel to observe signs animal and plant life that may be considered in the ecological risk assessment. Through the duration of site investigation field activities, any observable signs of wildlife will be documented in the site investigation field notebook.

## 2.3 RISK ASSESSMENT

Following the site investigation, B & E proposes to conduct risk assessment of the detected waste COCs to determine whether remediation activities may be minimized or eliminated. Additionally, as requested by the BLM, a site-specific ecological risk assessment will be performed in accordance with the EPA Office of Solid Waste and Emergency Remedial Response (OSWER) Directive 9285.7-01, Interim Final document dated March, 1989. According to the January, 1992 BLM letter and to Mr. Al Collar of the BLM at the bid walk, several alternatives are available to B & E to remediate the site. Alternatives involving risk assessment are defined as follows:

1. If pit wastes can be determined through risk assessment to not pose a threat to human health or the environment, the wastes may be left in

place and covered with two feet of compacted caliche, six inches of soil, and vegetation.

2. If pit wastes can not be left in place and require remediation and/or removal, risk assessment may be used to demonstrate that remaining constituents in the underlying soil will not pose a threat to human health or the environment.

Risk assessment analysis will be based on the New Mexico Environment Department's Risk Assessment Calculations for Carcinogens and Non-carcinogens (Appendix C). As part of the risk assessment process, potential migration pathways and receptors will be identified. The identification of these components will provide further justification in proposing alternate cleanup standards. The results of the risk assessment will be summarized with the site investigation data for submittal to the BLM.

Only those elements included in the interim guidance for ecological risk assessment (OSWER Directive 9285.7-01) and applicable to the B & E site will be reviewed and discussed in the ecological risk assessment.

## 2.4 GROUNDWATER PATHWAY ANALYSIS ON COCs

A groundwater pathway analysis for those COCs identified in the pit waste characterization will be performed. The analysis will be based on the migration and dispersal characteristics of the constituents identified. The potential for biological, physical and chemical and/or degradation of the constituents will be identified. Constituent propeties which will be identified and discussed include:

- physical state at 20 Deg. C,
- viscosity,
- specific gravity,
- water solubility,
- Henry's Law constant,
- partition coefficient (octanol/water),
- boiling point,
- melting point, and
- flash point.

Transformations depend on constituent adsorption onto the surface and adsorption within the soil molecules. Therefore, such properties as soil cation exchange capacity (CEC), pH, and organic fraction will be considered.

## 2.5 EVALUATION OF REMEDIAL ALTERNATIVES

Several remedial alternatives will be considered for the Tuzlu Kopek site. Potential pit remedial alternatives, based on the data currently available, include but are not limited to:

- No source removal, establish caliche cover design;
- Removal and disposal at an appropriate disposal facility;
- Removal, thermal treatment, and return to excavation as backfill; and
- Removal, biological treatment, and return to excavation as backfill.

Of the biological treatment technologies, thin spreading (i.e., prepared bed biological treatment) or composting would be considered applicable technologies. A summary of each of these technologies is provided below.

<u>No Source Removal, Establish Caliche Cover Design</u>

This remedial alternative requires that constituent concentrations in the pit wastes meet risk-based closure criteria such that no source removal is required. A two-foot compacted caliche cover with six inches of soil and vegetative cover will be established over the pit wastes to minimize infiltration of surface water.

<u>Removal and Disposal at an Appropriate Facility</u>

This remedial alternative assumes that the no source removal alternative can not be implemented due to waste constituent concentrations exceeding risk-allowed levels. Although the wastes are currently exempt from RCRA hazardous waste designation, disposal at a non-hazardous landfill can not be permitted if the waste exhibits hazardous characteristics. Based on available data, however, the waste may be accepted at a non-hazardous landfill. The excavated pits will be backfilled with clean borrow material to grade.

Removal, Thermal Treatment, and Return to Excavation as Backfill

The waste characterization data will help in the evaluation of thermal treatment of the waste and affected soils. On-site thermal treatment would be achieved using a technology such as an asphalt burner. The treated material would then be returned to the pit excavation as backfill. If necessary, the treated material (waste) will be covered with compacted caliche, soil, and vegetation. Stabilization of the treated material for metals may be necessary for this technology.

Removal, Biological Treatment, and Return to Excavation as Backfill

This technology requires the waste material to be a practical candidate for biological treatment. Although oily wastes can successfully be bioremediated, several factors may hinder the treatability of the E&P wastes. Such factors include high salt content and presence of heavy organics. The success of biological treatment will depend upon a viable microbial population acclimated to the disposition of the waste.

These remedial alternatives will be subjected to an evaluation using the criteria of effectiveness, implementability, and cost. These screening criteria are briefly described in the following sections.

### 2.5.1 Effectiveness Evaluation

The effectiveness evaluation will consider the capability of each remedial alternative to protect human health and the environment as defined by the risk assessment. Each alternative will be evaluated as to the protection it would provide, and the reductions in toxicity, mobility or volume it would achieve. Both short and long term components of effectiveness will be evaluated; short term referring to the construction and implementation period, and long term referring to the period after the remedial action is complete.

### 2.5.2 Implementability Evaluation

The implementability evaluation will be used to measure both the technical and administrative feasibility of executing the remedial action alternative. In addition, the availability of the technologies involved in a remedial alternative and any unique site-specific characteristics which will inhibit the application of the technologies involved will also be considered.

### 2.5.3 Cost Evaluation

Cost evaluation will include estimates of capital costs, operation and maintenance (O&M) costs, and present worth analyses. These conceptual cost estimates are order-of-magnitude estimates, and will be prepared based on preliminary conceptual engineering for major construction components and unit costs of capital investment and general O&M costs.

Following the evaluation of the selected remediation alternatives, a selection of the most appropriate technology for the site will be made.

## 2.6 PREPARATION OF PHASE I REPORT

At the conclusion of the Phase I activities, a report will be prepared summarizing the results of the waste characterization, site investigation, risk assessment (including ecological risk assessment), and remediation alternatives evaluation. The report will be submitted to the BLM. Phase II of the project will not be initiated until approval of the report is received from the BLM.

## 2.7 PREPARATION OF PHASE II CLOSURE PLAN

The Closure Plan will consist of activities for site remediation/restoration, and will be based on the approved Phase I report. Although the selected alternative can not be determined at this time, the Closure Plan will include the following components for any of the alternatives:

1. Site Background and Description
2. Closure Objectives
3. Construction Design
4. Operations and Maintenance Specification
5. Sampling and Analysis Procedures
6. Closure Schedule
7. Health and Safety Plan
8. Quality Assurance/Quality Control
9. Closure Confirmation/Certification Requirements

The Closure Plan will be prepared and submitted to the BLM for approval.

## 2.8 CLOSURE ACTIVITIES

As mentioned in the previous section, the selected remediation alternative can not be determined at this time. The selected closure method will most likely be one of the four alternatives proposed in Section 2.4. It is important to note that any alternative which requires long-term stockpiling or thin-spreading of the wastes and contaminated soils will require the construction of a low permeability liner or pad, as groundwater probably occurs at a depth of less than 100 feet below ground surface.

The closure activities will be conducted according to the approved Closure Plan. Any modifications to the plan, as deemed necessary by site conditions, will be approved through the BLM prior to implementation.

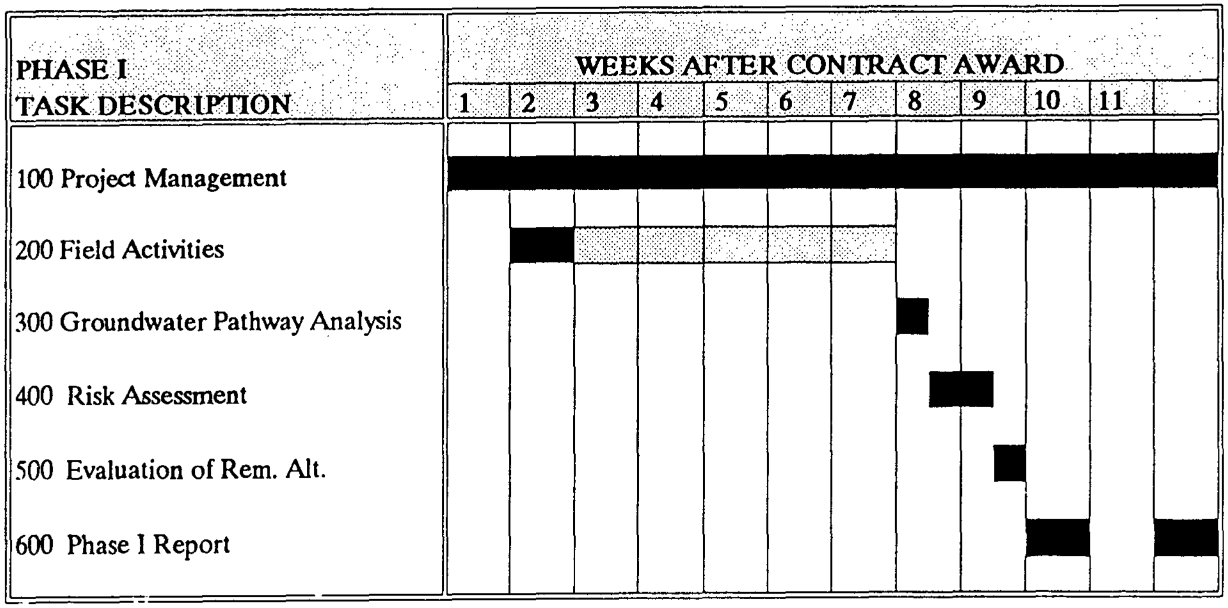
The length of time for completion of closure activities will also depend upon the selected alternative. The closure period may be as short as two weeks, if only cover establishment is required, or as long as one year or more if biological treatment is selected.

# 3.0 PROJECT SCHEDULE

A proposed project schedule for the implementation of Tuzlu Kopek site environmental investigation activities (Phase I) is included in Figure 3-1. B & E is prepared to begin the necessary sampling and field investigation activities upon receipt of notification of approval of this Work Plan from the BLM. Advance notice of initiation of field activites will be provided by B & E to the BLM.

The most time consuming step is the collection of analytical results, which generally takes up to five weeks. Data evaluation, risk assessment, groundwater pathway analysis, and evaluation of remedial alternatives will commence immediately after receipt of the analytical results. These results will be incorporated into a Phase I report.

FIGURE 3–1
PHASE I PROJECT SCHEDULE
B & E TUZLU KOPEK SITE




Note: Shaded row indicates time required for laboratory turn–around.

APPENDIX C

# APPENDIX C
# STUDIES OF THE HYDROLOGY OF THE PLAYA LAKE AREA OF EDDY COUNTY, NEW MEXICO

# HYDROLOGIC ASSESSMENT, LAGUNA TRES AREA

# EDDY COUNTY, NEW MEXICO

by

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May 1982

HYDROLOGIC ASSESSMENT, LAGUNA TRES AREA

EDDY COUNTY, NEW MEXICO

by

Geohydrology Associates, Inc.
Albuquerque, New Mexico

May 1982

CONTENTS

# INTRODUCTION

I. STATEMENT OF APPLICATION

B & E, Inc., a New Mexico corporation, requests permission of the New Mexico Oil Conservation Commission to establish a surface disposal system of saltwater waste. The saltwater waste is generated from oil field product waste. The proposed system would provide a badly needed approved dumping station in Eddy County sufficient to take care of Eddy County and West Lea County's needs and hopefully eliminate unauthorized dumping in the area.

II. PLANT

The proposed plant will use the batch treatment method and will have a quality control safety system designed to prevent the discharge of unsuitable water into the environment.

III. LOCATION

B & E, Inc., proposes two alternate locations for the plant. The primary location is located on BLM land in the NE/4 of Section 12, Township 23 South, Range 29 East. BLM has advised B & E, Inc., that its application for B & E, Inc., land use will be considered upon approval of the New Mexico Oil Conservation Commission. The alternate location is on private property in the NE/4 of Section 6, Township 23 South, Range 30 East. Both locations are covered by this application.

IV. HYDROLOGY

B & E, Inc., proposes to dispose of the saltwater in a natural salt lake. The oil field brine being released into the lake is very similar to the saltwater in the lake and will not adversely affect the ecology of the lake.

ILLUSTRATIONS

HYDROLOGIC ASSESSMENT, LAGUNA TRES AREA

EDDY COUNTY, NEW MEXICO

by

Geohydrology Associates, Inc.

In May 1982, B & E, Incorporated, of Carlsbad, New Mexico, requested that a hydrologic study be conducted in the vicinity of Laguna Tres in Eddy County, New Mexico. This area is located approximately 18 miles east of Carlsbad in Towship 23 South, Ranges 29 and 30 East. The study was made by representatives of Geohydrology Associates, Inc., of Albuquerque. T. E. Kelly was project leader.

The purpose of the hydrologic investigation was to determine the effects that might result from discharge of oil-field brines into existing brine lakes.

The regional pattern of ground-water flow had been described by earlier studies. However this northeast to southwest flow pattern has been changed locally by various factors, including the potash refineries, and various natural and man-made factors. Presently the State Highway Department is channelizing the local flow system near the proposed site.

Many of the earlier studies were devoted to the regional characteristics of the ground-water system. According to Robinson and Lang (1938), most of lower Nash Draw drains into the large, natural Laguna de la Sala Grande, commonly called Salt Lake. They also concluded that brine from the lake is not discharging into the Pecos River. Other investigations were made by Thomas (1963) and Mower and others (1964). However most of this work was completed before the major impacts of the potash refineries were exerted on the area.

Gilkey and Stotelmyer (1965) made one of the earliest detailed water-supply studies of the Nash Draw area. They concluded that brine-disposal ponds at the potash refineries contribute to the hydrologic system by leakage. A detailed study by Geohydrology Associates, Inc. (1979) identified significant quantities of brine entering the ground-water system, although much of this is confined to the Clayton Basin area which is north of Nash Draw and the project area. All of these factors have a bearing on the suitability of Laguna Tres as a brine-disposal site.

The study authorized by B & E, Inc., was based on a thorough literature and file search of existing data; it also drew heavily from the earlier reports by Geohydrology Assoc., Inc. which were prepared under contract with the Bureau of Land Management. A field reconnaissance was made which included a visual inspection of the area between Laguna Uno and Salt Lake, including Laguna Tres. An analysis of the data and the resulting conclusions are presented in this report.

# DESCRIPTION OF THE PROJECT AREA

## Geology

Owing to the mineral development of the region, a number of studies of the geology have been made. These include the work by King (1942), Hendrickson and Jones (1952), Vine (1963), Brokaw and others (1972) and Geohydrology Associates, Inc. (1978, 1978a, 1979). The reader is referred to these studies for more detailed information than is warranted in this report.

There are only two formations in the project area that are directly concerned by this study (fig. 1). These are the Salado Formation below and the overlying Rustler Formation. The Rustler generally is subdivided into a Lower Member, the Culebra Dolomite, the Tamarisk Member, the Magenta Member, and the uppermost Forty-niner Member.

### Salado Formation

This formation is an areally extensive unit which underlies much of Eddy County east of the Pecos River and it extends far beyond the study area. The Salado consists of more than 75 percent salt deposits with minor amounts of clastic rocks, anhydrite, and dolomite. The Salado is the source deposit of the potash which is mined in the region.

The Salado exerts major control over the shallow and surficial structures in the area because it is readily soluble and underlies the entire potash area, including Laguna Tres. Collapse structures, such as Nash Draw, are widespread and control the deposition of eolian and alluvial material in the area.

Structure contours on the top of the Salado Formation show that the Nash Draw depression, in which Laguna Tres is located, reflects a similar trough in the top of the salt (Vine, 1963, pl. 1). These are closed depressions in the top of the salt in the area of Salt Lake and the chain of lakes which drain to the Salt Lake. The depth to the top of the Salado Formation in the vicinity of Laguna Tres is approximately 275 feet.

### Rustler Formation

A leached zone approximately 60 feet thick separates the Rustler Formation from the Salado. This insoluble residue is regarded as basal Rustler Formation by some authors (Cooper and Glanzman, 1971) and as uppermost Salado Formation by others (Vine, 1963, p. 7). Regardless of the name used, this zone consists of an insoluble rubble of brecciated clastics and limestone which collapsed following the solution of the underlying evaporite deposits. This rubble represents material from the Lower Member, the Culebra Dolomite, and insoluble deposits from the Tamarisk Member. Because of the brecciated and unconsolidated nature of this material, it is a major zone of ground-water movement.

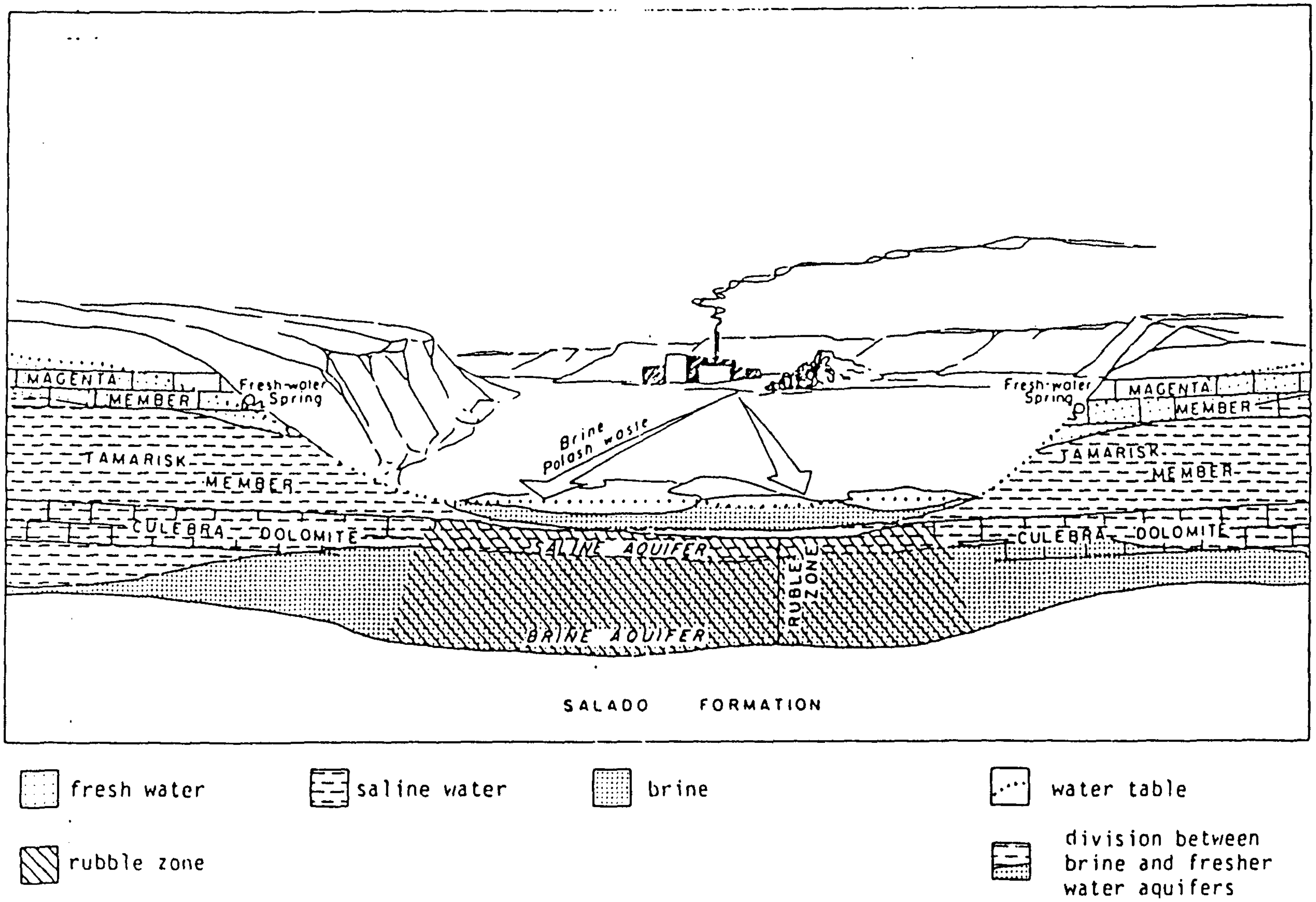


Figure 1. Diagrammatic east-west cross section through Nash Draw, showing stratigraphic units and ground-water relationships.

The Lower Member of the Rustler Formation consists of 60 to 120 feet of siltstone and fine-grained sandstone that locally contains gypsum, anhydrite, and halite (Brokaw and others, 1972, p. 50). It is overlain by the Culebra Dolomite which is a distinctive and persistent marker bed about 30 feet thick. Where tapped by wells, the Culebra produces large quantities of highly mineralized water, as in the vicinity of Mississippi Chemical Corporation in section 11, T. 21 S., R. 29 E.

The Tamarisk Member (Vine, 1963, p. 14) was named for its exposures at Tamarisk Flat about two miles northwest of the proposed disposal site. This member consists of about 115 feet of massive, coarsely crystalline gypsum in the outcrop but is chiefly anhydrite in the subsurface. Throughout most of the area of Nash Draw, the Tamarisk deopsits are blanked by a thin layer of silt and clay that has washed down from the rim of the Draw. However in the vicinity of Laguna Tres, there are massive exposures of deformed gypsum beds and large selenite crystals indicating recrystallization by the movement of ground water.

Brine from the potash refineries in and near Nash Draw is being deposited primarily into disposal ponds excavated in the Tamarisk Member.

The Magenta and Forty-niner Members of the Rustler Formation have been removed by erosion from Nash Draw, although some remnants of these members may be present in the rubble zone in the bottom of the Draw. Nevertheless, these two members generally do not affect the discharge of waste that is proposed by B & E, Inc., at Laguna Tres.

Topographic Setting

Nash Draw is the principal surface feature in the potash mining area of Eddy County. According to Vine (1963, p. B38), this feature is an undrained depression which resulted from regional differential solution of evaporite deposits in the upper Salado and/or lower Rustler Formations. The solution of these deposits resulted in large-scale collapse of the Lower Member, Culebra Dolomite, and the Tamarisk Members. Evidence for solution within the Rustler can be found almost everywhere that the formation is exposed at the surface.

Contour lines drawn on top of the massive salt in the Salado Formation show a high degree of similarity between the topography of Nash Draw and the top of the salt. The Salt Lake overlies a closed depression on top of the Salado. Likewise, there is a large closed depression northeast of Salt Lake which is ringed by a series of surface lakes, including Laguna Tres (fig. 2) which is the proposed disposal site.

Although the regional dip of the beds is toward the east, the rocks exposed along the margins of Nash Draw dip toward the depression. This also is true in Clayton Basin farther north. In addition, hydration of anhydrite to gypsum causes localized doming. Sinkholes and domes influence the direction of ground-water movement, which in turn controls the development of collapse structures through which ground water readily migrates.

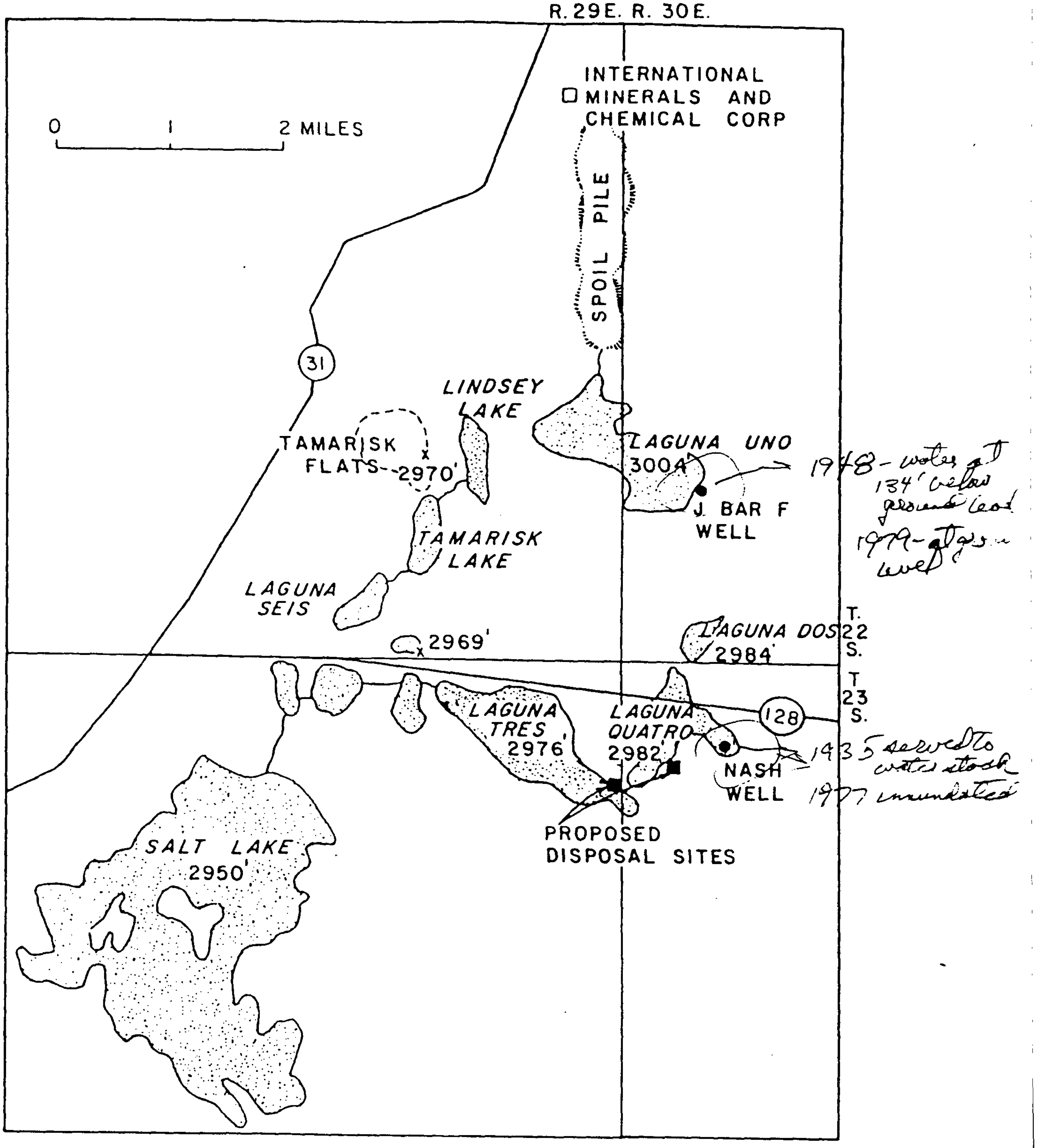


Figure 2. Distribution of lakes in the vicinity of IMC refinery and Salt Lake, with selected altitudes.

## Hydrology

### Ground Water

Two comprehensive studies of the hydrology of the potash area have been made by Brokaw and others (1972) and Geohydrology Associates, Inc. (1979). These studies have shown that the normal hydrologic system has been modified by collapse of Nash Draw and Clayton Basin. This has been further complicated by discharge from the various potash refineries in the area.

Hendrickson and Jones (1952, pl. 3) mapped the water table in Eddy County. East of the Pecos River the ground-water movement is predominately from north to south. Topographic divides exist along the Eddy-Lea County line and Quahada Ridge which tend to divert the regional flow into Nash Draw. The shallow ground water is potable to slightly saline in most areas. Wells outside Nash Draw generally produce adequate quantities of water to meet the stock and domestic requirements of the ranchers. However along the boundaries of Nash Draw, the regional water table intersects the land surface where ground water discharges as a series of seeps and springs (fig. 1). There is no known potable water within Nash Draw itself.

Saline water is present in most of the deeper aquifers. It has been shown that the regional dip of strata in the subsurface is from west to east. The Culebra Dolomite Member of the Rustler crops out along the Pecos River, and a few wells have tapped this strata in the subsurface. Highly mineralized water was produced from wells drilled by AMAX Corporation in T. 19 S., R. 30 E., and by Mississippi Chemical Corporation in T. 21 S., R. 29 E. The AMAX wells most likely were completed in the Culebra, although it is possible that they tap the shallower Magenta Member of the Rustler Formation. The Mississippi Chemical wells are known to tap the Culebra.

The so called "brine aquifer" has been identified by workers at the WIPP site as that zone of solution and collapse between the Salado and the basal Rustler. Although not present everywhere, it may be as much as 60 feet thick near Salt Lake and Laguna Tres. By the very nature of this zone, all of the water present is highly mineralized and probably is a saturated brine.

In addition to the natural ground-water flow into Nash Draw, there is a considerable amount of refinery waste released annually. Approximately 9,248 acre-feet per year is discharged as brine by refineries located in Nash Draw (Geohydrology Assoc., Inc., 1979, p. 60). In most cases this discharge is a saturated brine containing as much as 30 percent solids in the form of suspended clay.

The rubble zone, which represents the collapsed Rustler Formation in the bottom of Nash Draw, has produced potable water to wells in the past. Nash well (sec. 6, T. 23 S., R. 30 E.) was completed for stock use prior to 1935 (fig. 2). Subsequently the level of Laguna Quatro has risen to the point that this well was completely inundated by 1977. Likewise, the J Bar F well (sec. 20, T. 22 S., R. 30 E.) supplies water for stock at Laguna Uno.

According to Hendrickson and Jones (1952, p. 134-135), the water level in this well was 134.0 feet below land surface on March 17, 1948. The water level was at the land surface in 1979--a rise of 134 feet in 31 years. Since both of these wells are down gradient from IMC, it is probable that the rise in water level in the rubble zone can be attributed to discharge by IMC into Laguna Uno. The IMC refinery has been in operation since 1947.

Surface Water

All of the refinery discharge from International Minerals and Chemical Corporation is released into the headwaters of Laguna Uno which is in parts of sections 24 and 25, T. 22 S., R. 29 E., and adjoining sections. Discharge records of brine from the IMC refinery are not available. However, according to the New Mexico State Engineer Office in Roswell, the amount of water imported by IMC during 1977 was 5,233 acre-feet. This is equivalent to 3,244 gpm. Not all of this water enters Laguna Uno due to refining losses and evporation of water on the spoil pile. Nevertheless, the measured discharge into the lake is nearly equal to the quantity of imported water, thus indicating that the refining and evaporation loss are small.

The amount of water loss from Laguna Uno is difficult to determine. The size of the lake prevents the sediment-laden refinery discharge from spreading evenly across the lake. As as result, most of the sediment is deposited at the upper end of the lake, and the southeast end of Laguna Uno is characterized by relatively clear, sediment-free water. Thus there is no sealing effect at the fringes of the lake.

Studies at the lake determined that the summer evaporation rate at Laguna Uno was 6.69 gpm (gallons per minute) per acre and the winter evaporation rate was 0.369 gpm per acre (Geohydrology Assoc., 1979, p. 71). Inasmuch as the area of the lake is 710 acres, the summer loss would be about 4,750 gpm and the winter loss would be about 260 gpm. Therefore it is likely that virtually all of the refinery inflow during the summer is lost by evaporation from the lake. During the winter months the evaporation is only about 10 percent of the inflow rate. This surplus waste water then enters the lake chain which includes Laguna Dos, Laguna Tres, Laguna Quatro, and Salt Lake (fig. 2).

Lindsey Lake, Tamarisk Lake, and Laguna Seis also are topographically lower than Laguna Uno. Although there is no surface connection between Laguna Uno and this chain, it is likely that a subsurface connection exists.

In May 1982, a field reconnaissance was made of the area to assess the hydrologic connection between the IMC discharge point and Salt Lake. It was found that there is no surface connection between Laguna Uno and Laguna Dos; likewise there is no surface connection between Laguna Dos and Laguna Quatro. Laguna Quatro drains into Laguna Tres through a culvert and ditch system recently completed by the State Highway Department. At the culvert beneath Eddy County Road 793 which separates Laguna Quatro and Laguna Tres, the discharge is estimated to be about 500 gpm. With no surface inflow to the lake, this quantity of discharge can only originate from ground-water discharge.

Recent work by the Highway Department has provided a surface connection between Laguna Tres and several unnamed ponds south of Highway 128. The trenching has connected these lakes and ponds with Salt Lake. The total surface area of these surface-water bodies exceeds 1,200 acres. This would provide a summer evaporation capacity of 8,028 gpm and a winter capacity of 443 gpm.

## WATER QUALITY

A number of water samples were collected by B & E, Inc., from springs and lakes in the vicinity of the proposed discharge point. The distribution of these samples and the total dissolved solids are shown in Figure 2. Virtually all of the water exceeds 200,000 mg/l (milligrams per liter) dissolved solids. This level of mineralization is very similar to that in oil-field samples that are likely to be discharged at the proposed site. (Appendix A.)

## DISCHARGE PROPOSAL

B & E, Incorporated, estimates that the discharge facility will have the capacity to process approximately 50 loads of oil-field brine per day. Each load would be approximately 150 barrels. This represents a daily discharge of about 315,000 gallons, or a continuous discharge of 218 gpm.

The brine will be processed through a processing facility which will remove all hydrocarbons and solids. Only the oil-field brine will then be released to the hydrologic system. This facility will be located in the northeast quarter of section 12, T. 23 S., R. 29 E. This would be the upper end of Laguna Tres which presently has a natural inflow of about 500 gpm. The alternate site would be located near the center of section 6, T. 23 S., R. 30 E., along the south edge of Laguna Quatro.

Most of the oil production in the vicinity of the proposed facility produces from the Bone Springs and the Morrow Formations. Chemical quality within these formations does not vary significantly, and it is believed that the analyses given in the Appendix are representative of these two zones.

CONCLUSIONS

1. The discharge system proposed by B & E, Inc., will not adversely impact the existing hydrologic system in the vicinity of Laguna Quatro and Laguna Tres.

2. The surface area of the lakes between Laguna Tres and Salt Lake are adequate to totally consume the total discharge proposed for the system.

3. The continued natural discharge of ground water into this lake system will provide sufficient brine to mask any quality change that might originate from the oil-field brine.



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APPENDIX

P. O. BOX 1468
MONAHANS, TEXAS 79756
PHONE 943-3234 OR 563-1040

Martin Water Laboratories, Inc

705 W. INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

# RESULT OF WATER ANALYSES

LABORATORY NO. 482226
SAMPLE RECEIVED 4-9-82
RESULTS REPORTED 4-22-82

TO: Mr. Gene Green
P.O. Box 756, Carlsbad, NM

COMPANY B & E Transport LEASE

FIELD OR POOL

SECTION ____ BLOCK ____ SURVEY ____ COUNTY ____ STATE ____

SOURCE OF SAMPLE AND DATE TAKEN

NO. 1 Lake #1. 4-8-82
NO. 2 Lake #2. 4-8-82
NO. 3 Spring #1. 4-8-82
NO. 4 Spring #2. 4-8-82

REMARKS:

| CHEMICAL AND PHYSICAL PROPERTIES | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| Specific Gravity at 60° F. | 1.1996 | 1.2363 | 1.1784 | 1.2352 |
| pH When Sampled | | | | |
| pH When Received | 7.48 | 7.47 | 6.99 | 7.50 |
| Bicarbonate as $HCO_3$ | 234 | 312 | 210 | 307 |
| Supersaturation as $CaCO_3$ | | | | |
| Undersaturation as $CaCO_3$ | | | | |
| Total Hardness as $CaCO_3$ | 27,500 | 45,750 | 25,000 | 44,500 |
| Calcium as Ca | 590 | 390 | 620 | 390 |
| Magnesium as Mg | 6,324 | 10,880 | 5,698 | 10,577 |
| Sodium and/or Potassium | 111,428 | 125,222 | 100,599 | 123,801 |
| Sulfate as $SO_4$ | 22,313 | 23,375 | 20,400 | 22,100 |
| Chloride as Cl | 174,707 | 208,086 | 157,662 | 205,955 |
| Iron as Fe | 0.16 | 0.16 | 0.23 | 0.08 |
| Barium as Ba | 0 | 0 | 0 | 0 |
| Turbidity, Electric | | | | |
| Color as Pt | | | | |
| Total Solids, Calculated | 315,596 | 368,265 | 285,189 | 363,130 |
| Temperature °F. | | | | |
| Carbon Dioxide, Calculated | | | | |
| Dissolved Oxygen, Winkler | | | | |
| Hydrogen Sulfide | 0.0 | 0.0 | 0.0 | 0.0 |
| Resistivity, ohms/m at 77° F | 0.044 | 0.039 | 0.047 | 0.040 |
| Suspended Oil | | | | |
| Filtrable Solids as mg/l | | | | |
| Volume Filtered, ml | | | | |
| Carbonate, as $CO_3$ | 0 | 0 | 0 | 0 |
| Fluoride, as F | 6.0 | 6.0 | 6.0 | 6.5 |
| Nitrate, as $NO_3$ | 5.0 | 0.0 | 0.0 | 0.0 |

Results Reported As Milligrams Per Liter

| Additional Determinations And Remarks | | | | |
|---|---|---|---|---|
| Arsenic, as As | 0.009 | 0.006 | 0.006 | 0.009 |
| Cadmium, as Cd | 0.00 | 0.00 | 0.00 | 0.00 |
| Cyanide, as CN | 0.00 | 0.00 | 0.00 | 0.00 |
| Lead, as Pb | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Mercury, as Hg | 0.000 | 0.000 | 0.000 | 0.000 |
| Selenium, as Se | 0.00 | 0.00 | 0.00 | 0.00 |
| Silver, as Ag | 0.00 | 0.00 | 0.00 | 0.00 |

The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Form No. 3

By ____

Waylan C. Martin, M. A.

Locations from which foregoing samples were taken:

Lake #1: Quatro

Lake #2: Great Salt Lake

Spring #1: Upper end of Lake

Spring #2: Upper Great Salt Lake

P. O. BOX 1468
MONAHANS, TEXAS 79756
PHONE 943-3234 OR 943-1040

Martin Water Laboratories, Inc

709 W. INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

# RESULT OF WATER ANALYSES

LABORATORY NO. 58240
SAMPLE RECEIVED 5-4-82
RESULTS REPORTED 5-7-82

TO: Mr. Gene Green
P. O.Box 756, Carlsbad, NM 88220

COMPANY B & E Inc. LEASE As listed

FIELD OR POOL

SECTION ___ BLOCK ___ SURVEY ___ COUNTY Eddy STATE NM

SOURCE OF SAMPLE AND DATE TAKEN

NO. 1 Produced water - taken from Brantley. 5-3-82 [illegible]
NO. 2 Produced water - taken from Huber State. 5-3-82 [illegible]
NO. 3 Produced water - taken from SCB $4. 5-3-82 [illegible]
NO. 4 Produced water - taken from Southland State. 5-3-82 [illegible]

REMARKS:

| CHEMICAL AND PHYSICAL PROPERTIES | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| Specific Gravity at 60° F. | 1.0904 | 1.1760 | 1.1369 | 1.1720 |
| pH When Sampled | | | | |
| pH When Received | 6.46 | 5.86 | 6.83 | 5.91 |
| Bicarbonate as $HCO_3$ | 1,488 | 561 | 1,708 | 744 |
| Supersaturation as $CaCO_3$ | | | | |
| Undersaturation as $CaCO_3$ | | | | |
| Total Hardness as $CaCO_3$ | 13,600 | 67,000 | 2,300 | 43,000 |
| Calcium as Ca | 3,440 | 21,200 | 564 | 14,100 |
| Magnesium as Mg | 1,215 | 3,402 | 216 | 1,883 |
| Sodium and/or Potassium | 52,034 | 80,055 | 87,956 | 90,318 |
| Sulfate as $SO_4$ | 312 | 234 | 1,775 | 391 |
| Chloride as Cl | 88,774 | 170,446 | 134,936 | 169,025 |
| Iron as Fe | 441 | 155 | 48.3 | 169 |
| Barium as Ba | 0 | 0 | 0 | 0 |
| Turbidity, Electric | | | | |
| Color as Pt | | | | |
| Total Solids, Calculated | 147,263 | 275,898 | 227,155 | 276,461 |
| Temperature °F. | | | | |
| Carbon Dioxide, Calculated | | | | |
| Dissolved Oxygen, Winkler | | | | |
| Hydrogen Sulfide | 0.0 | 0.0 | 0.0 | 0.0 |
| Resistivity, ohms/m at 77° F. | 0.071 | 0.048 | 0.053 | 0.048 |
| Suspended Oil | | | | |
| Filtrable Solids as mg/l | | | | |
| Volume Filtered, ml | | | | |
| Carbonate, as $CO_3$ | 0 | 0 | 0 | 0 |
| Fluoride, as F | 0.3 | 0.0 | 0.0 | 0.0 |
| Nitrate, as $NO_3$ | 0.0 | 0.0 | 0.0 | 0.0 |

Results Reported As Milligrams Per Liter

Additional Determinations And Remarks

| | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| Arsenic, as As | 0.000 | 0.000 | 0.000 | 0.000 |
| Cadmium, as Cd | 0.20 | 0.20 | 0.80 | 0.20 |
| Cyanide, as CN | 0.00 | 0.00 | 0.00 | 0.00 |
| Lead, as Pb | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Mercury, as Hg | 0.000 | 0.000 | 0.000 | 0.000 |
| Selenium, as Se | 0.00 | 0.00 | 0.00 | 0.00 |
| Silver, as Ag | 0.00 | 0.00 | 0.00 | 0.00 |

The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Form No. 3

By

Waylan C. Martin, M. A.

1

P. O. BOX 1468
KERMIT? INAHANS. TEXAS 79756
943-3234 OR 563-1040

Martin Water Laboratories, Inc.

WATER CONSULTANTS SINCE 1953

BACTERIAL AND CHEMICAL ANALYSES

709 W. INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

To: Mr. Gene Green
P.O.Box 756
Carlsbad, NM

Laboratory No. 482226-A
Sample received 4-9-82
Results reported 5-11-82

Company: B & E Transport

Subject: To determine the radioactivity (radium 226 and 228) and uranium content of submitted water samples. Samples taken 4-8-82.

| Source of sample | Radium 226 pico curie/liter | Radium 228 pico curie/liter | Uranium mg/l |
|---|---|---|---|
| 1. Lake #1 | less than 0.6 | less than 1.0 | 0.099 |
| 2. Lake #2 | 9 (+or-1) | less than 1.0 | 0.051 |
| 3. Spring #1 | less than 0.6 | less than 1.0 | 0.081 |
| 4. Spring #2 | 9 (+or-1) | less than 1.0 | 0.051 |

Remarks: The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Waylan C. Martin, M. A.

DON G. McCORMICK
JAY W. FORBES
THOMAS L. MAREK
ROGER E. YARBRO
JOHN M. CARAWAY
CAS TABOR

McCORMICK AND FORBES
ATTORNEYS AT LAW
BUJAC BUILDING
P. O. BOX 1718
CARLSBAD, NEW MEXICO 88220

TELEPHONE 885-4171
AREA CODE 505

26 May 1982

New Mexico State Highway Department
P. O. Box 1457
Roswell, New Mexico 88201

Attn: Mr. Cliff Downey

Re: Proposed Location of Salt Water Disposal System
by B & E, Inc.

Dear Mr. Downey:

It is my understanding that Mr. Gene Green, of B & E, Inc., has discussed with you at some length the proposed locations for their proposed salt water disposal system. Both of these locations are located in Eddy County with the first or primary location being in the NE/4 of Section 12, Township 23 South, Range 29 East, and the secondary location being in the NE/4 of Section 6, Township 23 South, Range 30 East.

It is my understanding that you have reviewed these proposed locations with Mr. Green and on behalf of the State Highway Department, you are willing to state that the locations and the system proposed will not interfere with the use and operation of Highway 128 and the current draining operation, which you have underway along said highway as it leaves the intersection with State Highway 31. In the event the drainage of Highway 128 is interfered with, the salt water disposal system will terminate until arrangements can be made to correct the problem.

If you agree with the terms set forth herein, please return the signed copy of this letter to me for our records and for filing with the New Mexico State Oil Conservation Commission.

Sincerely,

Roger E. Yarbro

REY:lld

APPROVED BY:

Cliff Downey

# WATER QUALITY ASSURANCE FACILITY

B and E INCORPORATED
Carlsbad, New Mexico

## I INTRODUCTION

In order to make available to industry an approved waste water disposal station, the design herein described and depicted is presented. This facility provides a proven method of removing oily and solid wastes from water of varying quality by the batch treatment method. Water will be hauled to the site in 150-barrel or less loads and discharged into the facility at a rate not exceeding 10 barrels per minute (420 GPM). The goal of the facility is to remove insoluble oils to below maximum concentration of 50 PPM with an average concentration below 15 PPM. Should an oil concentration higher than desired (and approved by the State of N. Mexico) occur, an alarm system will close valving to stop the flow of fluid into and out of the facility

## II FLUID FLOW

The fluids, a predominantly water with small quantities of oil and solids, enter the facility through an electrically actuated emergency shutdown valve and a key activated turbine flow meter into the first process vessel, a Skim Tank. The Skim Tank is designed to be predominantly filled with water to assure maximum residence time and correspondingly high water quality. A thin layer of oil is maintained near the top of the tank. This oil layer is near the level of the oily influent minimizing the distance this contaminant must travel to be absorbed into the oil blanket. Oil is skimmed off into a holding tank ready for sale to a waste oil reclaimer. Water flows to the Surge Tank, typically 30 percent larger than the Skim Tank. While the internals of the Surge Tank are not as complex as the Skim Tank, the flow and levels are similar. Oily wastes are captured near the top and drawn off to storage. Water is removed from the bottom and flows to the Aeration Tank for final quality control. A portion of the water in the Aeration Tank is pulled off near bottom and pumped into an aeration nozzle. The aeration of this water has the effect of clarifying it prior to discharging it into the adjacent salt lake.

Each Skim Tank and Surge Tank is designed to process the influent from one transport truck at a time. The initial system will consist of a twin set of these vessels feeding one Aeration Tank as indicated on C-E Natco Drawing No. 75747. Therefore, two transport trucks can unload at the same time into separate process facilities.

## III SYSTEM CAPACITY

Each of the twin systems described above will accept a load of waste water from one transport truck at a time. Each transport truck has a capacity of approximately 150 barrels. Trucks are equipped to offload via on-board pumping systems. The truck pumping capacities vary, but do not exceed ten barrels per minute. Therefore, the maximum influent rate is 10 barrels per minute. Each truck must position itself properly, connect to the influent nozzle, activate the key actuated valve/meter assembly, unload, disconnect and proceed out of the unload area. While unloading can occur in as few as 15 minutes, the entire process typically takes a minimum of 25 minutes. And, by the time a second transport is ready to unload, a minimum of 30 minutes has elasped. This equates to surges of 10 barrels per minute (420 GPM) and averaged maximum plant throughput of five barrels per minute (210 GPM) per unloading process train. Since the initial system concept consists of two trains, maximum averaged discharge capacity will be on the order of 10 barrels per minute total or 14,400 barrels per day

The actual discharge volume is anticipated at less than 6,000 barrels per month. This volume will be carried 50 percent by the owner/operator's transports and 50 percent by others.

IV OIL PROCESSING

Waste oil will be collected and sold to a waste oil reclaimer. As the volume of this product justifies, a process addition designed to reclaim oil on-site may be added. This system will include a low pressure boiler and a larger process tank with steam coils for heat input.

VII SOLIDS

Minor amounts of solids will accumulate in the system. These solids will be decanted from the Skim and Surge Tanks via draw-off laterals. Solids will accumulate in the solids storage tank. Water separated from solids will be cycled back into the water process system.

VIII WATER QUALITY CONTROL

The implementation of appropriate design concepts for tank internals will assure a high degree of water quality under normal circumstances. However, to prevent the possibility of an upset, vandalism, or other cause resulting in an oil discharged, a water quality monitor continuously monitors the concentration of oil in water between the Surge Tank and the Aeration Tank. Should the concentration exceed preset limits, the automatic valving switches to the closed position to stop flow through the facility. The automatic valves are fail closed so that any loss of power causes a facility shut down. No manual override will be installed in this system.

# REASSESSMENT OF HYDROLOGIC CONDITIONS
# LAGUNA TRES AREA
# EDDY COUNTY, NEW MEXICO

by

**Geohydrology Associates, Inc.**

4015 Carlisle, N.E. • Suite A • (505) 884-0580
Albuquerque, New Mexico 87107

January 1986

# Geohydrology Associates, Inc.

REASSESSMENT OF HYDROLOGIC CONDITIONS, LAGUNA TRES AREA
EDDY COUNTY, NEW MEXICO

by

Geohydrology Associates, Inc.
Albuquerque, New Mexico

January 1986

4015 Carlisle, N.E. • Suite A • (505) 884-0580
Albuquerque, New Mexico 87107

## CONTENTS

ILLUSTRATIONS

# REASSESSMENT OF HYDROLOGIC CONDITIONS, LAGUNA TRES AREA
# EDDY COUNTY, NEW MEXICO

by

Geohydrology Associates, Inc.

In May 1982 B&E, Incorporated, of Carlsbad, New Mexico, requested that a hydrologic study be conducted in the vicinity of Laguna Tres, Eddy County, New Mexico. The Laguna Tres area is located approximately 18 miles east of Carlsbad in Township 23 South, Ranges 29 and 30 East (fig. 1). The purpose of this hydrologic investigation was to determine the effects that might result from discharge of oil-field brines into existing brine lakes. Two separate sites had been proposed by B&E, Inc.; one site was proposed for Laguna Tres and the other site was proposed for the east end of Laguna Quatro. An application for salt-water disposal was made before the Oil Conservation Commission as Case No. 6712 which was heard by the Commission on June 22, 1982.

By Order No. R-7031, the Oil Conservation Commission granted B&E, Inc., permission to discharge 7,500 barrels of brine per day at each of the two proposed sites. Subsequently a processing and discharge facility was constructed at the Laguna Quatro site and named Tuzlu Kopek (Salty Dog). [redacted] operation [redacted].

In November 1985 B&E requested that a reassessment of the area be made to determine the impacts of the Tuzlu Kopek facility on Laguna Quatro and the feasibility of expanding this site to double its capacity. This report contains a summary of the findings. The 1982 and 1985 studies were made by representatives of Geohydrology Associates, Inc., of Albuquerque. T. E. Kelly was project leader for both investigations.

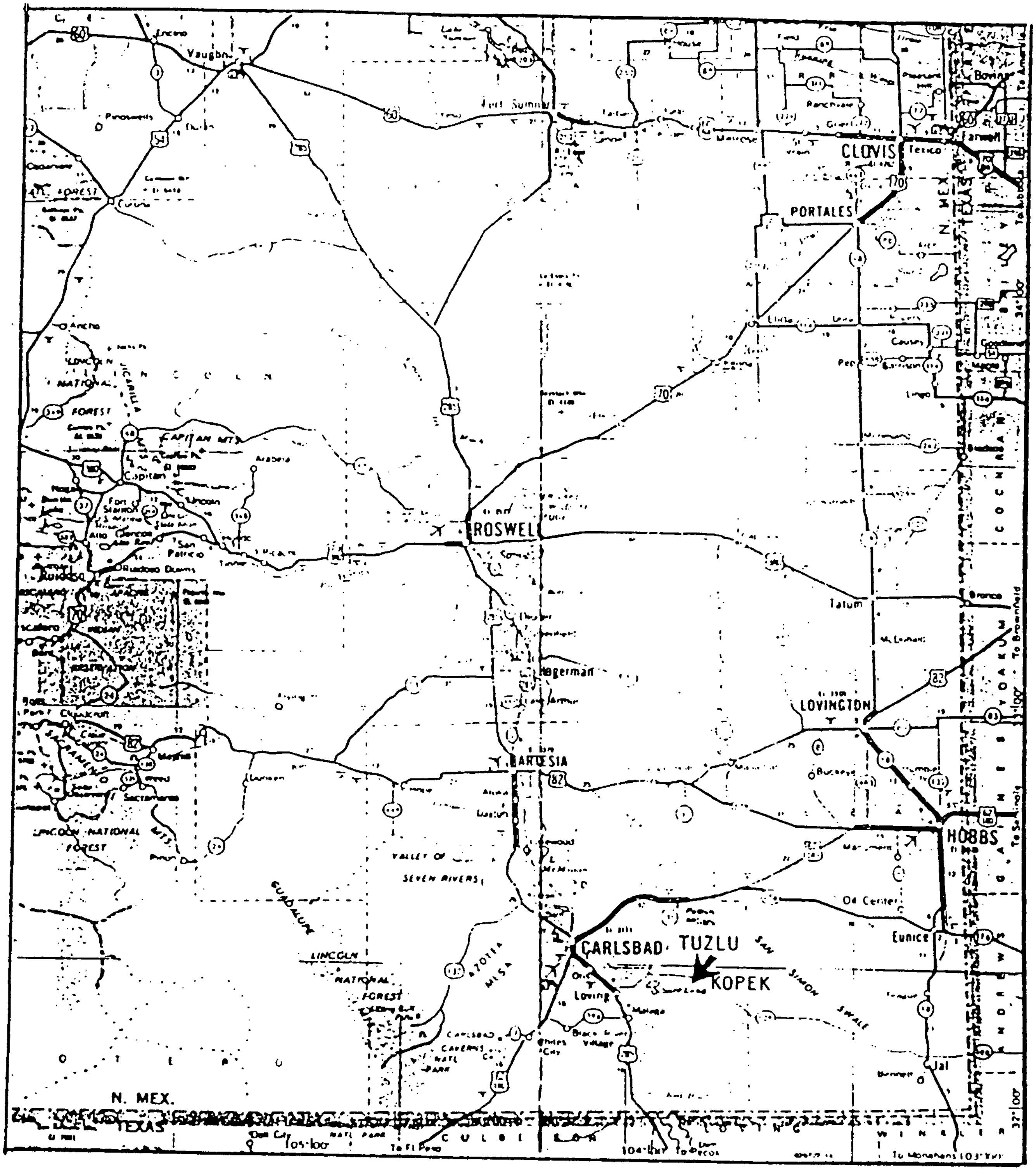


Figure 1.--Location map of Laguna Tres area.

## DESCRIPTION OF THE PROJECT AREA

### Previous Studies

Many of the earlier studies were devoted to the regional characteristics of the ground-water system. According to Robinson and Lang (1938), most of lower Nash Draw drains into the large, natural Laguna de la Sala Grande, commonly called Salt Lake. They also concluded that brine from the lake is not discharging into the Pecos River. Other investigations were made by Thomas (1963) and Mower and others (1964). However most of this work was completed before the major impacts of the potash refineries were exerted on the area.

Gilkey and Stotelmyer (1965) made one of the earliest detailed water-supply studies of the Nash Draw area. They concluded that brine-disposal ponds at the potash refineries contribute to the hydrologic system by leakage. A detailed study by Geohydrology Associates, Inc. (1979) identified significant quantities of brine entering the ground-water system, although much of this is confined to the Clayton Basin area which is north of Nash Draw and the project area. All of these factors have a bearing on the suitability of Laguna Quatro as a brine-disposal site.

The regional pattern of ground-water flow from northeast to southwest has been described by earlier studies. However this flow pattern has been changed locally by various factors, including the potash refineries, and various natural and man-made factors. The State Highway Department has channelized the local flow system near the proposed site.

In addition to the previous report that was prepared for B&E, Inc., (Geohydrology Assoc., 1982a), the consultant has prepared two other reports describing the geohydrologic conditions in the Salt Lake area. The Lindsey Lake area was evaluated for Requesa, Inc. (Geohydrology Assoc., 1982) and an assessment of the Laguna Tres area was made for Unichem International (Geohydrology Assoc., 1982b). All of these studies concluded that the area northeast of Salt Lake was suitable for brine disposal.

The studies authorized by B&E, Inc. were based on a thorough literature and file search of existing data; it also drew heavily from the earlier reports by Geohydrology Associates, Inc., which were prepared under contract with the Bureau of Land Management. A field reconnaissance was made which included a visual inspection of the area between Laguna Uno and Salt Lake, including Laguna Quatro. An analysis of the data and the resulting conclusions are presented in this report.

## Geology

Owing to the mineral development of the region, a number of studies of the geology have been made. These include the work by King (1942), Hendrickson and Jones (1952), Vine (1963), Brokaw and others (1972) and Geohydrology Associates, Inc. (1978, 1978a, 1979). The reader is referred to these studies for more detailed information than is warranted by this report.

Only two formations in the project area are directly concerned by this study (fig. 2). These are the Rustler Formation at the surface and the underlying Salado Formation. The Rustler generally is subdivided into uppermost Forty-niner Member, the Magenta Member, the Tamarisk Member, the Culebra Dolomite, and the Lower Member at the base of the formation.

### Rustler Formation

The Forty-niner and Magenta Members of the Rustler Formation have been

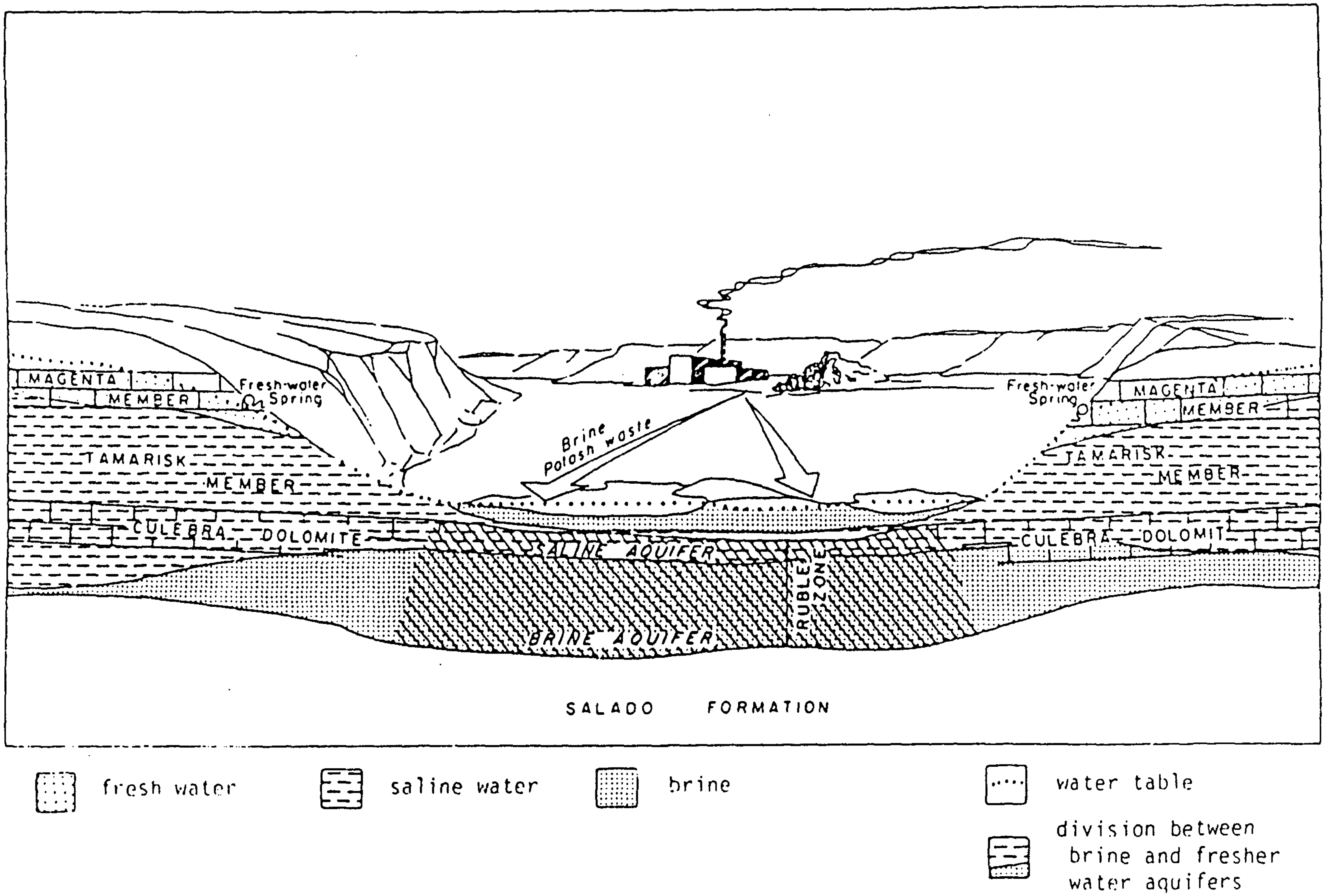


Figure 2.--Diagrammatic east-west cross section through Nash Draw, showing stratigraphic units and ground-water relationships.

removed by erosion from the inner part of Nash Draw; however it is likely that some rubble may remain as erosional remnants in the bottom of the Draw. Nevertheless, these two members generally do not affect the discharge of waste that is proposed by B&E, Inc., at Laguna Quatro. As illustrated by Figure 2, these formations are present only on the flanks of Nash Draw.

The Tamarisk Member (Vine, 1963, p. 14) was named for its exposure at Tamarisk Flat about two miles northwest of the Tuzlu Kopek facility. This member consists of about 115 feet of massive, coarsely crystalline gypsum in the outcrop but is chiefly anhydrite in the subsurface. Throughout most of the area of Nash Draw, the Tamarisk deposits are blanketed by a thin layer of silt and clay that was washed down from the rim of the Draw. However in the vicinity of Laguna Quatro, there are massive exposures of deformed gypsum beds and large selenite crystals indicating recrystallization by the movement of ground water.

Brine from the potash refineries in and near Nash Draw is being deposited primarily into disposal ponds excavated in the Tamarisk Member.

The Culebra Dolomite is a distinctive and persistent marker bed about 30 feet thick in the Rustler Formation. Where tapped by wells, the Culebra produces large quantities of highly mineralized water, as in the vicinity of Mississippi Chemical Corporation in Section 11, T. 21 S., R. 29 E. The dolomite is underlain by the lower member of the Rustler Formation consisting of 60 to 120 feet of siltstone and fine-grained sandstone that locally contains gypsum, anhydrite, and halite (Brokaw and others, 1972, p. 50).

There is a leached zone at the base of the Rustler which is estimated to average about 60 feet in thickness. This insoluble residue is regarded as basal Rustler Formation by some authors (Cooper and Glanzman, 1971) and as uppermost Salado Formation by others (Vine, 1963, p. 7). Regardless of the name used, this zone consists of an insoluble rubble of brecciated clastics and limestone which collapsed following the solution of the underlying evaporite deposits. This rubble represents material from the Tamarisk Member, the Culebra Dolomite, and the Lower Member. Because of the brecciated and unconsolidated nature of this material, it is a major zone of groundwater movement.

## Salado Formation

This formation is an areally extensive unit which underlies much of Eddy County east of the Pecos River and it extends far beyond the study area. The Salado consists of more than 75 percent salt deposits with minor amounts of clastic rocks, anhydrite, and dolomite. The Salado is the source deposit of the potash which is mined in the region.

The Salado exerts major control over the shallow and surficial structures in the area because it is readily soluble and underlies the entire potash area, including Laguna Tres and Laguna Quatro. Collapse structures, such as Nash Draw, are widespread and control the deposition of eolian and alluvial material in the area.

Structure contours on the top of the Salado Formation show that the Nash Draw depression, in which Laguna Quatro is located, reflects a similar trough in the top of the salt (Vine, 1963, pl. 1). These are closed depressions in the top of the salt in the area of Salt Lake and the chain of lakes which drain to the Salt Lake. The depth to the top of the Salado Formation in the vicinity of Laguna Quatro is approximately 275 feet.

## Topographic Setting

Nash Draw is the principal surface feature in the potash mining area of Eddy County. According to Vine (1963, p. B38), this feature is an undrained depression which resulted from regional differential solution of evaporite deposits in the upper Salado and/or lower Rustler Formations. The solution of these deposits resulted in large-scale collapse of the Tamarisk Member, Culebra Dolomite, and the Lower Members. Evidence for solution within the Rustler can be found almost everywhere that the formation is exposed at the surface.

Contour lines drawn on top of the massive salt in the Salado Formation show a high degree of similarity between the topography of Nash Draw and the top of the salt. The Salt Lake overlies a closed depression on top of the Salado. Likewise, there is a large closed depression northeast of Salt Lake which is ringed by a series of surface lakes, including Laguna Quatro (fig. 3) at which the Tuzlu Kopek facility is located.

Although the regional dip of beds is toward the east, the rocks exposed along the margins of Nash Draw dip toward the depression. This also is true in Clayton Basin farther north. In addition, hydration of anhydrite to gypsum causes localized doming. Sinkholes and domes influence the direction of ground-water movement, which in turn controls the development of collapse structures through which ground water readily migrates.

## Hydrology

### Ground Water

Two comprehensive studies of the hydrology of the potash area have been made by Brokaw and others (1972) and Geohydrology Associates, Inc. (1979). These studies have shown that the normal hydrologic system has been modified by collapse of Nash Draw and Clayton Basin. This has been further complicated by discharge from the various potash refineries in the area.

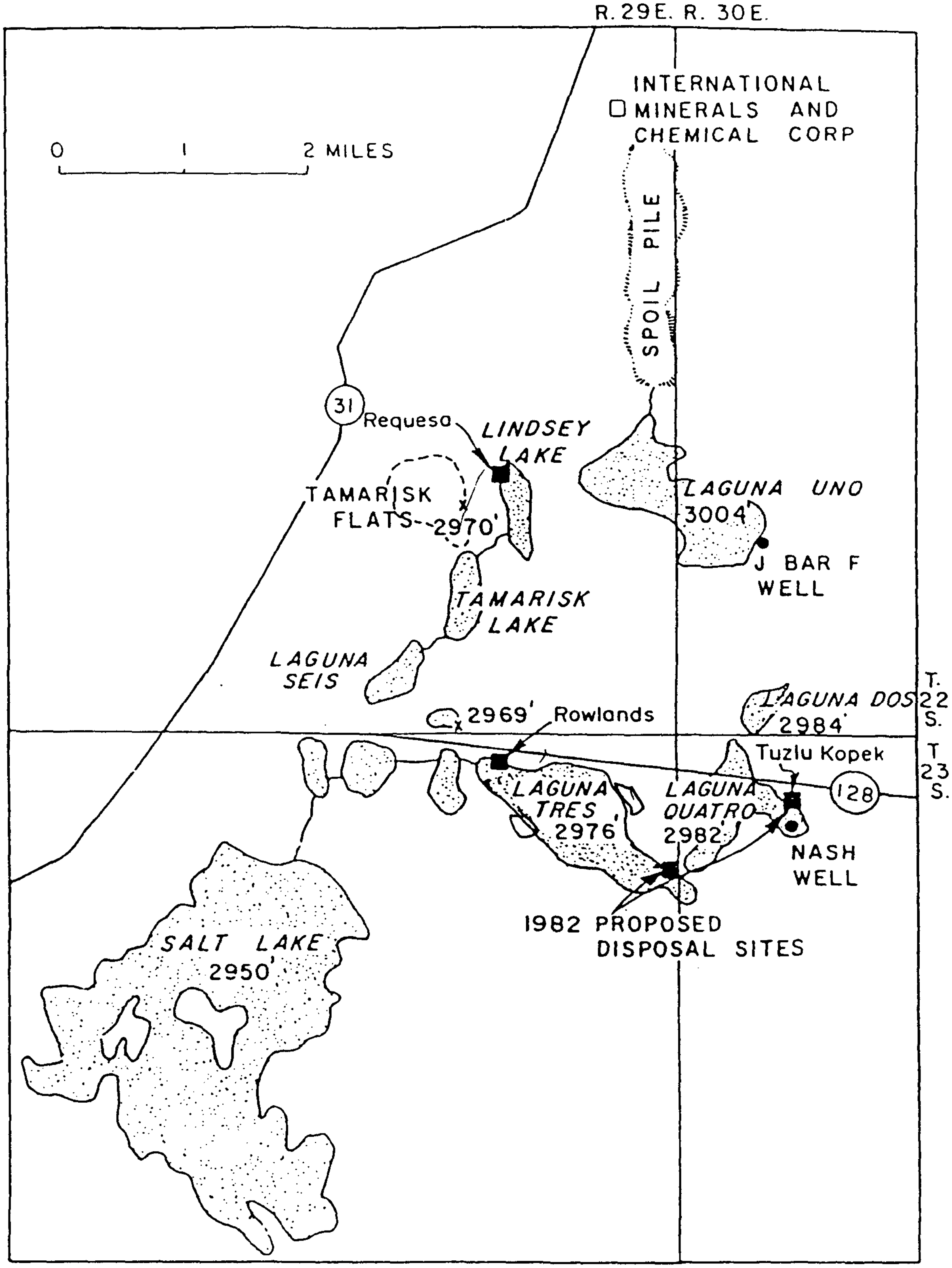


Figure 3.--Distribution of lakes in the vicinity of IMC Refinery and Salt Lake, with selected altitudes. The 1982 proposed sites, Tuzlu Kopek facility, and Rowlands facility are located at Laguna Quatro and Laguna Tres.

Hendrickson and Jones (1952, pl. 3) mapped the water table in Eddy County. East of the Pecos River the ground-water movement is predominately from north to south. Topographic divides exist along the Eddy-Lea County line and Quahada Ridge which tend to divert the regional flow into Nash Draw. The shallow ground water is potable to slightly saline in most areas. Wells outside Nash Draw generally produce adequate quantities of water to meet the stock and domestic requirements of the ranchers. However along the boundaries of Nash Draw, the regional water table intersects the land surface where ground water discharges as a series of seeps and springs (fig. 2). There is no known potable water within Nash Draw itself.

Saline water is present in most of the deeper aquifers. It has been shown that the regional dip of strata in the subsurface is from west to east. The Culebra Dolomite Member of the Rustler crops out along the Pecos River, and a few wells have tapped this strata in the subsurface. Highly mineralized water was produced from wells drilled by AMAX Corporation in T. 19 S., R. 30 E., and by Mississippi Chemical Corporation in T. 21 S., R. 29 E. The AMAX wells most likely were completed in the Culebra, although it is possible that they tap the shallower Magenta Member of the Rustler Formation. The Mississippi Chemical wells are known to tap the Culebra.

The so called "brine aquifer" has been identified by workers at the WIPP site as that zone of solution and collapse between the Salado and the basal Rustler. Although not present everywhere, it may be as much as 60 feet thick near Salt Lake and Laguna Quatro. By the very nature of this zone, all of the water present is highly mineralized and probably is a saturated brine.

In addition to the natural ground-water flow into Nash Draw, there is a considerable amount of refinery waste released annually. Approximately

9.248 acre-feet pre year is discharged as brine by refineries located in Nash Draw (Geohydrology Assoc., 1979, p. 60). In most cases this discharge is a saturated brine containing as much as 30 percent solids in the form of suspended clay.

The rubble zone, which represents the collapsed Rustler Formation in the bottom of Nash Draw, has produced potable water to wells in the past. Nash well (sec. 6, T. 23 S., R. 30 E.) was completed for stock use prior to 1935 (fig. 3). Subsequently the level of Laguna Quatro has risen to the point that this well was completely inundated by 1977. Likewise, the J Bar F well (sec. 20, T. 22 S., R. 30 E.) supplies water for stock at Laguna Uno. According to Hendrickson and Jones (1952, p. 134-135), the water level in this well was 134.0 feet below land surface on March 17, 1948. The water level was at the land surface in 1979--a rise of 134 feet in 31 years. Since both of these wells are down gradient from IMC, it is probable that the rise in water level in the rubble zone can be attributed to discharge by IMC into Laguna Uno. The IMC refinery has been in operation since 1947.

## Surface Water

All of the refinery discharge from International Minerals and Chemical Corporation is released into the headwaters of Laguna Uno which is in parts of sections 24 and 25, T. 22 S., R. 29 E., and adjoining sections. Discharge records of brine from the IMC refinery are not available. However, according to the New Mexico State Engineer Office in Roswell, the amount of water imported by IMC during 1977 was 5,233 acre-feet. This is equivalent to 3,244 gpm. Not all of this water enters Laguna Uno due to refining losses and evaporation of water on the spoil pile. Nevertheless, the measured discharge into the lake is nearly equal to the quantity of imported water, thus indicating that the refining and evaporation loss are small.

The amount of water loss from Laguna Uno is difficult to determine. The size of the lake prevents the sediment-laden refinery discharge from spreading evenly across the lake. As a result, most of the sediment is deposited at the upper end of the lake, and the southeast end of Laguna Uno is characterized by relatively clear, sediment-free water. Thus there is no sealing effect at the south boundary of the lake.

Studies at the lake determined that the summer evaporate rate at Laguna Uno was 6.69 gpm (gallons per minute) per acre and the winter evaporation rate was 0.369 gpm per acre (Geohydrology Assoc., 1979, p. 71). Inasmuch as the area of the lake is 710 acres, the summer loss would be about 4,750 gpm and the winter loss would be about 260 gpm. Therefore it is likely that virtually all of the refinery inflow during the summer is lost by evaporation from the lake. During the winter months the evaporation is only about 10 percent of the inflow rate. This surplus waste water then enters the hydrologic system which includes Laguna Dos, Laguna Tres, Laguna Quatro, and Salt Lake (fig. 3).

Lindsey Lake, Tamarisk Lake, and Laguna Seis also are topographically lower than Laguna Uno. Although there is no surface connection between Laguna Uno and this chain of lakes, it is likely that a subsurface connection exists.

In November 1985 a field reconnaissance was made of the area to assess the hydrologic connection between the IMC discharge point and Salt Lake. It was found that there is no surface connection between Laguna Uno and Laguna Dos; likewise there is no surface connection between Laguna Dos and Laguna Quatro. Laguna Quatro drains into Laguna Tres through a culvert and ditch system recently completed by the State Highway Department. At the culvert beneath Eddy County Road 793 which separates Laguna Quatro and Laguna Tres, the discharge was measured as 1.05 cfs (cubic feet per second) or 470 gpm on November 18, 1985.

Recent work by the Highway Department has provided a surface connection between Laguna Tres and several unnamed ponds south of Highway 128. The trenching has connected these lakes and ponds with Salt Lake. The total surface area of these surface-water bodies exceeds 1,200 acres. This would provide a summer evaporation capacity of 8,028 gpm and a winter capacity of 443 gpm in the chain of lakes and ponds above the Salt Lake. The capacity of Salt Lake would more than double the evaporation potential of the surface-water system in the area to more than 16,000 gpm during the summer and 880 gpm during the winter.

## WATER QUALITY

A number of water samples were collected by B&E, Inc., from springs and lakes in the vicinity of the proposed discharge point. The distribution of these samples and the total dissolved solids are shown in Figure 3. Virtually all of the water exceeds 200,000 mg/l (milligrams per liter) dissolved solids. This level of mineralization is very similar to that in oil-field samples that are likely to be discharged at the proposed site (Appendix A).

## EXISTING DISPOSAL FACILITIES

Three earlier studies by Geohydrology Associates, Inc. (1982,-a,-b) have evaluated proposed oil-field brine disposal sites in the vicinity of Salt Lake. The first proposal was submitted by Requesa, Inc., to discharge a maximum of about 88 gpm into Lindsey Lake (fig. 3). Unichem International, Inc., proposed a facility now operated by Rowlands oil-field services at the west end of Laguna Tres. This facility has a capacity of 2,000 barrels per day, or a continuous discharge of about 58.3 gpm. Both of these facilities have been approved by the Oil Conservation Commission; however to date the Requesa facility has not been constructed.

B&E's Tuzlu Kopek facility is located at the east end of Laguna Quatro in the northeast quarter of Section 6, T. 23 S., R. 30 E. In 1982 this facility was approved by the Commission for the processing and discharge of 7,500 barrels per day, or a continuous discharge of 218 gpm. This facility went on line in September 1982. The greatest production to date has been 151,987 barrels in October 1985, or an average of 4,903 barrels per day (Table 1). The cumulative production for the period of operation is 2,573,029 barrels; the average daily discharge is 2,285 barrels for the same period.

There has been no appreciable effect on the hydrologic system as a result of the brine disposal operations. In November 1985 the static water level in Salt Lake was 0.83 feet lower than that in August 1982. Also, the flow through the culvert connecting Laguna Quatro with Laguna Tres was estimated to be 500 gpm in May 1982 and was measured at 470 gpm in November 1985 following three years of discharge from Tuzlu Kopek.

The lack of change in the hydrologic system during this three-year time frame can be attributed to at least three factors. These factors include

Table 1.--Monthly and cumulative production figures for the Tuzlu Kopek facility operated by B&E, Inc., at Laguna Quatro since operation began in September 1982.

Tuzlu Kopek facility
Start-up September 1982.
Holding capacity is 5,050 barrels.

| Date | Monthly Discharge | Cumulative Total (in Bbls) |
|---|---|---|
| September 1982 | 5,250 | 5,250 |
| October | 29,394 | 34,644 |
| November | 62,896 | 97,540 |
| December | 56,245 | 153,785 |
| January 1983 | 64,887 | 218,672 |
| February | 42,220 | 260,892 |
| March | 43,338 | 304,230 |
| April | 46,684 | 350,914 |
| May | 51,406 | 402,320 |
| June | 26,986 | 429,306 |
| July | 29,647 | 458,953 |
| August | 33,584 | 492,537 |
| September | 41,374 | 533,911 |
| October | 38,706 | 572,617 |
| November | 37,532 | 610,149 |
| December | 42,651 | 652,800 |
| January 1984 | 69,269 | 722,069 |
| February | 63,327 | 785,396 |
| March | 66,556 | 851,952 |
| April | 54,723 | 906,675 |
| May | 62,584 | 969,259 |
| June | 63,754 | 1,033,013 |
| July | 74,291 | 1,107,304 |
| August | 87,022 | 1,194,326 |
| September | 93,165 | 1,287,491 |
| October | 81,704 | 1,369,195 |
| November | 69,947 | 1,439,142 |
| December | 78,261 | 1,517,403 |
| January 1985 | 72,823 | 1,590,226 |
| February | 70,521 | 1,660,747 |
| March | 72,168 | 1,732,915 |
| April | 72,313 | 1,805,228 |
| May | 113,285 | 1,918,513 |
| June | 116,159 | 2,034,672 |
| July | 120,830 | 2,155,502 |
| August | 120,235 | 2,275,737 |
| September | 145,305 | 2,421,042 |
| October | 151,987 | 2,573,029 |

(1) There has been a significant decline in potash production and refining during the past three years. This has reduced the amount of refinery waste (brine) that is entering the hydrologic system and migrating toward Salt Lake.
(2) There may be a greater summer evaporation rate than was reported by Geohydrology Associates, Inc. (1979, p. 71) and therefore the brine loss from Laguna Quatro is greater than estimated.
(3) The aeration system used at Tuzlo Kopek probably reduces the total amount of discharge to the lake.

## DISCHARGE PROPOSAL

B&E, Incorporated, has requested that the size of the Tuzlu Kopek facility be expanded to double its present rated capacity from 7,500 to **15,000 barrels per day.** This would represent a daily discharge of about 630,000 gallons, or a continuous discharge of 436 gpm (gallons per minute).

The brine will be processed through an expanded processing facility which will remove all hydrocarbons and solids. Only the oil-field brine will then be released to the hydrologic system in Laguna Quatro. If it is assumed that both Rowlands (Unichem) and Tuzlu Kopek are operating at full capacity simultaneously during the winter months, there would be a discharge of 494 gpm, or approximately 97 percent of the total evaporation potential for Laguna Tres, Laguna Quatro, and connected unnamed lakes and ponds (fig. 4). The total combined discharge would be only **~~six percent of the~~ summer evaporation potential.**

At the present time most of the brine being processed at the Tuzlu Kopek facility is produced from oil wells tapping the Bone Springs and the Morrow Formations. Chemical quality within these formations does not vary

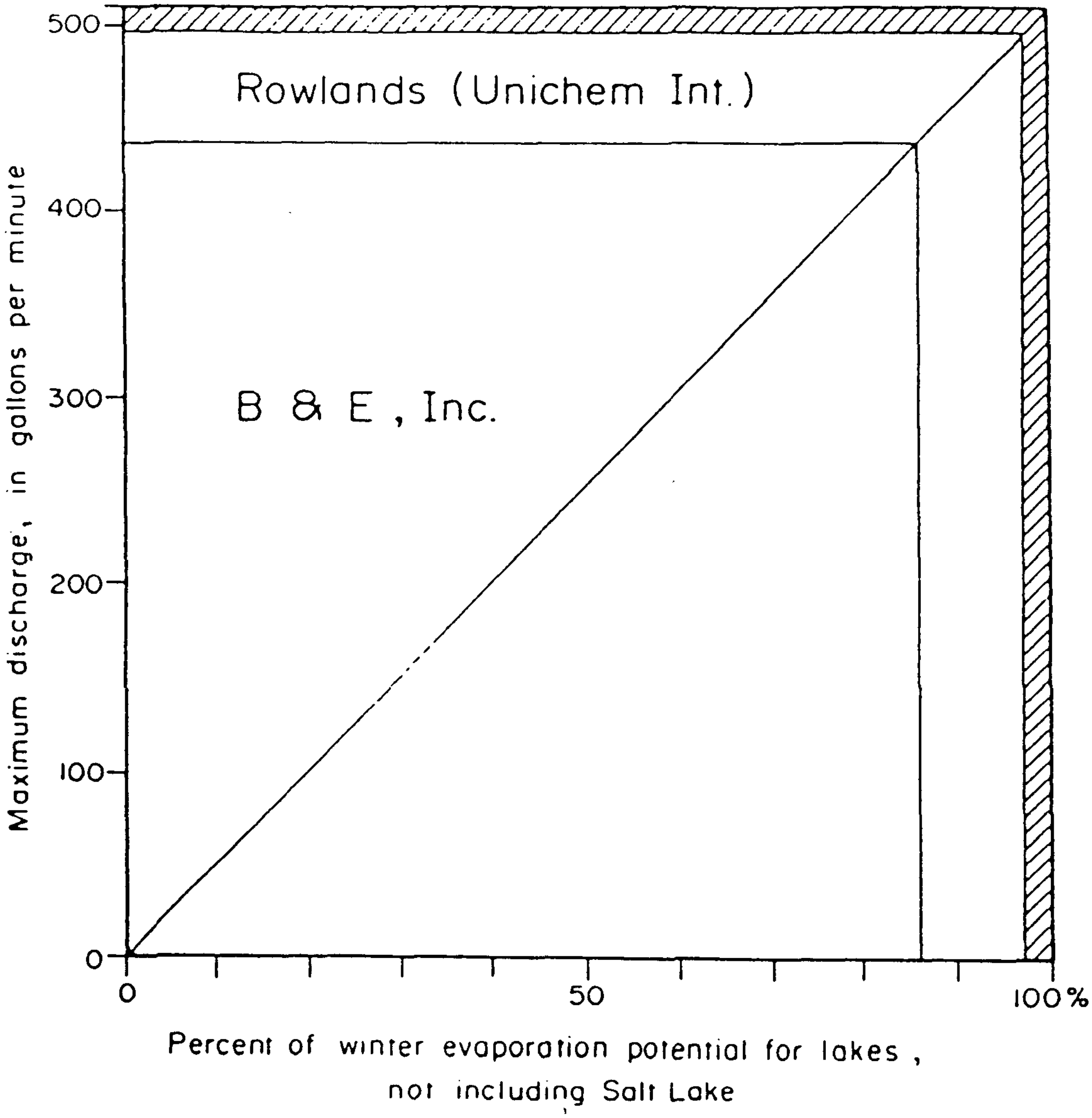


Figure 4.--Relationship of approved and proposed discharge of brine to the evaporation potential in the Laguna Quatro area. Cross-hached area shows unappropriated potential during winter period. This represents a "worst-case" condition.

significantly, and it is believed that the analyses given in the Appendix are representative of these two zones. Expanding the Tuzlu Kopek site will enable B&E to accept brine from the Delaware Formation. This brine will be slightly less mineralized than that from the Bone Springs and Morrow; slightly higher hydrogen sulfide will be dissipated during the processing operation.

## CONCLUSIONS

1. The discharge system proposed by B&E, Inc., will not adversely impact the existing hydrologic system in the vicinity of Laguna Quatro and Laguna Tres.

2. The surface area of the lakes between Laguna Tres and Salt Lake are adequate to totally consume the total discharge proposed for the system.

3. The continued natural discharge of ground water into this lake system will provide sufficient brine to mask any quality change that might originate from the oil-field brine.

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APPENDIX

P. O. BOX 1468
MONAHANS, TEXAS 79756
PHONE 943-3234 OR 563-1040

Martin Water Laboratories, Inc

709 W. INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

# RESULT OF WATER ANALYSES

LABORATORY NO. 482226
SAMPLE RECEIVED 4-9-82
RESULTS REPORTED 4-22-82

To Mr. Gene Green
P.O. Box 756, Carlsbad, NM

COMPANY B & E Transport LEASE
FIELD OR POOL
SECTION ____ BLOCK ____ SURVEY ____ COUNTY ____ STATE ____

SOURCE OF SAMPLE AND DATE TAKEN

NO. 1 Lake #1. 4-8-82
NO. 2 Lake #2. 4-8-82
NO. 3 Spring #1. 4-8-82
NO. 4 Spring #2. 4-8-82

REMARKS:

CHEMICAL AND PHYSICAL PROPERTIES

| | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| Specific Gravity at 60° F. | 1.1996 | 1.2363 | 1.1784 | 1.2352 |
| pH When Sampled | | | | |
| pH When Received | 7.48 | 7.47 | 6.99 | 7.50 |
| Bicarbonate as $HCO_3$ | 234 | 312 | 210 | 307 |
| Supersaturation as $CaCO_3$ | | | | |
| Undersaturation as $CaCO_3$ | | | | |
| Total Hardness as $CaCO_3$ | 27,500 | 45,750 | 25,000 | 44,500 |
| Calcium as Ca | 590 | 390 | 620 | 390 |
| Magnesium as Mg | 6,324 | 10,880 | 5,698 | 10,577 |
| Sodium and/or Potassium | 111,428 | 125,222 | 100,599 | 123,801 |
| Sulfate as $SO_4$ | 22,313 | 23,375 | 20,400 | 22,100 |
| Chloride as Cl | 174,707 | 208,086 | 157,662 | 205,955 |
| Iron as Fe | 0.16 | 0.16 | 0.23 | 0.08 |
| Barium as Ba | 0 | 0 | 0 | 0 |
| Turbidity, Electric | | | | |
| Color as Pt | | | | |
| Total Solids, Calculated | 315,596 | 368,265 | 285,189 | 363,130 |
| Temperature °F. | | | | |
| Carbon Dioxide, Calculated | | | | |
| Dissolved Oxygen, Winkler | | | | |
| Hydrogen Sulfide | 0.0 | 0.0 | 0.0 | 0.0 |
| Resistivity, ohms/m at 77° F | 0.044 | 0.039 | 0.047 | 0.040 |
| Suspended Oil | | | | |
| Filtrable Solids as mg/l | | | | |
| Volume Filtered, ml | | | | |
| Carbonate, as $CO_3$ | 0 | 0 | 0 | 0 |
| Fluoride, as F | 6.0 | 6.0 | 6.0 | 6.5 |
| Nitrate, as $NO_3$ | 5.0 | 0.0 | 0.0 | 0.0 |

Results Reported As Milligrams Per Liter

Additional Determinations And Remarks:

| | | | | |
|---|---|---|---|---|
| Arsenic, as As | 0.009 | 0.006 | 0.006 | 0.009 |
| Cadmium, as Cd | 0.00 | 0.00 | 0.00 | 0.00 |
| Cyanide, as CN | 0.00 | 0.00 | 0.00 | 0.00 |
| Lead, as Pb | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Mercury, as Hg | 0.000 | 0.000 | 0.000 | 0.000 |
| Selenium, as Se | 0.00 | 0.00 | 0.00 | 0.00 |
| Silver, as Ag | 0.00 | 0.00 | 0.00 | 0.00 |

The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Form No. 3

By ______

Waylan C. Martin, M. A.

Martin Water Laboratories, Inc.
WATER CONSULTANTS SINCE 1953
BACTERIAL AND CHEMICAL ANALYSES

P. O. BOX 1468
MONAHANS, TEXAS 79756
943-3234 OR 563-1040

709 W. INDIANA
MIDLAND, TEXAS 7970
PHONE 683-4521

To: Mr. Gene Green
P.O.Box 756
Carlsbad, NM

Laboratory No. 482226-A
Sample received 4-9-82
Results reported 5-11-82

Company: B & B Transport

Subject: To determine the radioactivity (radium 226 and 228) and uranium content of submitted water samples. Samples taken 4-8-82.

| Source of sample | Radium 226 pico curie/liter | Radium 228 pico curie/liter | Uranium mg/l |
|---|---|---|---|
| 1. Lake #1 | less than 0.6 | less than 1.0 | 0.099 |
| 2. Lake #2 | 9 (+or-1) | less than 1.0 | 0.051 |
| 3. Spring #1 | less than 0.6 | less than 1.0 | 0.081 |
| 4. Spring #2 | 9 (+or-1) | less than 1.0 | 0.051 |

Remarks: The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Waylan C. Martin, M. A.

P. O. BOX 1468
MONAHANS, TEXAS 79756
PHONE 943-3234 OR 563-1040

Martin Water Laboratories, Inc.

MIDLAND, TEXAS 79701
PHONE 683-4521

# RESULT OF WATER ANALYSES

LABORATORY NO. 58240
SAMPLE RECEIVED 5-4-82
RESULTS REPORTED 5-7-82

Mr. Gene Green
P. O.Box 756, Carlsbad, NM 88220

COMPANY B & K Inc. LEASE As listed
FIELD OR POOL
SECTION ____ BLOCK ____ SURVEY ____ COUNTY Eddy STATE NM
SOURCE OF SAMPLE AND DATE TAKEN
NO. 1 Produced water - taken from Brantley. 5-3-82 [illegible]
NO. 2 Produced water - taken from Huber State. 5-3-82 [illegible]
NO. 3 Produced water - taken from SCB 34. 5-3-82 [illegible]
NO. 4 Produced water - taken from Southland State. 5-3-82 [illegible]
REMARKS:

CHEMICAL AND PHYSICAL PROPERTIES

| | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| Specific Gravity at 60° F. | 1.0904 | 1.1760 | 1.1369 | 1.1720 |
| pH When Sampled | | | | |
| pH When Received | 6.46 | 5.86 | 6.83 | 5.91 |
| Bicarbonate as $HCO_3$ | 1,488 | 561 | 1,708 | 744 |
| Supersaturation as $CaCO_3$ | | | | |
| Undersaturation as $CaCO_3$ | | | | |
| Total Hardness as $CaCO_3$ | 13,600 | 67,000 | 2,300 | 43,000 |
| Calcium as Ca | 3,440 | 21,200 | 564 | 14,100 |
| Magnesium as Mg | 1,215 | 3,402 | 216 | 1,883 |
| Sodium and/or Potassium | 52,034 | 80,055 | 87,956 | 90,318 |
| Sulfate as $SO_4$ | 312 | 234 | 1,775 | 391 |
| Chloride as Cl | 88,774 | 170,446 | 134,936 | 169,025 |
| Iron as Fe | 441 | 155 | 48.3 | 169 |
| Barium as Ba | 0 | 0 | 0 | 0 |
| Turbidity, Electric | | | | |
| Color as Pt | | | | |
| Total Solids, Calculated | 147,263 | 275,898 | 227,153 | 276,461 |
| Temperature °F. | | | | |
| Carbon Dioxide, Calculated | | | | |
| Dissolved Oxygen, Winkler | | | | |
| Hydrogen Sulfide | 0.0 | 0.0 | 0.0 | 0.0 |
| Resistivity, ohms/m at 77° F. | 0.071 | 0.048 | 0.053 | 0.048 |
| Suspended Oil | | | | |
| Filtrable Solids as mg/l | | | | |
| Volume Filtered, ml | | | | |
| Carbonate, as $CO_3$ | 0 | 0 | 0 | 0 |
| Fluoride, as F | 0.3 | 0.0 | 0.0 | 0.0 |
| Nitrate, as $NO_3$ | 0.0 | 0.0 | 0.0 | 0.0 |

Results Reported As Milligrams Per Liter

Additional Determinations And Remarks

| | | | | |
|---|---|---|---|---|
| Arsenic, as As | 0.000 | 0.000 | 0.000 | 0.000 |
| Cadmium, as Cd | 0.20 | 0.20 | 0.80 | 0.20 |
| Cyanide, as CN | 0.00 | 0.00 | 0.00 | 0.00 |
| Lead, as Pb | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Mercury, as Hg | 0.000 | 0.000 | 0.000 | 0.000 |
| Selenium, as Se | 0.00 | 0.00 | 0.00 | 0.00 |
| Silver, as Ag | 0.00 | 0.00 | 0.00 | 0.00 |

The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Form No. 3

By ______________________

Waylan C. Martin, M. A.

P. O. BOX 1444
MONAHANS, TEXAS 79756
PHONE 943-3234 OR 943-1040

MIDLAND, TEXAS 79701
PHONE 683-4521

# RESULT OF WATER ANALYSES

LABORATORY NO. 58240
SAMPLE RECEIVED 5-4-82
RESULTS REPORTED 5-7-82

Mr. Gene Green
. O.Box 756, Carlsbad, NM 88220

COMPANY B & E Inc. LEASE As listed
FIELD OR POOL
SECTION ___ BLOCK ___ SURVEY ___ COUNTY Eddy STATE NM

SOURCE OF SAMPLE AND DATE TAKEN:

NO. 1 Produced water - taken from Brantley. 5-3-82 Morrow
NO. 2 Produced water - taken from Huber State. 5-3-82 Bone Springs
NO. 3 Produced water - taken from SCB 34. 5-3-82 Morrow
NO. 4 Produced water - taken from Southland State. 5-3-82 Bone Spring

REMARKS:

CHEMICAL AND PHYSICAL PROPERTIES

| | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| Specific Gravity at 60° F. | 1.0904 | 1.1760 | 1.1369 | 1.1720 |
| pH When Sampled | | | | |
| pH When Received | 6.46 | 5.86 | 6.83 | 5.91 |
| Bicarbonate as $HCO_3$ | 1,488 | 561 | 1,708 | 744 |
| Supersaturation as $CaCO_3$ | | | | |
| Undersaturation as $CaCO_3$ | | | | |
| Total Hardness as $CaCO_3$ | 13,600 | 67,000 | 2,300 | 43,000 |
| Calcium as Ca | 3,440 | 21,200 | 564 | 14,100 |
| Magnesium as Mg | 1,215 | 3,402 | 216 | 1,883 |
| Sodium and/or Potassium | 52,034 | 80,055 | 87,956 | 90,318 |
| Sulfate as $SO_4$ | 312 | 234 | 1,775 | 391 |
| Chloride as Cl | 88,774 | 170,446 | 134,936 | 169,025 |
| Iron as Fe | 441 | 155 | 48.3 | 169 |
| Barium as Ba | 0 | 0 | 0 | 0 |
| Turbidity, Electric | | | | |
| Color as Pt | | | | |
| Total Solids, Calculated | 147,263 | 275,898 | 227,155 | 276,461 |
| Temperature °F. | | | | |
| Carbon Dioxide, Calculated | | | | |
| Dissolved Oxygen, Winkler | | | | |
| Hydrogen Sulfide | 0.0 | 0.0 | 0.0 | 0.0 |
| Resistivity, ohms/m at 77° F. | 0.071 | 0.048 | 0.053 | 0.048 |
| Suspended Oil | | | | |
| Filtrable Solids as mg/l | | | | |
| Volume Filtered, ml | | | | |
| Carbonate, as $CO_3$ | 0 | 0 | 0 | 0 |
| Fluoride, as F | 0.3 | 0.0 | 0.0 | 0.0 |
| Nitrate, as $NO_3$ | 0.0 | 0.0 | 0.0 | 0.0 |

Results Reported As Milligrams Per Liter

Additional Determinations And Remarks

| | NO. 1 | NO. 2 | NO. 3 | NO. 4 |
|---|---|---|---|---|
| Arsenic, as As | 0.000 | 0.000 | 0.000 | 0.000 |
| Cadmium, as Cd | 0.20 | 0.20 | 0.80 | 0.20 |
| Cyanide, as CN | 0.00 | 0.00 | 0.00 | 0.00 |
| Lead, as Pb | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Mercury, as Hg | 0.000 | 0.000 | 0.000 | 0.000 |
| Selenium, as Se | 0.00 | 0.00 | 0.00 | 0.00 |
| Silver, as Ag | 0.00 | 0.00 | 0.00 | 0.00 |

The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Form No. 3

By ______________________

Waylan C. Martin, M. A.

P. O. BOX 1468
MONAHANS, TEXAS 79756
943-3234 OR 563-1040

Martin Water Laboratories, Inc.
WATER CONSULTANTS SINCE 1953
BACTERIAL AND CHEMICAL ANALYSES

709 W. INDIANA
MIDLAND, TEXAS 79701
PHONE 683-4521

To: Mr. Gene Green
P.O.Box 756
Carlsbad, NM

Laboratory No. 482226-A
Sample received 4-9-82
Results reported 5-11-82

Company: B & E Transport

Subject: To determine the radioactivity (radium 226 and 228) and uranium content of submitted water samples. Samples taken 4-8-82.

| Source of sample | Radium 226 pico curie/liter | Radium 228 pico curie/liter | Uranium mg/l |
|---|---|---|---|
| 1. Lake #1 | less than 0.6 | less than 1.0 | 0.099 |
| 2. Lake #2 | 9 (+or-1) | less than 1.0 | 0.051 |
| 3. Spring #1 | less than 0.6 | less than 1.0 | 0.081 |
| 4. Spring #2 | 9 (+or-1) | less than 1.0 | 0.051 |

Remarks: The undersigned certifies the above to be true and correct to the best of his knowledge and belief.

Waylan C. Martin, M. A.

EVALUATION OF SOUTHERN NASH DRAW
FOR POTENTIAL DISPOSAL
OF BRINE WATER

EDDY COUNTY, NEW MEXICO

Prepared For
MYCO INDUSTRIES, INC.
Artesia, New Mexico

7/85

TABLE OF CONTENTS

EVALUATION OF SOUTHERN NASH DRAW FOR
POTENTIAL SURFACE DISPOSAL OF BRINE WATER
EDDY COUNTY, NEW MEXICO

## INTRODUCTION

Ed L. Reed and Associates has conducted a geohydrologic investigation for MYCO Industries, Inc., of Artesia, New Mexico. MYCO has proposed the use of certain lakes in southern Nash Draw, Eddy County, New Mexico, for surface disposal of produced oil field brine. Up to 10,000 barrels per day of brine may be produced from MYCO's operations in the Big Eddy Unit, Township 22 South, Range 28E, Eddy County, New Mexico. The center of the Big Eddy Unit lies approximately 8 miles west-northwest of the area proposed for disposal in Nash Draw (see Figure 1).

The main focus of this investigation was to determine the effect of brine disposal on existing surface water and shallow groundwater. Field studies and sample collections were undertaken on June 6 and 7, 1985.

Data presented and reviewed for this report are from the New Mexico State Engineer's office, previous studies in the area by Ed L. Reed and Associates, and published reports listed under the references section.

## GENERAL GEOLOGY

Rocks exposed in Eddy County, New Mexico are of sedimentary origin (except for a few small igneous dikes to the southwest) and of Permian, Triassic, Tertiary, and Quaternary age. Rocks older than the Upper

Permian Ochoan Series near the Nash Draw area do not contain potable ground water and are not discussed here.

The oldest Ochoan rocks underlying the study area are the anhydrites and halites of the Castile Formation. The salt member pinches out just to the north and the anhydrite beds thin rapidly to a feather edge along the base of the Capitan Reef. Castile water is high in sulfates and undesirable for human consumption. It is utilized for stock water, however, in its outcrop area in southern and southwestern Eddy County.

The Salado Formation, mined for potash in Nash Draw, overlies the Castile. It contains mostly halite and potassium minerals with minor clastics, dolomite and anhydrite. The Salado appears to be free of circulating ground water, although pockets of trapped water are occasionally encountered during mining operations. The formation acts as an aquiclude, separating the fresher water of the Castile from the brines in the overlying Rustler. The Salado is the major cause of surface topography in Nash Draw. Because of the salt's soluble nature, collapse structures (especially closed depressions) are common.

The Rustler Formation, which outcrops on the floor of Nash Draw in the area studied, consists of gypsum, anhydrite, dolomite, siltstone and shale. It is separated from the underlying Salado by a basal leached zone of insoluble residue. This basal zone of detrital material is filled with poor quality water of very high total dissolved solids content and is referred to as the brine aquifer. The Rustler is topographically higher in areas where solution has not occurred in the Salado and lower where Salado has been removed. In general, the

Rustler is lower in Nash Draw than to the east or west. Because of collapse within the draw, the Rustler is often brecciated. This facilitates the flow of groundwater.

The lower-most member of the Rustler above the brine aquifer consists of gypsum, anhydrite, sandstone and siltstone. This member is overlain by the Culebra Dolomite, a marker bed about 30 feet thick which provides fresh water outside the draw area. Within the draw the Culebra consists of dolomite rubble at a fairly shallow depth and contains saline water.

The Culebra is overlain by the Tamarisk Member of anhydrite, gypsum and siltstone. The Tamarisk rubble is the principal outcrop in most of the southwestern part of Nash Draw. As a result, brine from potash operations and oil field brine disposal is being put primarily on the Tamarisk Member.

Above the Tamarisk is the Magenta Dolomite Member in which the freshest water in the area is found. The Magenta outcrops within the bluffs on either side of Nash Draw. The Magenta is not a major source of water in the area, however, and does not always yield water to wells.

Overlying the Magenta Member is the Forty-Niner member of gypsum and siltstone. It is not an aquifer in the Nash Draw area.

The Dewey Lake Redbeds, the youngest Ochoan rocks present, overlie the Rustler Formation. These reddish siltstones and sandstones are free of evaporite deposits but are above the local water table. These rocks are exposed in bluffs in the general area such as Livingston Ridge and Maroon Cliffs to the east of Nash Draw.

Triassic rocks of the Santa Rosa and Chinle formations occur mainly to the east of Nash Draw. A thin layer of alluvium and caliche may be found at various locales in and near the draw. Neither Triassic nor Quaternary deposits are important to the geohydrology of southern Nash Draw.

## HYDROLOGY

### Groundwater Movement

Figure 2 is a water table map derived from the New Mexico State Engineer's Office records of measurements of wells in the area and the U. S. Bureau of Land Management's regional water table map from the 1979 study. Locally ground water appears to be flowing toward Nash Draw and thence southwestward to Salt Lake. Ultimately ground water may enter the Pecos River at Malaga, contributing to a deterioration of water quality which has been documented in several studies.

The occurrence of fresh water in wells to the east and west of Nash Draw supports the concept of ground water flow toward the Draw. In Nash Draw water quality is poor due to the occurrence of a natural brine aquifer in the Rustler in this area of dissolution, and to the influx of brines from the potash and oil and gas industries within the Draw itself.

The Bureau of Land Management report suggests that the area of lakes starting with Laguna Uno southwestward to Salt Lake are hydrologically connected. Most flow of water from lake to lake is through ground water movement rather than surface overflow. This can be readily seen between Laguna Uno and Lindsey Lake where a series of brine seeps occur. Also between Lindsey Lake and Tamarisk Flat there is no direct surface connection. It was observed during field investigations, however, that the soil is very wet and in lower levels nearly saturated across the shoulder of land which separates these lakes. The water in these lakes appears to actually represent the surface of the ground water table.

A topographically high area bisects the lows where lakes occur just south of Laguna Uno. This may reflect an area of less solution and collapse of overlying beds and perhaps decreased permeability in the Rustler. Ground water may be flowing outward from and around this area to create the ring of lakes evident on Figure 2.

Water Quality

Twelve samples of surface water and two soil samples were taken during this firm's investigations. In addition, 3 samples of production brine were obtained from MYCO's Big Eddy Unit wells. Other water quality analyses in the area were taken from the Bureau of Land Management report and from the files of the State Engineer. All water quality values may be found on Figure 2. Those analyses obtained from our field investigations are in Appendix A.

Water suitable for livestock exists on the heights to the west of Nash Draw. A windmill in T-22S, R-29E, Sec. 33 had chlorides of 2650 mg/l and specific conductance of 3587 micromhos in April 1985 State testing. This well probably taps the Culebra Dolomite Member of the Rustler and may reflect an area of naturally brackish water. However, intrusion of saline water from Nash Draw may also be a contributing factor. Water quality in this well has deteriorated from an analysis done in 1948. At that time chlorides were only 406 mg/l and conductivity was 2580 micromhos. Since 1948 the regional water table has been raised considerably due to discharge of water from the potash refineries in Nash Draw. This buildup of water within the draw may be locally altering the hydrologic gradient into the draw and could possibly cause the deterioration in quality seen in this well. The water table map in Figure 2 indicates how close the water level in this well is to that found in parts of Nash Draw.

To the east of the study area water of excellent quality can be found in the Rustler (Culebra Member). A well in T-22S, R-30E, Sec. 22 had chlorides of 46 mg/l and specific conductance of 588 micromhos in April 1985. This well is up gradient from the lakes in Nash Draw.

No other wells were available for analysis within the study area. Several wells on the floor of the Draw have been inundated by lake water. In the 1930's and 40's, before the import of water for potash operations, water levels in these wells were 7 to 34 feet below ground level.

Locations of surface water and auger samples are indicated on Figure 2. Some samples were analyzed for major minerals, some for chlorides, sulfates and total dissolved solids, and others for specific conductance only.

Water samples ranged from a low of 134,000 mg/l total dissolved solids in a small stagnant pool in southern Tamarisk Flat (possibly diluted by recent heavy rains) to a high of 352,600 mg/l at the southern end of Lindsey Lake. Chlorides ranged from 72,333 mg/l in the pool in southern Tamarisk to 189,343 mg/l in Laguna Tres. Sulfates varied from 6,362 mg/l in Tamarisk to 22,600 in Lindsey Lake.

Soil samples were taken in the northeastern drainage to Lindsey Lake and the drainage to the northwest feeding Tamarisk Flat. The Lindsey drainage soil contained 4,151 mg/l sulfate, 18,083 mg/l chloride and 36,910 mg/l total dissolved solids from a 1:1 extraction.

The Tamarisk drainage soil had 3,022 mg/l, 15,956 mg/l and 30,370 mg/l respectively.

Brine samples from MYCO production in the Big Eddy Unit averaged as follows: 10,937 mg/l sulfate, 109,091 mg/l chloride, and 197,300 mg/l total dissolved solids. As can be readily seen, the introduction of this production brine into the existing lake water would not have any deleterious effects on surface water quality.

## Evaporation

The evaporation potential has been examined from several view points. Technical Report No. 31 (New Mexico State Engineer, 1965) gives the evaporation and precipitation records for several stations in the state. Based upon the mean monthly pan evaporation for Portales, Bitter Lakes and Lake Avalon, the net lake evaporation for the area is 62 inches or 5.2 feet per year.

> Report 64 (Texas Water Development Board, 1967) presents monthly reservoir evaporation rates for a quadrant grid over the state. These figures are based upon the evaporation for the years 1940 to 1965. Using this report, and examining the quadrants adjacent to Eddy and Lea Counties, New Mexico, the average annual net lake surface evaporation rate is about six feet. The lowest evaporation for any one year was 2.57 feet in quadrant E5, (Gaines and Andrews Counties), which occurred in 1941.

Report 192 (Texas Water Development Board, 1975), lists the pan evaporation for Red Bluff dam from 1940 to 1970. Out of this period of record, 11 years do not have enough data to provide an annual total. The 20-year average, however, is 108.9 inches of gross pan evaporation.

Using a pan to lake evaporation coefficient of 0.7 and subtracting rainfall to arrive at net evaporation gives a net lake evaporation of 69 inches per year, or 5.7 feet per year. The lowest evaporation year was in 1941, with 86.9 inches of gross pan evaporation. That year the dam received 26.3 inches of rain resulting in a net pan evaporation of 61 inches. Corrected for the pan-lake coefficient, the net lake evaporation was about 42 inches, or about 3.5 feet for the year.

Report 77, (Texas Water Development Board, 1968), demonstrates that brines may evaporate at a rate ranging from about 70 to 90% of fresh water under the conditions which can be expected in the study area. Using these figures, we can expect the average brine evaporation to be about 3.8 to 5.0 feet per year with a minimum of 1.8 feet per year. Based upon the U.S.G.S. topographic maps of the study area, we believe that there are between 250 and 350 acres of potential evaporative surface (see Figure 3). If 10,000 barrels of salt water per day are put on 250 acres of land, this would amount to 470 acre-feet of water on 250 surface acres, or about 1.88 feet of water to be evaporated per year. These figures show that even using the least amount of acreage which we believe is available, and using the lowest figures for evaporation, there is still sufficient evaporation to totally dispose of all of the 10,000 barrels of brine at the study site.

We believe there are disposal enhancements which also may be necessary or desirable to increase the evaporation potential. These would include using existing elevation head (from the escarpment to the valley floor) to spray the brine out over the lake area, and the possible use of continuous gated plastic pipe to act as water spreaders, if the detailed evaluation of the land surface indicates that the land is not flat enough to permit 250 to 350 acres to be utilized without resorting to diking.

Diking Nash Draw to allow ponding of the water may not be practical, since our preliminary rainfall runoff calculations indicate that even one year storms can be expected to create several hundred acre-feet of runoff down the draw.

## SUMMARY

A successful evaporative brine disposal system is dependent on adequate acreage to accommodate the amount of brine which will be disposed. The limiting factor on the amount of acreage needed is the amount of net evaporation that an area experiences.

In the area of Nash draw, the net annual evaporation is over five feet from a lake surface. Brines can be expected to evaporate at an annual rate of about 4 to 5 feet per year. A worst year can be around 1.8 feet. If only 250 acres of land are available, 10,000 barrels of water per day will require 1.88 feet of evaporation per year. Since we believe that 250 acres of land are the minimum available on the site, and this amount will provide for evaporation of the total amount of water to be disposed under worst conditions, it is our opinion that the Nash draw area can support the disposal of an additional 10,000 barrels of brine per day.

Respectfully submitted,

ED L. REED AND ASSOCIATES, INC.

A. Joseph Reed

A. Joseph Reed

# REFERENCES

## REFERENCES


1. "Characteristics of the Water Supply in New Mexico," New Mexico State Engineer, 1965.

2. "Evaporation Data in Texas," Report 192, Texas Water Development Board, 1975.

3. "Evaporation From Brine Solutions Under Controlled Laboratory Conditions," Report 77, Texas Water Development Board, 1968.

4. "Feasibility of Injecting Brine from Malaga Bend into the Delaware Mountain Group, Eddy County, New Mexico," Open File Report, U.S.G.S., October 1960.

5. "Geology and Ground Water Resources of Eddy County, New Mexico," Ground Water Report 3, New Mexico Bureau of Mines and Mineral Resources, 1952.

6. "Geology and Hydrology of the Carlsbad Potash Area, Eddy and Lea Counties, New Mexico," Open File Report 72-49, U.S.G.S., 1972.

7. "Monthly Reservoir Evaporation Rates for Texas 1940 through 1965," Report 64, Texas Water Development Board, 1967.

8. "Possible Improvement of Quality of Water of the Pecos River by Diversion of Brine at Malaga Bend, Eddy County, New Mexico," Pecos River Commission and U.S.G.S., December 1954.

9. "Water Resources Study of the Carlsbad Potash Area," Contract YA-512-CT8-195, U.S.B.L.M., 1979.

# APPENDIX A

# SAMPLE ANALYSES

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1703 W. Industrial Avenue (915-683-3348) • P.O. Box 2150 • Midland, Texas 79701

Client No. 3485000

File No. C-1902-W

Report No 36540

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 1, Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec. 34,SE¼NE¼ (eastern shore lake north of State 128)

| | mg/L |
|---|---|
| Sulfate | 18057 |
| Chloride | 180124 |
| Total Dissolved Solids @ 180°C | 343000 |

Technician: KLH

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Client No. 3485000

File No. C-1902-W

Report No. 36541

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 2,
Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec.35,SW¼NW¼ (along pipeline road north of State 128)

| | mg/L |
|---|---|
| Sulfate | 20517 |
| Chloride | 176578 |
| Total Dissolved Solids @ 180°C | 327000 |

Technician: KLH

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File No. C-1902-W

Report No. 36542

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 3, Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec.25,SW¼NW¼ (seep between Lindsey and Uno)

| | mg/L |
|---|---|
| Calcium | 464 |
| Magnesium | 5451 |
| Sodium & Potassium (Calc. as Na) | 105691 |
| Carbonate | None |
| Bicarbonate | 177 |
| Sulfate | 20509 |
| Chloride | 164523 |
| Total Dissolved Solids @ 180°C | 310800 |
| Total Hardness (as $CaCO_3$) | 23600 |

pH---------- 6.90

Technician: KLH

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Client No. 3485000

File No C-1902-W

Report No. 36543

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 4, Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec.24,SW¼SW¼ (west shore Laguna Uno)

Conductivity-------------------- 20408 micromhos/cm @ 25°C

Technician: KLH

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Client No. 3485000

File No C-1902-X

Report No 27628

Report Date 6-18-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on Soil

Client Ed L. Reed & Associates

Identification Eddy County, New Mexico, MYCO, Sample No. 5, Sampled 6-6-85 by A. Schmidt

T22S, R29E, Sec.24, NW¼SW¼ (auger sample ½ mi. northeast of Lindsey)

| | PPM |
|---|---|
| Sulfate | 4151 |
| Chloride | 18083 |
| Total Dissolved Solids @ 180°C | 36910 |

Sample was extracted 1:1 with deionized water and the above parameters run on the resulting aqueous solution.

Technician KLH

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File No C-1902-W

Report No. 36545

Report Date 6-17-85

Date Received 6-10-85

Report of tests on: Water

Client: Ed L. Reed & Associates

Delivered By Reed & Assoc.

Identification: Eddy County, New Mexico, MYCO, Sample No. 6, Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec.23,SW¼SE¼ (North shore Lindsey Lake)

Conductivity---------------- 20000 micromhos/cm @ 25°C

Technician: KLH

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File No. C-1902-W

Report No. 36546

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 7, Sampled 6-6-85 by A. Schmidt

T22S, R29E, Sec.26, NE¼SE¼ (south shore Lindsey Lake)

| | mg/L |
|---|---|
| Sulfate | 22600 |
| Chloride | 188634 |
| Total Dissolved Solids @ 180°C | 352600 |

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File No. C-1902-W

Report No. 36550

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 11, Sampled 6-6-85 by A. Schmidt

T23S, R29E, Sec.1, NE¼NW¼ (northeast corner Laguna Tres)

| | mg/L |
|---|---|
| Sulfate | 20007 |
| Chloride | 189343 |
| Total Dissolved Solids @ 180°C | 352200 |

Technician KLH

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File No C-1902-W

Report No 36551

Report Date 6-17-85

Date Received 6-10-85

Report of tests on: Water

Client: Ed L. Reed & Associates

Delivered By: Reed & Assoc.

Identification: Eddy County, New Mexico, MYCO, Sample No. 12, Sampled 6-6-85 by A. Schmidt

T22S,R30E,Sec.31,SW¼SE¼ (lake just northeast Laguna Quatro)

| | mg/L |
|---|---|
| Sulfate | 20945 |
| Chloride | 177997 |
| Total Dissolved Solids @ 180°C | 330400 |

Technician: KLH

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Client No. 3485000

File No C-1902-W

Report No 36552

Report Date 6-17-85

Date Received 6-10-85

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Report of tests on Water

Client Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 13, Sampled 6-6-85 by A. Schmidt

T22S,R30E,Sec.30,NW¼SE¼ (southeast corner Laguna Uno)

| | mg/L |
|---|---|
| Calcium | 384 |
| Magnesium | 18519 |
| Sodium & Potassium (Calc. as Na) | 95801 |
| Carbonate | None |
| Bicarbonate | 184 |
| Sulfate | 22493 |
| Chloride | 185797 |
| Total Dissolved Solids @ 180°C | 315200 |
| Total Hardness (as $CaCO_3$) | 77200 |
| pH | 7.57 |

Technician: KLH

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File No C-1902-X

Report No 27629

Report Date 6-18-85

Date Received 6-10-85

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Report of tests on Soil

Client Ed L. Reed & Associates

Identification Eddy County, New Mexico, MYCO, Sample No. 14, Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec.27,NE¼NE¼ (auger ½ mi. northwest of Tamarisk)

| | PPM |
|---|---|
| Sulfate | 3022 |
| Chloride | 15956 |
| Total Dissolved Solids @ 180°C | 30370 |

Sample was extracted 1:1 with deionized water and the above parameters run on the resulting aqueous solution.

Technician: KLH

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File No C-1902-W

Report No 36553

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO Production Brine, Unit No. 105, Sampled 6-7-85 by A. Schmidt

| | mg/L |
|---|---|
| Calcium | 11120 |
| Magnesium | 5817 |
| Sodium & Potassium (Calc. as Na) | 46363 |
| Carbonate | None |
| Bicarbonate | 342 |
| Sulfate | 12740 |
| Chloride | 98572 |
| Total Dissolved Solids @ 180°C | 179700 |
| Total Hardness (as $CaCO_3$) | 51750 |

pH------------ 7.53

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File No C-1902-W

Report No. 36555

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO Production Brine, Big Eddy Unit No. 110, Sampled 6-7-85 by A. Schmidt

| | mg/L |
|---|---|
| Calcium | 18400 |
| Magnesium | 4251 |
| Sodium & Potassium (Calc. as Na) | 51410 |
| Carbonate | None |
| Bicarbonate | 368 |
| Sulfate | 9061 |
| Chloride | 117364 |
| Total Dissolved Solids @ 180°C | 217000 |
| Total Hardness (as $CaCO_3$) | 63500 |
| pH | 7.42 |

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Client No. 3485000

File No. C-1902-W

Report No. 36554

Report Date 6-17-85

Report of tests on: Water

Date Received 6-10-85

Client: Ed L. Reed & Associates

Delivered By Reed & Assoc.

Identification: Eddy County, New Mexico, MYCO Production Brine, Big Eddy Unit No. 106-107, Common Battery, Sampled 6-7-85 by A. Schmidt

| | mg/L |
|---|---|
| Calcium | 14320 |
| Magnesium | 3085 |
| Sodium & Potassium (Calc. as Na) | 55297 |
| Carbonate | None |
| Bicarbonate | 303 |
| Sulfate | 11012 |
| Chloride | 111337 |
| Total Dissolved Solids @ 180°C | 195201 |
| Total Hardness (as $CaCO_3$) | 48500 |
| pH | 7.40 |

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Client No. 3485000

File No C-1902-W

Report No 36547

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 8, Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec.35,NE¼NW¼ (southeast corner Tamarisk)

| | mg/L |
|---|---|
| Calcium | 1952 |
| Magnesium | 3770 |
| Sodium & Potassium (Calc. as Na) | 40607 |
| Carbonate | None |
| Bicarbonate | 111 |
| Sulfate | 6362 |
| Chloride | 72333 |
| Total Dissolved Solids @ 180°C | 134000 |
| Total Hardness (as $CaCO_3$) | 20400 |
| pH | 7.00 |

Technician: KLH

Copies Ed L. Reed & Associates

SOUTHWESTERN LABORATORIES

Gary M. Burch

SwL

# SOUTHWESTERN LABORATORIES

*Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services*

1703 W. Industrial Avenue (915-683-3348) • P.O. Box 2150 • Midland, Texas 79701

Client No. 3485000

File No C-1902-W

Report No 36548

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 9, Sampled 6-6-85 by A. Schmidt

T22S,R29E,Sec.26,SE¼NW¼ (northeast corner Tamarisk)

Conductivity----------------- 20833 micromhos/cm @ 25°C

Technician: KLH

Copies: Ed L. Reed & Associates

SOUTHWESTERN LABORATORIES

Gary M. Bunch

SWL **SOUTHWESTERN LABORATORIES**

*Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services*

1703 W. Industrial Avenue (915 - 683-3348) • P.O. Box 2150 • Midland, Texas 79701

Client No. 3485000

File No C-1902-W

Report No. 36549

Report Date 6-17-85

Date Received 6-10-85

Delivered By Reed & Assoc.

Report of tests on: Water

Client: Ed L. Reed & Associates

Identification: Eddy County, New Mexico, MYCO, Sample No. 10, Sampled 6-6-85 by A. Schmidt

T23S,R30E,Sec.6,SW¼NE¼ (east side Laguna Quatro)

| | mg/L |
|---|---|
| Sulfate | 21036 |
| Chloride | 180833 |
| Total Dissolved Solids @ 180°C | 337000 |

Technician: KLH

Copies Ed L. Reed & Associates

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Gary M. Burch

FIGURE 1

AREA STUDIED FOR PROPOSED BRINE DISPOSAL,
EXISTING BRINE DISPOSAL PERMITS

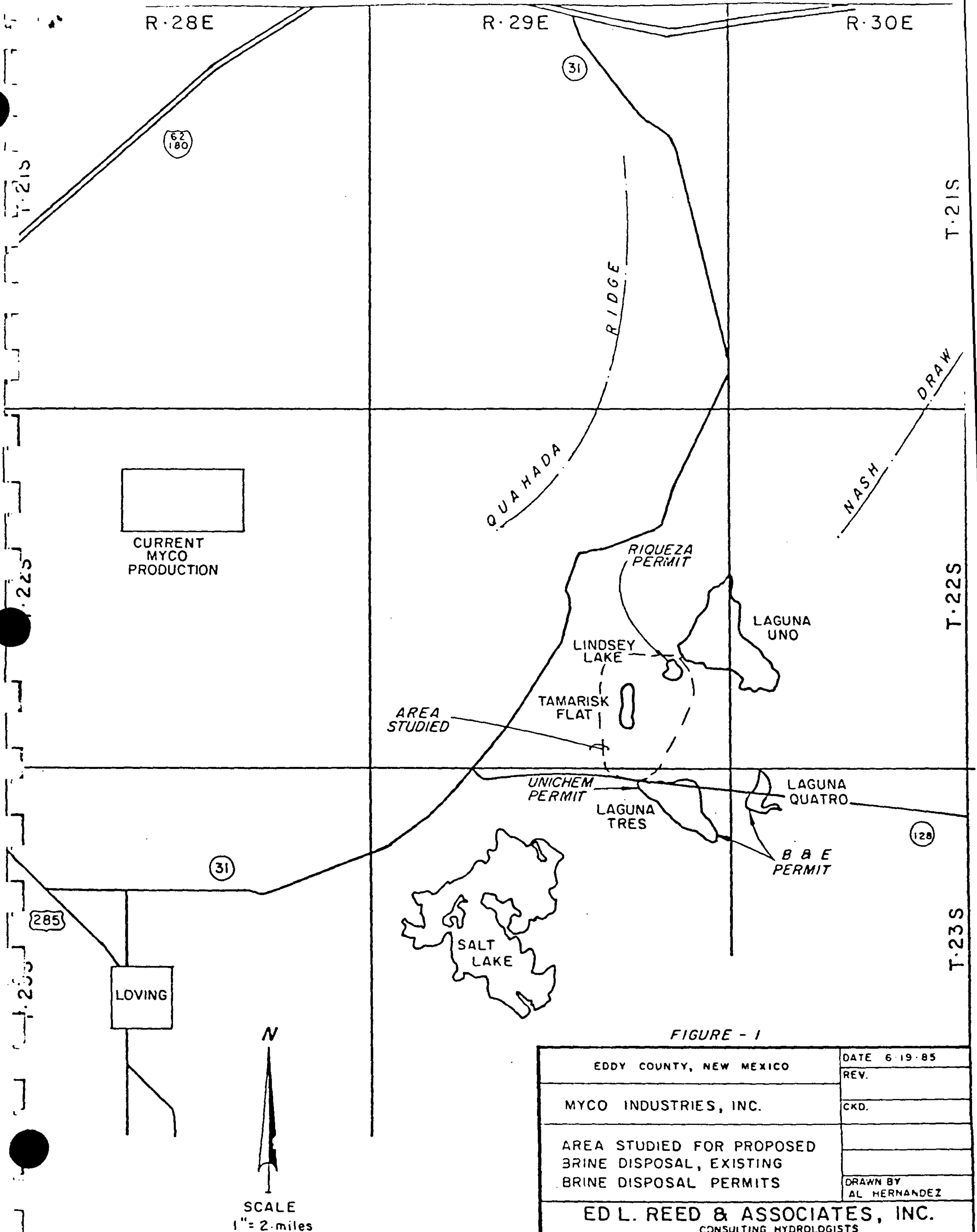



FIGURE - 1

| | |
|---|---|
| EDDY COUNTY, NEW MEXICO | DATE 6·19·85 |
| | REV. |
| MYCO INDUSTRIES, INC. | CKD. |
| AREA STUDIED FOR PROPOSED BRINE DISPOSAL, EXISTING BRINE DISPOSAL PERMITS | DRAWN BY AL HERNANDEZ |

ED L. REED & ASSOCIATES, INC.
CONSULTING HYDROLOGISTS
MIDLAND, CORPUS CHRISTI, TEXAS

FIGURE 2

WATER TABLE AND QUALITY MAP

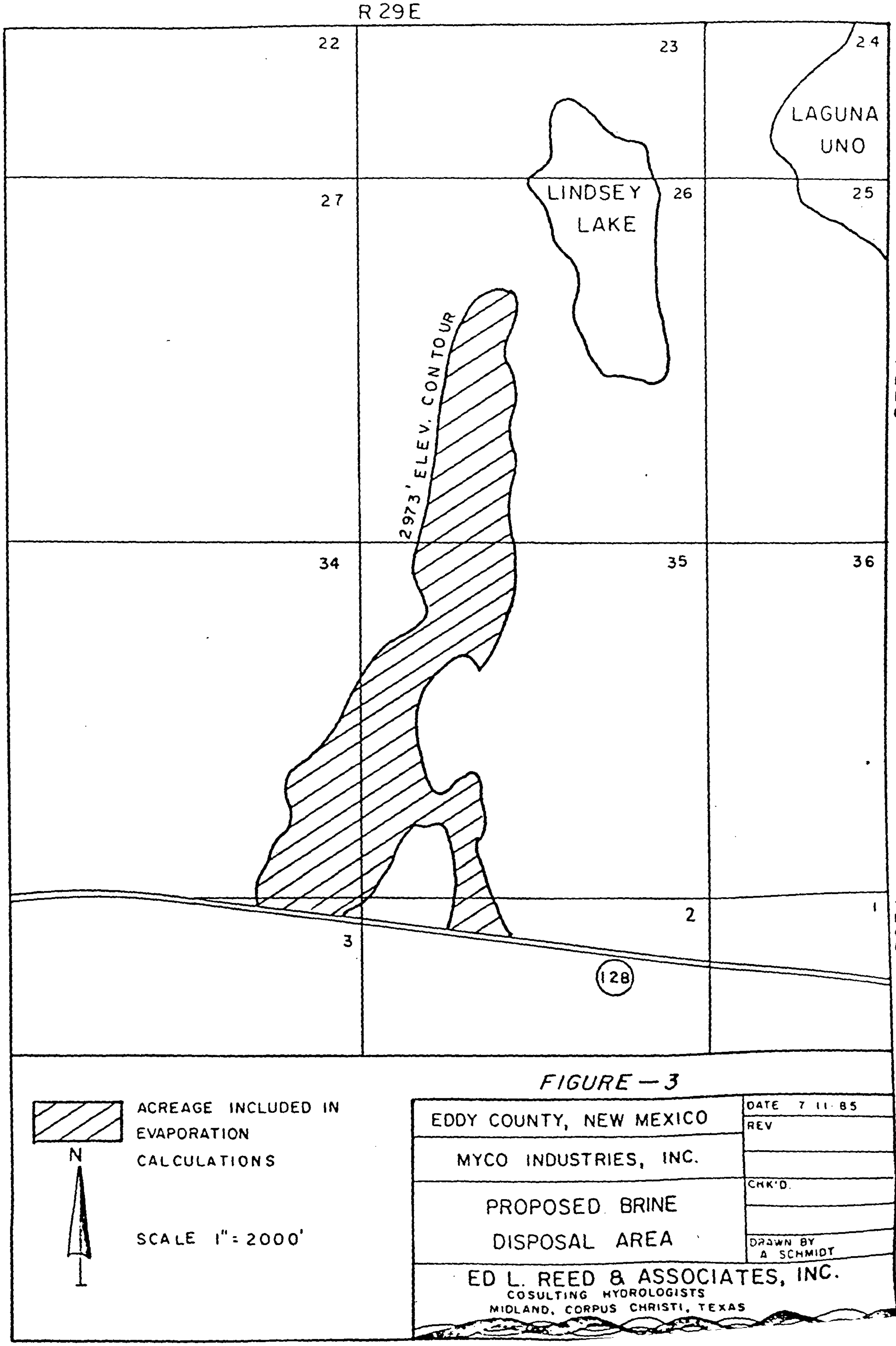
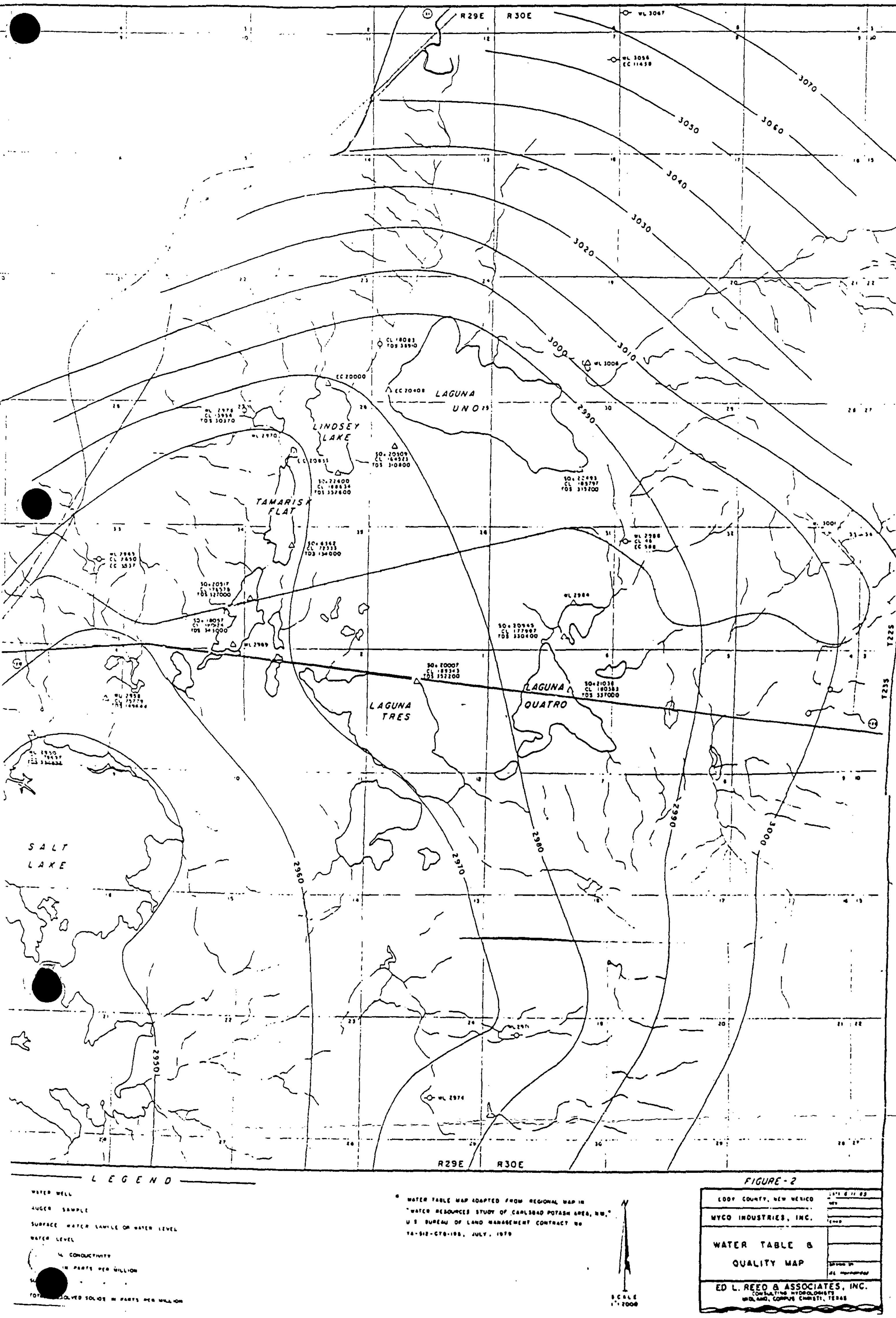



FIGURE — 3

| EDDY COUNTY, NEW MEXICO | DATE 7 11 85 |
|---|---|
| | REV |
| MYCO INDUSTRIES, INC. | |
| PROPOSED BRINE DISPOSAL AREA | CHK'D. |
| | DRAWN BY A SCHMIDT |

ED L. REED & ASSOCIATES, INC.
COSULTING HYDROLOGISTS
MIDLAND, CORPUS CHRISTI, TEXAS


R29E
R30E
3070
3060
3050
3040
3030
3020
3010
3000
2990
2980
2970
2960
2950
LAGUNA UNO
LINDSEY LAKE
TAMARISK FLAT
LAGUNA TRES
LAGUNA QUATRO
SALT LAKE
T22S
T23S
LEGEND
WATER WELL
AUGER SAMPLE
SURFACE WATER SAMPLE OR WATER LEVEL
WATER LEVEL
IN PARTS PER MILLION
SOLVED SOLIDS IN PARTS PER MILLION
* WATER TABLE MAP ADAPTED FROM REGIONAL MAP IN "WATER RESOURCES STUDY OF CARLSBAD POTASH AREA, N.M.," U S BUREAU OF LAND MANAGEMENT CONTRACT NO YA-512-CT8-195, JULY, 1979
N
SCALE
FIGURE - 2
EDDY COUNTY, NEW MEXICO
MYCO INDUSTRIES, INC.
WATER TABLE & QUALITY MAP
ED L. REED & ASSOCIATES, INC.
CONSULTING HYDROLOGISTS
MIDLAND, CORPUS CHRISTI, TEXAS

APPENDIX D

# APPENDIX D
# STANDARD OPERATING PROCEDURE - FIELD SAMPLING

# SOP: SOIL SAMPLING AND SUBSURFACE EXPLORATION

## 1.0 PURPOSE AND APPLICABILITY

This SOP describes the methods used in obtaining soil samples for physical testing, stratigraphic correlations, and chemical analysis. Soil samples are obtained in conjunction with test pit excavations and soil borings. These procedures provide direct information as to the physical makeup of the surface and subsurface environment. This SOP will discuss sampling of the surface material with hand tools and sampling of the subsurface material within test pits.

## 2.0 RESPONSIBILITIES

The project geologist/engineer will be responsible for the proper use and maintenance of all types of equipment used for obtaining surface and test pit samples. The geologist/engineer will determine the location, total depth and overall size of each surface sample collection point and test pit, and the location and depth of all subsurface borings.

It will be the responsibility of the project geologist/ engineer to observe all activities pertaining to soil sampling and subsurface investigations to ensure that all the standard procedures are followed properly, and to record all pertinent data, including unified soil system classification, on a field log or field book. The collection, handling, and storage of all samples will be the responsibility of the geologist/engineer.

## 3.0 SUPPORTING MATERIALS

The geologist/engineer will provide:

- sample bottles/containers and labels;
- boring and test pit logs;
- field notebook;
- chain-of-custody forms;

- depth measurement device;
- stakes and fluorescent flagging tape;
- decontamination solutions;
- camera for photographing sections (as allowed); and
- sample cutting/extracting equipment: knives, trowels, shovels, hand auger.

## 4.0 METHODS

Specific sampling equipment and methodology will be dictated by the characteristics of the soil to be sampled, the type of soil samples required and by the analytical procedures to be employed. Soil samples obtained at the surface may be collected using a shovel, trowel, or hand auger. A hand auger can be used to extract shallow soil samples up to 10 feet below the surface. Sampling to obtain uniform coverage within a specified area will often require the use of an area grid. These considerations will be followed based upon specific project requirements.

## 4.1 GENERAL APPLICATIONS

General locations for test pits and sampling locations may be documented by survey or by using topographic maps and/or plans. A preliminary log of the test pit will be prepared in the field by the geologist or engineer. A sketch of the test pit may be necessary to depict the strata encountered.

Sampling locations will be mapped by the geologist or engineer. All information will be recorded in a log book.

## 4.2 SURFACE SAMPLING

Prior to surface sampling, remove all surface materials that are not to be included such as rocks, twigs, leaves. For sample collection within the upper two to three feet use a shovel or trowel. A hand auger may be used to depths of up to 10 feet. When using the hand auger, auger the hole to the required depth, then slowly remove the auger and collect the soil sample from the auger flight at the point corresponding to the required depth. A tube sampler can be attached to the auger rods after augering to the desired depth, inserted into the open borehole, and then advanced into the deposits at the base of the boring. If sampling is in sandy or non-cohesive soil, a shovel may be necessary to collect samples.

## 4.3 TEST PIT EXCAVATION AND SAMPLING

The test pits will be excavated in compliance with applicable safety regulations. Walls should be cut as near vertical as possible to facilitate stratigraphic logging. The size and depth of test pit will be recorded in A Test Pit Log.

Photographs of specific geologic features may be required for documentation purposes. A scale or an item providing a size perspective should be placed in each photograph. The frame number and picture location will also be documented in the field log book. The test pit will be inspected to ensure that all required data and samples have been collected. All test pits will be backfilled to original grade and compacted.

## 4.4 SAMPLE COLLECTION TECHNIQUES

When collecting soil samples, potential for cross-contamination will be minimized through proper and careful collection techniques. The following techniques are specific to the sampling methods discussed previously in this SOP.

<u>Surface</u>

The sampling device used to collect the soil sample should be properly decontaminated prior to collecting each sample. After the sample is collected, place it on a clean sheet of tin foil. Use a decontaminated utensil such as a stainless steel knife to remove carry-down material from the sample. Carry-down material includes the soil along the side of a core sample that was carried down by the auger from a location above the actual sample point. Carry-down can be removed from a core sample by shaving the sides of the core with the knife. If the sample is collected using a shovel or trowel, clear the area

## 5.0 DOCUMENTATION

The following documentation will be placed in the project files:

- test pit log,
- sample log sheets,
- field log book,
- chain-of-custody forms, and
- shipping receipts.

APPENDIX E

# APPENDIX E
# OIL CONSERVATION DIVISION (OCD) GUIDELINES

# GUIDELINES
# FOR
# SURFACE IMPOUNDMENT CLOSURE

(October 29,1991)

NEW MEXICO OIL CONSERVATION DIVISION
STATE LAND OFFICE BUILDING
P.O. BOX 2088
SANTA FE, NEW MEXICO 87504-2088

# PREFACE

The following procedures shall be used as a guide for the closure of surface impoundments used for the containment of those wastes regulated by the Oil Conservation Division, individual districts may impose additional requirements. All plans and specifications shall be submitted to and approved by the Oil Conservation Division prior to closure. Procedures may deviate from the following guidelines if it can be shown that the proposed procedure will remove or isolate contaminants in such a manner that ground water, surface water and the environment are protected from future contamination.

If a number of impoundments are to be closed by a single company, one plan detailing the procedures to be followed at all locations may be submitted for approval. The plan must state the specific location of each impoundment that is to be closed under the procedures proposed in the plan.

Constituents and procedures for soil and ground water testing and remediation may vary depending on the site specific conditions.

# INTRODUCTION

OCD Surface Impoundment Closure Guidelines are intended to provide guidance to operators and facility owners for closure of surface impoundments in a manner that assures protection of surface waters, ground waters and the environment.

# PART I EXEMPT IMPOUNDMENTS

## I. SITE ASSESSMENT

Prior to final closure of surface impoundments, the operator or facility owner will perform an investigation to determine the extent to which soils and/or ground water have been impacted by the operation of the impoundment using the following procedures:

A. Soil Contamination Assessment

1. Highly Contaminated Soils

Highly contaminated soils are defined as soils which are stained or saturated with any type of petroleum product. These soils can be distinguished by observing the physical properties of the soil for observable free phase petroleum product, gross staining and evidence of a very strong odor. These physical properties are criteria which may be used to determine if the soil is highly contaminated.

2. Other Contaminated Soils

Other contaminated soils are defined as those soils which do not exhibit highly contaminated characteristics as described in Part 1 I.A.1. above. The following field or laboratory procedures may be utilized to determine the degree of contamination:

a. Headspace Method

i. Fill a 0.5 liter or larger jar half full of sample.

ii. Seal top tightly with aluminum foil.

iii. Ensure sample is at 15 to 25 degrees Celsius or approximately 60 to 80 degrees Fahrenheit. A warm water bath should be used if necessary to raise sample temperature to an acceptable range.

iv. Aromatic hydrocarbon vapor concentrations must be allowed to develop in the headspace of the sample jar for 5 to 10 minutes. During this headspace development period, the sample jar should be shaken vigorously for 1 minute.

v. Pierce aluminum foil seal with the probe of either a PID or FID organic vapor analyzer, and then record the highest (peak) measurement. The instrument must be calibrated to assume a benzene response factor.

b. Laboratory Method

i. Sampling Procedure

1. Collect samples in clean air tight jars, preferably jars supplied by the laboratory which will conduct the analysis.

2. Cool and store samples on ice.

3. Promptly ship sample to the lab for analysis following chain of custody procedures as necessary,

ii. Analysis Methods

Below are the OCD required laboratory methods required for the analysis of contaminated soils. Alternate laboratory methods may be used for analyzing soils for contaminant concentrations, if approved in advance by the OCD.

1. Purgeable organic contaminants will be determined using EPA Method 8010 and EPA Method 8020.

2. Total Petroleum Hydrocarbons (TPH) will be determined using the modified EPA Method 8015.

B. Ground Water Contamination Assessment

The installation of monitor wells to determine the impact of the disposal of wastes to surface impoundments may be required depending on the results of the assessment of soil contamination at the site. If monitor wells are required, they are to be installed and sampled using the following guidelines:

1. Monitor Well Installation

a. Locations

One monitor well should be installed through the center of the impoundment or directly adjacent and downgradient of the impoundment to determine if ground water has been impacted by disposal activities. Additional monitor wells, upgradient and downgradient of the impoundment, to delineate the full extent of ground water contamination may be required if ground water directly underneath the pit has been found to be impacted by disposal activities.

b. Construction

Monitor wells construction materials shall be selected to be chemically resistant to the contaminants to be monitored and be able to be installed without the use of glues or adhesives.

Monitor wells shall be constructed according to accepted industry standards with a minimum of five feet of well screen above the water table to accommodate seasonal fluctuations in the static water table.

2. Ground Water Sampling

Ground water shall be sampled from monitor wells according to accepted industry standards. Samples shall be analyzed for potential contaminants contained in the wastes disposed of in the impoundment. All laboratory analyses will be conducted pursuant to standard EPA Methods unless OCD has approved the use of alternate laboratory methods.

## II. Action Levels

A. Soils

The action levels listed below apply directly for sites where soils are to be remediated in place or removed for treatment on the surface.

1. Highly Contaminated Soils

a. Soils which are determined to be highly contaminated either by the observation of physical properties must be remediated.

2. Other Contaminated Soils

a. Field Headspace Method

A measurement of 100 parts per million (ppm) or greater of total organic vapor indicates that remedial action is necessary.

b. Laboratory Method

Remedial action is necessary if any of the following contaminant levels are exceeded:

i. The sum of the concentrations of all detected aromatics is greater than 50 ppm.

ii. The benzene concentration is greater than 10 ppm.

iii. The concentration of TPH is greater than 100 ppm.

B. Ground Water

Ground waters found to be contaminated from waste disposal at a surface impoundment with free phase products and dissolved phase constituents in excess of New Mexico Water Quality Control Commission (WQCC) water quality standards will be required to perform remedial actions.

III. REMEDIATION

A. Soils

When a contaminated soil requires remediation according to standards set forth in Part 1.II.A., it must be remediated according to the criteria described below.

1. Removal

a. Highly Contaminated Soils

Highly contaminated soils should be excavated from the ground to the maximum depth and horizontal extent practicable.

b. Other Contaminated Soils

Contaminated soil which exceeds the action levels set out in Part 1.II.A.2. must be excavated to the maximum depth and horizontal extent practicable until samples from the walls and bottom of the excavation pass the contaminant specific action level.

2. Disposal/Treatment

Below is a list of options to be used for either the treatment or disposal of contaminated soils.

a. Disposal

Excavated contaminated soils may be disposed of offsite at an OCD approved facility with prior OCD approval.

b. Treatment Of Excavated Soils

i. Thin Spreading

Soil must be spread in a single layer no greater than six inches thick in a bermed area. If the depth to the seasonal high static water level is less than 100 feet, the soil must be placed in a level bermed area on an impermeable barrier such as hypalon or concrete. All necessary precautions must be taken to prevent runoff of contaminants or the infiltration of contaminants below the ground surface. The soil should be disced to enhance aerobic biodegradation approximately once every two weeks.

ii. Other Methods

The OCD encourages other methods of soil remediation, including but not limited to, active soil aeration, bioremediation and thermal treatment. Alternatives to thin spreading must be proposed to OCD for approval or disapproval prior to commencement of remediation activities. Soils which are temporarily stockpiled prior to treatment or disposal must be kept on an impermeable barrier in a bermed area to prevent runoff or infiltration of contaminants.

c. Residual Contamination

Where contaminated soils remain beyond the horizontal or vertical extent of practicable excavation, they must be treated in place .In place treatment may be accomplished using vapor venting, bioremediation or some other treatment system. The method to be used must be approved in advance by the OCD and must be capable of reducing contaminant levels in a timely manner.

B. Ground Water

When contaminated ground water requires remediation according to standards set forth in Part 1.II.B., it must be remediated according to the criteria described below.

1. Free Phase Contamination

Free phase products must be removed from ground water. Floating product can be removed from ground water through the use of either skimming type devices or total fluid type pumps. The OCD does not endorse the use of any specific product for the removal of free phase products from ground water.

2. Dissolved Phase Contamination

Ground water contaminated with dissolved phase constituents in excess of WQCC water quality standards can be remediated by either removing and treating the ground water or insitu treatment. The OCD does not require the use of any specific technique or product to remediate contaminated ground water. If treated waters are to be disposed of onto or below the ground surface, a discharge plan must be submitted and approved by OCD.

## IV. TERMINATION OF REMEDIAL ACTION

Remedial action may be terminated when the criteria described below have been met:

### A. Soils

Soil contamination must be reduced to a concentration which will not contaminate ground water through percolation (aquifer recharge) or as the water table rises and falls with seasonal fluctuations. Analytical testing must be conducted on sites where the seasonal high static water table is 50 feet or less and the ground water contains 10,000 ppm or less of total dissolved solids(TDS). The appropriate, contaminant specific procedure for soils testing must be conducted on representative samples of the remaining contaminated soils. The results of the analysis of these samples must conform to the standards specified in Part 1.II.A.2.. of the guidelines.

If the soil contaminant standards cannot practicably be attained, a risk assessment may be performed and provided to OCD for approval showing that the remaining contaminants will not pose a threat to beneficial use for the foreseeable future

B. Ground Water

A ground water remedial action may be terminated if all free phase product has been removed from the water and the concentration of dissolved phase contaminants in the ground water does not exceed New Mexico WQCC water quality standards.

If the water quality standards cannot practicably be attained, a risk assessment may be performed and provided to OCD for approval showing that the remaining contaminants will not pose a threat to beneficial use for the foreseeable future

## V. Final Closure

Upon completion of any necessary remediation activities the impoundment shall be backfilled with clean materials and mounded to prevent ponding.

APPENDIX F

# APPENDIX F
# LABORATORY (ANALYSYS, INC.) DATA REPORTS

AnalySys inc.
4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

RECEIVED
NOV 19 1992

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32574
**Report Date:** 10/27/92

**Project Description:** B&E Site Investigation
**Sample Name:** Total pit composite **Matrix:** soil
**Date/Time Taken:** 9/22/92 6:00:00 **Date/Time Received:** 9/24/92 10:00:00

**Report of Analysis**

see attached

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated.
"Less than" values reflect the nominal detection limit of the method employed.

# Report of Analysis

**Project Desc:** B&E Site Investigation  **Report #:** 32574

**Sample Name:** Total pit composite  **Report Date:** 10/27/92

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | — | | | | 9/23/92 | 3540 |
| Benzene | 1.9 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | 49 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | 48 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | 18 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| TCLP Extraction-ABN/metals | — | | | | 9/25/92 | 1311 |
| Toluene | 0.26 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Aluminum/ICP | 2,600 | mg/Kg | 1.00 | <0.05 | 9/30/92 | 200.7 & 6010 |
| Antimony/GFAA | <60 | µg/Kg | 60 | <3 | 9/30/92 | 204.2&7041 |
| Arsenic/GFAA | 4,000 | µg/Kg | 20 | <1 | 9/28/92 | 206.2&7060 |
| Barium/ICP | 9.6 | mg/Kg | 0.20 | <0.01 | 9/28/92 | 200.7 & 6010 |
| Beryllium/ICP | 0.25 | mg/Kg | 0.100 | <0.005 | 9/30/92 | 200.7 & 6010 |
| Cadmium/ICP | 0.89 | mg/Kg | 0.100 | <0.005 | 9/28/92 | 200.7 & 6010 |
| Calcium/ICP | 130,000 | mg/Kg | 100.00 | <0.05 | 10/1/92 | 200.7 & 6010 |
| Chromium/ICP | 49 | mg/Kg | 1.00 | <0.05 | 9/28/92 | 200.7 & 6010 |
| Cobalt/ICP | 4.1 | mg/Kg | 1.00 | <0.05 | 9/30/92 | 200.7 & 6010 |
| Copper/ICP | 31 | mg/Kg | 0.20 | <0.01 | 10/1/92 | 200.7 & 6010 |
| Iron/ICP | 12,000 | mg/Kg | 10.00 | <0.05 | 9/30/92 | 200.7 & 6010 |
| Lead/ICP | 110 | mg/Kg | 1.00 | <0.05 | 9/28/92 | 200.7 & 6010 |
| Magnesium/ICP | 10,000 | mg/Kg | 10.00 | <0.05 | 10/1/92 | 200.7 & 6010 |
| Manganese/ICP | 130 | mg/Kg | 0.20 | <0.01 | 9/30/92 | 200.7 & 6010 |
| Mercury/CVAA | 50 | µg/Kg | 5 | <0.2 | 9/29/92 | 245.1&7470 |
| Nickel/ICP | 11 | mg/Kg | 1.00 | <0.05 | 9/30/92 | 200.7 & 6010 |
| Potassium/AA | 71 | mg/Kg | 1 | <0.05 | 10/1/92 | 258.1&7610 |
| Selenium/GFAA | 260 | µg/Kg | 40 | <2 | 9/28/92 | 270.2&7740 |
| Silver/GFAA | 65 | µg/Kg | 4 | <0.2 | 9/29/92 | 272.2&7761 |
| Sodium/ICP | 8,100 | mg/Kg | 20.0 | <0.1 | 10/1/92 | 200.7 & 6010 |
| TCLP-Arsenic/ICP | <0.5 | mg/L | 0.5 | <0.5 | 9/29/92 | 200.7 & 6010 |
| TCLP-Barium/ICP | 0.66 | mg/L | 0.1 | <0.1 | 9/29/92 | 200.7 & 6010 |
| TCLP-Cadmium/ICP | <0.1 | mg/L | 0.1 | <0.1 | 9/29/92 | 200.7 & 6010 |
| TCLP-Chromium/ICP | <0.5 | mg/L | 0.5 | <0.5 | 9/29/92 | 200.7 & 6010 |
| TCLP-Lead/ICP | <0.5 | mg/L | 0.5 | <0.5 | 9/29/92 | 200.7 & 6010 |
| TCLP-Mercury/CVAA | <5 | µg/L | 5 | <5 | 9/29/92 | 245.1&7470 |
| TCLP-Selenium/GFAA | <100 | µg/L | 100 | <100 | 9/28/92 | 270.2&7740 |
| TCLP-Silver/AA | <0.1 | mg/L | 0.1 | <0.1 | 9/28/92 | 7760&272.2 |
| Thallium/GFAA | <20 | µg/Kg | 20 | <1 | 9/30/92 | 279.2&7841 |
| Tin/GFAA | <100 | µg/Kg | 100 | <5 | 10/1/92 | 282.2 |
| Vanadium/ICP | 12 | mg/Kg | 1.00 | <0.05 | 9/30/92 | 200.7 & 6010 |
| Zinc/ICP | 120 | mg/Kg | 0.20 | <0.01 | 9/30/92 | 200.7 & 6010 |
| Cyanide | <0.2 | mg/Kg | 0.2 | <0.02 | 9/25/92 | 335.2&9010 |
| Fluoride | 2.3 | mg/Kg | <0.20 | <0.050 | 9/28/92 | 340.2 |
| Sulfide | 30 | mg/Kg | <1 | -NA- | 9/25/92 | 9030 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

## Report of Analysis-Volatile Organics

**Project Desc:** B&E Site Investigation | **Report #:** 32574

**Sample Name:** Total pit composite | **Report Date:** 10/27/92

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| Volatile organics-8260 | see enclosed | | | | 9/29/92 | 624 & 8260 |
| 1,1,1,2-tetrachloroethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,1,1-trichloroethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,1,2,2-tetrachloroethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,1,2-trichloroethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,1-dichloroethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,1-dichloroethene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,2,3-trichloropropane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,2-dibromo-3-chloropropane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,2-dibromoethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,2-dichlorobenzene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,2-dichloroethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,2-dichloropropane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,3-dichlorobenzene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 4-dichloro-2-butene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,4-dichlorobenzene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,4-dioxane | <5000 | µg/Kg | 5000 | <5000 | 9/29/92 | 624 & 8260 |
| 2-butanone (MEK) | <5000 | µg/Kg | 5000 | <5000 | 9/29/92 | 624 & 8260 |
| 2-chloroethyl vinyl ether | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 4-methyl-2-pentanone (MIBK) | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Acetone | <5000 | µg/Kg | 5000 | <5000 | 9/29/92 | 624 & 8260 |
| Acetonitrile | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Acrolein | <5000 | µg/Kg | 5000 | <5000 | 9/29/92 | 624 & 8260 |
| Acrylonitrile | <5000 | µg/Kg | 5000 | <5000 | 9/29/92 | 624 & 8260 |
| Allyl chloride | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Bromodichloromethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Bromoform | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Bromomethane | <500 | µg/Kg | 500 | <500 | 9/29/92 | 624 & 8260 |
| c-1,3-dichloropropene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Carbon disulfide | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Carbon tetrachloride | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Chlorobenzene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Chloroethane | <500 | µg/Kg | 500 | <500 | 9/29/92 | 624 & 8260 |
| Chloroform | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Chloromethane | <500 | µg/Kg | 500 | <500 | 9/29/92 | 624 & 8260 |
| Dibromochloromethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| ibromomethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Ethyl methacrylate | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Isobutanol | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Methacrylonitrile | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Methyl methacrylate | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Methylene chloride | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Propionitrile | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| t-1,2-dichloroethene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| 1,3-dichloropropene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Tetrachloroethene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Trichloroethene | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Trichlorofluoromethane | <250 | µg/Kg | 250 | <250 | 9/29/92 | 624 & 8260 |
| Vinyl chloride | <500 | µg/Kg | 500 | <500 | 9/29/92 | 624 & 8260 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

## Report of Analysis-Extractable Organics

**Project Desc:** B&E Site Investigation — **Report #:** 32574

**Sample Name:** Total pit composite — **Report Date:** 10/27/92

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| Extractable organics-8270 | see enclosed | | | | 10/1/92 | 625 & 8270 |
| 1,2,4,5-Tetrachlorobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 1,2,4-Trichlorobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 1,2-Dinitrobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 1,3,5-Trinitrobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 1,4-Naphthoquinone | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 1,4-Phenylenediamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 1-Naphthylamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2,3,4,6-Tetrachlorophenol | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| 2,4,5-Trichlorophenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2,4,6-Trichlorophenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2,4-Dichlorophenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2,4-Dimethylphenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2,4-Dinitrophenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2,4-Dinitrotoluene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| ,6-Dichlorophenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2,6-Dinitrotoluene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2-Acetylaminofluorene | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| 2-Chloronaphthalene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2-Chlorophenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2-Methylnaphthalene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2-Methylphenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2-Naphthylamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2-Nitroaniline | <200000 | µg/Kg | 200000 | <200000 | 10/1/92 | 625 & 8270 |
| 2-Nitrophenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 2-Picoline | <200000 | µg/Kg | 200000 | <200000 | 10/1/92 | 625 & 8270 |
| 3&4-Methylphenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 3,3'-Dichlorobenzidene | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| 3,3'-Dimethylbenzidine | <400000 | µg/Kg | 400000 | <400000 | 10/1/92 | 625 & 8270 |
| 3-Methylcholanthrene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 3-Nitroaniline | <200000 | µg/Kg | 200000 | <200000 | 10/1/92 | 625 & 8270 |
| 4,6-Dinitro-2-methylphenol | <200000 | µg/Kg | 200000 | <200000 | 10/1/92 | 625 & 8270 |
| 4-Aminobiphenyl | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| 4-Chloro-3-methylphenol | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| 4-Chloroaniline | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| 4-Chlorophenyl phenyl ether | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| -Nitroaniline | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| -Nitrophenol | <200000 | µg/Kg | 200000 | <200000 | 10/1/92 | 625 & 8270 |
| 4-Nitroquinoline 1-oxide | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| 5-Nitro-o-toluidine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 7,12-Dimethylbenz(a)anthracene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |

| | | | | | | |
|---|---|---|---|---|---|---|
| a,a-Dimethylphenethylamine | <400000 | µg/Kg | 400000 | <400000 | 10/1/92 | 625 & 8270 |
| Acenaphthene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Acenaphthylene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| ,cetophenone | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Aniline | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Anthracene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Aramite | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Benzo(a)anthracene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Benzo(a)pyrene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Benzo(b&j&k)fluoranthene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Benzo(ghi)perylene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Benzyl alcohol | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| bis(2-Chloroethoxy)methane | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| bis(2-Chloroethyl)ether | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| bis(2-Chloroisopropyl)ether | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| bis(2-Ethylhexyl)phthalate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Bromophenyl phenyl ether | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Butyl benzyl phthalate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Chlorobenzilate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Chrysene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Di-n-butyl phthalate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Di-n-octylphthalate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Diallate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Dibenz(a,h)anthracene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Dibenzofuran | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| 'iethylphthalate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Dimethoate | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Dimethylphthalate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Dinoseb | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Diphenylamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Disulfoton | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Ethyl methanesulfonate | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Ethyl parathion | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Famphur | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Fluoranthene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Fluorene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Hexachlorobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Hexachlorobutadiene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Hexachlorocyclopentadiene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Hexachloroethane | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Hexachlorophene | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Hexachloropropene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Indeno(1,2,3-cd)pyrene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Isophorone | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Isosafrole | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Kepone | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Methapyrilene | <400000 | µg/Kg | 400000 | <400000 | 10/1/92 | 625 & 8270 |
| Iethyl parathion | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Methylmethanesulfonate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| N-Nitrosodi-n-butylamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| N-Nitrosodi-n-propylamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| N-Nitrosodiethylamine | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |

| | | | | | | |
|---|---|---|---|---|---|---|
| N-Nitrosodimethylamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| N-Nitrosodiphenylamine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| N-Nitrosomethylethylamine | <400000 | µg/Kg | 400000 | <400000 | 10/1/92 | 625 & 8270 |
| N-Nitrosomorpholine | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| N-Nitrosopiperidine | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| N-Nitrosopyrrolidine | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Naphthalene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Nitrobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| O,O,O-Triethylphosphorothioate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| o-Toluidine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| p-Dimethylaminoazobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Pentachlorobenzene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Pentachloroethane | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Pentachloronitrobenzene | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Pentachlorophenol | <200000 | µg/Kg | 200000 | <200000 | 10/1/92 | 625 & 8270 |
| Phenacetin | <80000 | µg/Kg | 80000 | <80000 | 10/1/92 | 625 & 8270 |
| Phenanthrene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Phenol | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Phorate | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Pronamide | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Pyrene | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Pyridine | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Safrole | <40000 | µg/Kg | 40000 | <40000 | 10/1/92 | 625 & 8270 |
| Tetraethyldithiopyrophosphate | <400000 | µg/Kg | 400000 | <400000 | 10/1/92 | 625 & 8270 |
| Thionazine | <400000 | µg/Kg | 400000 | <400000 | 10/1/92 | 625 & 8270 |

Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

AnalySys inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766



**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32575
**Report Date:** 12/10/92

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#1 composite
**Matrix:** soil
**Date/Time Taken:** 9/22/92 10:00:00
**Date/Time Received:** 9/24/92 10:00:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | — | | | | 10/5/92 | 3540 |
| Benzene | 5.1 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | 160 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Ignitability | Non Ignitable | °F | -NA- | -NA- | 9/25/92 | 1010 |
| m,p-Xylenes | 160 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | 61 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 51,000 | mg/Kg | 500 | 0 | 9/25/92 | 418.1 |
| pH | 8.8 | | -NA- | -NA- | 9/25/92 | 9045 |
| Toluene | 0.38 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Arsenic/GFAA | 3,600 | µg/Kg | 20 | <1 | 10/13/92 | 206.2&7060 |
| Barium/ICP | 23 | mg/Kg | 0.20 | <0.01 | 10/13/92 | 200.7 & 6010 |
| Cadmium/ICP | 1.8 | mg/Kg | 0.100 | <0.005 | 10/13/92 | 200.7 & 6010 |
| Chromium/ICP | 140 | mg/Kg | 1.00 | <0.05 | 12/2/92 | 200.7 & 6010 |
| Lead/ICP | 170 | mg/Kg | 1.00 | <0.05 | 10/13/92 | 200.7 & 6010 |
| Mercury/CVAA | 180 | µg/Kg | 5 | <0.2 | 10/19/92 | 245.1&7470 |
| Selenium/GFAA | 58 | µg/Kg | 40 | <2 | 10/28/92 | 270.2&7740 |
| Silver/GFAA | 18 | µg/Kg | 4 | <0.2 | 10/13/92 | 272.2&7761 |
| Reactivity-Cyanide | <0.2 | mg/Kg | 0.2 | <0.02 | 9/25/92 | 335.2&9010 |
| Reactivity-sulfide | 22 | mg/Kg | <1 | -NA- | 9/25/92 | 9030 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32576 |
| | | **Report Date:** | 12/10/92 |

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#2 composite **Matrix:** soil
**Date/Time Taken:** 9/22/92 5:30:00 **Date/Time Received:** 9/24/92 10:00:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | — | | | | 10/5/92 | 3540 |
| Benzene | 3.3 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.2 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Ignitability | Non Ignitable | °F | -NA- | -NA- | 9/25/92 | 1010 |
| m,p-Xylenes | 49 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | 22 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 30,000 | mg/Kg | 500 | 0 | 9/25/92 | 418.1 |
| pH | 8.5 | | -NA- | -NA- | 9/25/92 | 9045 |
| Toluene | 11 | mg/Kg | 0.2 | <0.02 | 10/5/92 | 8020 |
| Arsenic/GFAA | 2,900 | µg/Kg | 20 | <1 | 10/13/92 | 206.2&7060 |
| Barium/ICP | 37 | mg/Kg | 0.20 | <0.01 | 10/13/92 | 200.7 & 6010 |
| Cadmium/ICP | 1.7 | mg/Kg | 0.100 | <0.005 | 10/13/92 | 200.7 & 6010 |
| Chromium/ICP | 53 | mg/Kg | 1.00 | <0.05 | 12/2/92 | 200.7 & 6010 |
| Lead/ICP | 140 | mg/Kg | 1.00 | <0.05 | 10/13/92 | 200.7 & 6010 |
| Mercury/CVAA | 200 | µg/Kg | 5 | <0.2 | 10/19/92 | 245.1&7470 |
| Selenium/GFAA | 120 | µg/Kg | 40 | <2 | 10/28/92 | 270.2&7740 |
| Silver/GFAA | 34 | µg/Kg | 4 | <0.2 | 10/13/92 | 272.2&7761 |
| Reactivity-Cyanide | <0.2 | mg/Kg | 0.2 | <0.02 | 9/25/92 | 335.2&9010 |
| Reactivity-sulfide | 8.1 | mg/Kg | <1 | -NA- | 9/25/92 | 9030 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32577
**Report Date:** 12/10/92

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#3 composite **Matrix:** soil
**Date/Time Taken:** 9/21/92 6:00:00 **Date/Time Received:** 9/24/92 10:00:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | — | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | 0.051 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ignitability | Non Ignitable | °F | -NA- | -NA- | 9/25/92 | 1010 |
| m,p-Xylenes | 0.027 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 690 | mg/Kg | 10 | 5 | 9/25/92 | 418.1 |
| pH | 8.2 | | -NA- | -NA- | 9/25/92 | 9045 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Arsenic/GFAA | 1,500 | µg/Kg | 20 | <1 | 10/13/92 | 206.2&7060 |
| Barium/ICP | 11 | mg/Kg | 0.20 | <0.01 | 10/13/92 | 200.7 & 6010 |
| Cadmium/ICP | 0.40 | mg/Kg | 0.100 | <0.005 | 10/13/92 | 200.7 & 6010 |
| Chromium/ICP | 3.1 | mg/Kg | 1.00 | <0.05 | 12/2/92 | 200.7 & 6010 |
| Lead/ICP | 17 | mg/Kg | 1.00 | <0.05 | 10/13/92 | 200.7 & 6010 |
| Mercury/CVAA | <5 | µg/Kg | 5 | <0.2 | 10/19/92 | 245.1&7470 |
| Selenium/GFAA | 120 | µg/Kg | 40 | <2 | 10/28/92 | 270.2&7740 |
| Silver/GFAA | <4 | µg/Kg | 4 | <0.2 | 10/13/92 | 272.2&7761 |
| Reactivity-Cyanide | <0.2 | mg/Kg | 0.2 | <0.02 | 9/25/92 | 335.2&9010 |
| Reactivity-sulfide | 3.6 | mg/Kg | <1 | -NA- | 9/25/92 | 9030 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32575

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#1 composite **Matrix:** soil
**Date/Time Taken:** 9/22/92 10:00:00 **Date/Time Received:** 9/24/92 10:00:00

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| Ignitability | 0 | -NA- |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 18.9 | -NA- |
| pH | 0.1 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 0 | 109 |
| Barium/ICP | 0.3 | 98 |
| Cadmium/ICP | 0.5 | 96 |
| Chromium/ICP | 0 | -NA- |
| Lead/ICP | 0.3 | 96 |
| Mercury/CVAA | 4.1 | 100 |
| Selenium/GFAA | 3.2 | 94 |
| Silver/GFAA | 9.5 | 105 |
| Reactivity-Cyanide | 3.2 | 116 |
| Reactivity-sulfide | 8.7 | -NA- |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman | **Report #:** | 32576 |
| | 512-477-8661 | | |

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#2 composite **Matrix:** soil
**Date/Time Taken:** 9/22/92 5:30:00 **Date/Time Received:** 9/24/92 10:00:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| Ignitability | 0 | -NA- |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 18.9 | -NA- |
| pH | 0.1 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 0 | 109 |
| Barium/ICP | 0.3 | 98 |
| Cadmium/ICP | 0.5 | 96 |
| Chromium/ICP | 0 | -NA- |
| Lead/ICP | 0.3 | 96 |
| Mercury/CVAA | 4.1 | 100 |
| Selenium/GFAA | 3.2 | 94 |
| Silver/GFAA | 9.5 | 105 |
| Reactivity-Cyanide | 3.2 | 116 |
| Reactivity-sulfide | 8.7 | -NA- |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32577

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#3 composite **Matrix:** soil
**Date/Time Taken:** 9/21/92 6:00:00 **Date/Time Received:** 9/24/92 10:00:00

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 18.9 | -NA- |
| pH | 0.1 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 0 | 109 |
| Barium/ICP | 0.3 | 98 |
| Cadmium/ICP | 0.5 | 96 |
| Chromium/ICP | 0 | -NA- |
| Lead/ICP | 0.3 | 96 |
| Mercury/CVAA | 4.1 | 100 |
| Selenium/GFAA | 3.2 | 94 |
| Silver/GFAA | 9.5 | 105 |
| Reactivity-Cyanide | 3.2 | 116 |
| Reactivity-sulfide | 8.7 | -NA- |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

AnalySys Inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 □ (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32578
**Report Date:** 10/27/92

**Project Description:** B&E Site Investigation
**Sample Name:** Pit #1 2.3-2.7'
**Matrix:** soil
**Date/Time Taken:** 9/22/92 12:00:00
**Date/Time Received:** 9/24/92 10:00:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | --- | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | 0.031 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 35 | mg/Kg | 10 | <2 | 10/27/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32579 |
| | | **Report Date:** | 11/19/92 |

**Project Description:** B&E Site Investigation

**Sample Name:** Pit #2 3.7-4.2' **Matrix:** soil

**Date/Time Taken:** 9/22/92 3:30:00 **Date/Time Received:** 9/24/92 10:00:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | — | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | 0.021 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | 0.033 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 10 | mg/Kg | 10 | <2 | 10/27/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32580
**Report Date:** 10/27/92

**Project Description:** B&E Site Investigation
**Sample Name:** Pit #3 1.5-1.7'
**Matrix:** soil
**Date/Time Taken:** 9/22/92 8:45:00
**Date/Time Received:** 9/24/92 10:00:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | --- | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | <10 | mg/Kg | 10 | <2 | 10/27/92 | 418.1 |
| Toluene | 0.021 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys inc.

2 5 1992

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32759
**Report Date:** 11/23/92

**Project Description:** B&E Sit Investigation
**Sample Name:** BG-1 Background at Laguna Tres. **Matrix:** soil
**Date/Time Taken:** 9/23/92 10:30:00 **Date/Time Received:** 9/29/92 9:55:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | --- | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 30 | mg/Kg | 10 | 8 | 9/30/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Arsenic/GFAA | 2,400 | µg/Kg | 20 | <1 | 11/20/92 | 206.2&7060 |
| Barium/ICP | 8.0 | mg/Kg | 0.20 | <0.01 | 11/20/92 | 200.7 & 6010 |
| Cadmium/ICP | 0.85 | mg/Kg | 0.20 | <0.01 | 11/20/92 | 200.7 & 6010 |
| Calcium/ICP | 56,000 | mg/Kg | 100.00 | <0.05 | 10/9/92 | 200.7 & 6010 |
| Chromium/ICP | 2.0 | mg/Kg | 1.00 | <0.05 | 11/20/92 | 200.7 & 6010 |
| Iron/ICP | 620 | mg/Kg | 10.00 | <0.05 | 10/13/92 | 200.7 & 6010 |
| Lead/ICP | 21 | mg/Kg | 1.00 | <0.05 | 11/20/92 | 200.7 & 6010 |
| Magnesium/ICP | 2,400 | mg/Kg | 100.00 | <0.05 | 10/9/92 | 200.7 & 6010 |
| Mercury/CVAA | <5 | µg/Kg | 5 | <0.2 | 11/20/92 | 245.1&7470 |
| Selenium/GFAA | 390 | µg/Kg | 40 | <2 | 11/19/92 | 270.2&7740 |
| Silver/GFAA | 510 | µg/Kg | 4 | <0.2 | 11/19/92 | 272.2&7761 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

# QUALITY ASSURANCE

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32759

**Project Description:** B&E Sit Investigation
**Sample Name:** BG-1 Background at Laguna Tres. **Matrix:** soil
**Date/Time Taken:** 9/23/92 10:30:00 **Date/Time Received:** 9/29/92 9:55:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 0 | 63 |
| Ethylbenzene | 2.3 | 80 |
| m,p-Xylenes | 2.3 | 84 |
| o-Xylene | 2.5 | 88 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 1.5 | 81 |
| Arsenic/GFAA | 10.3 | 102 |
| Barium/ICP | 1.5 | 109 |
| Cadmium/ICP | 1 | 101 |
| Calcium/ICP | 0.4 | 99 |
| Chromium/ICP | 2.1 | 110 |
| Iron/ICP | 0.3 | 104 |
| Lead/ICP | 0.6 | 104 |
| Mercury/CVAA | 0 | 112 |
| Selenium/GFAA | 4.5 | 90 |
| Silver/GFAA | 11 | 116 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

AnalySys inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32582
**Report Date:** 11/13/92

**Project Description:** B&E Site Investigation
**Sample Name:** BG-2 0-1'
**Matrix:** soil
**Date/Time Taken:** 9/21/92 5:15:00
**Date/Time Received:** 9/24/92 10:00:00

**Report of Analysis**

see attached

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated.
"Less than" values reflect the nominal detection limit of the method employed.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32582
**Report Date:** 11/19/92

**Project Description:** B&E Site Investigation
**Sample Name:** BG-2 0-1'
**Matrix:** soil
**Date/Time Taken:** 9/21/92 5:15:00 **Date/Time Received:** 9/24/92 10:00:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | — | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 13 | mg/Kg | 10 | 5 | 9/25/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Arsenic/GFAA | 610 | µg/Kg | 20 | <1 | 10/28/92 | 206.2&7060 |
| Barium/ICP | 9.5 | mg/Kg | 0.20 | <0.01 | 11/2/92 | 200.7 & 6010 |
| Cadmium/ICP | 0.32 | mg/Kg | 0.100 | <0.005 | 11/9/92 | 200.7 & 6010 |
| Calcium/ICP | 110,000 | mg/Kg | 100.00 | <0.05 | 10/9/92 | 200.7 & 6010 |
| Chromium/ICP | <1 | mg/Kg | 1.00 | <0.05 | 11/2/92 | 200.7 & 6010 |
| Iron/ICP | 190 | mg/Kg | 10.00 | <0.05 | 10/13/92 | 200.7 & 6010 |
| Lead/ICP | 6.9 | mg/Kg | 1.00 | <0.05 | 11/2/92 | 200.7 & 6010 |
| Magnesium/ICP | <100 | mg/Kg | 100.00 | <0.05 | 10/9/92 | 200.7 & 6010 |
| Mercury/CVAA | <5 | µg/Kg | 5 | <0.2 | 11/4/92 | 245.1&7470 |
| Selenium/GFAA | <40 | µg/Kg | 40 | <2 | 10/28/92 | 270.2&7740 |
| Silver/GFAA | 10 | µg/Kg | 4 | <0.2 | 10/29/92 | 272.2&7761 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys Inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32753 |
| | | **Report Date:** | 10/27/92 |

**Project Description:** B&E Sit Investigation
**Sample Name:** T-1 Horiz. trench #1 0.5-1' **Matrix:** soil
**Date/Time Taken:** 9/23/92 10:00:00 **Date/Time Received:** 9/29/92 9:55:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | --- | | | | 10/5/92 | 3540 |
| Benzene | 0.083 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | 0.052 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | 0.041 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 41 | mg/Kg | 10 | 8 | 9/30/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32754
**Report Date:** 10/27/92

**Project Description:** B&E Sit Investigation
**Sample Name:** T-2 Horiz. trench #2 2.5-3'
**Matrix:** soil
**Date/Time Taken:** 9/23/92 11:10:00
**Date/Time Received:** 9/29/92 9:55:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | --- | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 38 | mg/Kg | 10 | 8 | 9/30/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys inc.

4221 Friedrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32755
**Report Date:** 10/27/92

**Project Description:** B&E Sit Investigation
**Sample Name:** T-3 Horiz. trench #3 3-3.5'
**Matrix:** soil
**Date/Time Taken:** 9/23/92 11:30:00
**Date/Time Received:** 9/29/92 9:55:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | — | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 49 | mg/Kg | 10 | 8 | 9/30/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys Inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:**<br>**Report Date:** | 32756<br>10/27/92 |

**Project Description:** B&E Sit Investigation
**Sample Name:** T-4 Horiz. trench #4 10-11' **Matrix:** soil
**Date/Time Taken:** 9/23/92 12:15:00 **Date/Time Received:** 9/29/92 9:55:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | --- | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 53 | mg/Kg | 10 | 8 | 9/30/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys inc.
4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32757
**Report Date:** 10/27/92

**Project Description:** B&E Sit Investigation
**Sample Name:** T-5 Horiz. trench #5 6.5-7'
**Matrix:** soil
**Date/Time Taken:** 9/23/92 16:15:00
**Date/Time Received:** 9/29/92 9:55:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| Petroleum hydrocarbons | 53 | mg/Kg | 10 | 8 | 9/30/92 | 418.1 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

AnalySys inc.

4221 Freidrich Lane, Suite 190, Austin, Texas 78744-1044 ☐ (512) 444-5896 FAX: (512) 447-4766

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32758
**Report Date:** 10/27/92

**Project Description:** B&E Sit Investigation
**Sample Name:** T-6 Horiz. trench #6 9.2-9.7'
**Matrix:** soil
**Date/Time Taken:** 9/23/92 17:00:00
**Date/Time Received:** 9/29/92 9:55:00

## Report of Analysis

| Parameter | Result | Units | MDL/PQL(1) | Blank | Date Analyzed | Test Method |
|---|---|---|---|---|---|---|
| A/BN extraction-8270 | --- | | | | 10/5/92 | 3540 |
| Benzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Ethylbenzene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| m,p-Xylenes | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| o-Xylene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |
| Petroleum hydrocarbons | 45 | mg/Kg | 10 | 8 | 9/30/92 | 418.1 |
| Toluene | <0.02 | mg/Kg | 0.02 | <0.02 | 10/5/92 | 8020 |

1. Method Detection Limit (MDL), principally for inorganics, or Practical Quantitation Limit (PQL), principally for organics by GC or GC/MS.

Respectfully submitted,

Hopkins Haden

Hopkins Haden

All method numbers denote USEPA procedures unless otherwise stated. "< or Less than" values reflect the nominal detection or quantitation limit (MDL/PQL) of the method employed.

# QUALITY ASSURANCE

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32574

**Project Description:** B&E Site Investigation
**Sample Name:** Total pit composite **Matrix:** soil
**Date/Time Taken:** 9/22/92 6:00:00 **Date/Time Received:** 9/24/92 10:00:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Toluene | 3.1 | 95 |
| Aluminum/ICP | 0.7 | 101 |
| Antimony/GFAA | 2 | 99 |
| Arsenic/GFAA | 0 | 115 |
| Barium/ICP | 0.3 | 100 |
| Beryllium/ICP | 0.9 | 93 |
| Cadmium/ICP | 0.1 | 98 |
| Calcium/ICP | 0 | 99 |
| Chromium/ICP | 0.3 | 98 |
| Cobalt/ICP | 1.1 | 93 |
| Copper/ICP | 1.3 | 97 |
| Iron/ICP | 0.5 | 102 |
| Lead/ICP | 0.1 | 98 |
| Magnesium/ICP | 0.5 | 100 |
| Manganese/ICP | 0.7 | 97 |
| Mercury/CVAA | 5.1 | 80 |
| Nickel/ICP | 0.9 | 94 |
| Potassium/AA | 9.5 | 100 |
| Selenium/GFAA | 2.9 | 70 |
| Silver/GFAA | 4.2 | 95 |
| Sodium/ICP | 0.3 | 100 |
| TCLP-Arsenic/ICP | 0 | 98 |
| TCLP-Barium/ICP | 0.1 | 99 |
| TCLP-Cadmium/ICP | 0.4 | 96 |
| TCLP-Chromium/ICP | 0.5 | 95 |
| TCLP-Lead/ICP | 0.6 | 92 |
| TCLP-Mercury/CVAA | 0 | 104 |
| TCLP-Selenium/GFAA | 2.3 | 88 |
| TCLP-Silver/AA | 2.2 | 94 |
| Thallium/GFAA | 6.7 | 46 |
| Tin/GFAA | 3.1 | 49 |

| | | |
|---|---|---|
| Vanadium/ICP | 0.7 | 93 |
| Zinc/ICP | 0 | 99 |
| Cyanide | 3.2 | 116 |
| Sulfide | 8.7 | -NA- |

**Volatile Surrogates:**

| Surrogate | Surrogate Recovery |
|---|---|
| 1,2-dichloroethane-d4 | 109 |
| Toluene-d8 | 92 |
| Bromofluorobenzene | 109 |

**Extractable Surrogates:**

| Surrogate | Surrogate Recovery |
|---|---|
| Fluorophenol | diluted |
| Phenol-d6 | diluted |
| Nitrobenzene-d5 | diluted |
| Fluorobiphenyl | diluted |
| Tribromophenol | diluted |
| Terphenyl-d14 | diluted |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32575

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#1 composite **Matrix:** soil
**Date/Time Taken:** 9/22/92 10:00:00 **Date/Time Received:** 9/24/92 10:00:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| Ignitability | 0 | -NA- |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 18.9 | -NA- |
| pH | 0.1 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 0 | 109 |
| Barium/ICP | 0.3 | 98 |
| Cadmium/ICP | 0.5 | 96 |
| Lead/ICP | 0.3 | 96 |
| Mercury/CVAA | 4.1 | 100 |
| Selenium/GFAA | 3.2 | 94 |
| Silver/GFAA | 9.5 | 105 |
| Reactivity-Cyanide | 3.2 | 116 |
| Reactivity-sulfide | 8.7 | -NA- |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32576 |

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#2 composite **Matrix:** soil
**Date/Time Taken:** 9/22/92 5:30:00 **Date/Time Received:** 9/24/92 10:00:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| Ignitability | 0 | -NA- |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 18.9 | -NA- |
| pH | 0.1 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 0 | 109 |
| Barium/ICP | 0.3 | 98 |
| Cadmium/ICP | 0.5 | 96 |
| Lead/ICP | 0.3 | 96 |
| Mercury/CVAA | 4.1 | 100 |
| Selenium/GFAA | 3.2 | 94 |
| Silver/GFAA | 9.5 | 105 |
| Reactivity-Cyanide | 3.2 | 116 |
| Reactivity-sulfide | 8.7 | -NA- |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32577

**Project Description:** B&E Site Investigation
**Sample Name:** Pit#3 composite **Matrix:** soil
**Date/Time Taken:** 9/21/92 6:00:00 **Date/Time Received:** 9/24/92 10:00:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 18.9 | -NA- |
| pH | 0.1 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 0 | 109 |
| Barium/ICP | 0.3 | 98 |
| Cadmium/ICP | 0.5 | 96 |
| Lead/ICP | 0.3 | 96 |
| Mercury/CVAA | 4.1 | 100 |
| Selenium/GFAA | 3.2 | 94 |
| Silver/GFAA | 9.5 | 105 |
| Reactivity-Cyanide | 3.2 | 116 |
| Reactivity-sulfide | 8.7 | -NA- |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32578

**Project Description:** B&E Site Investigation
**Sample Name:** Pit #1 2.3-2.7' **Matrix:** soil
**Date/Time Taken:** 9/22/92 12:00:00 **Date/Time Received:** 9/24/92 10:00:00

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 3.1 | 95 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32579

**Project Description:** B&E Site Investigation
**Sample Name:** Pit #2 3.7-4.2' **Matrix:** soil
**Date/Time Taken:** 9/22/92 3:30:00 **Date/Time Received:** 9/24/92 10:00:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 0 | 105 |
| Barium/ICP | 4.1 | 95 |
| Cadmium/ICP | 0.1 | 106 |
| Chromium/ICP | 1.4 | 106 |
| Lead/ICP | 1.8 | 100 |
| Mercury/CVAA | 3.1 | 99 |
| Selenium/GFAA | 1.8 | 86 |
| Silver/GFAA | 5.6 | 100 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32580 |

**Project Description:** B&E Site Investigation
**Sample Name:** Pit #3 1.5-1.7' **Matrix:** soil
**Date/Time Taken:** 9/22/92 8:45:00 **Date/Time Received:** 9/24/92 10:00:00

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 3.1 | 95 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc. | **Report #:** | 32582 |
| | 1301 West 25th Street, Suite 406 | | |
| | Austin TX 78705 | | |
| | Attn: Fred Closman 512-477-8661 | | |

**Project Description:** B&E Site Investigation
**Sample Name:** BG-2 0-1' **Matrix:** soil
**Date/Time Taken:** 9/21/92 5:15:00 **Date/Time Received:** 9/24/92 10:00:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 1.3 | 73 |
| Ethylbenzene | 5.2 | 121 |
| m,p-Xylenes | 4.6 | 121 |
| o-Xylene | 7.2 | 117 |
| Petroleum hydrocarbons | 18.9 | -NA- |
| Toluene | 3.1 | 95 |
| Arsenic/GFAA | 1 | 99 |
| Barium/ICP | 4.1 | 95 |
| Cadmium/ICP | 0.1 | 106 |
| Calcium/ICP | 0.4 | 99 |
| Chromium/ICP | 1.4 | 106 |
| Iron/ICP | 0.3 | 104 |
| Lead/ICP | 1.8 | 100 |
| Manganese/ICP | 0.2 | 99 |
| Mercury/CVAA | 3.1 | 99 |
| Selenium/GFAA | 3.2 | 94 |
| Silver/GFAA | 0 | 116 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

Client: Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

Report #: 32753

Project Description: B&E Sit Investigation
Sample Name: T-1 Horiz. trench #1 0.5-1'
Matrix: soil
Date/Time Taken: 9/23/92 10:00:00
Date/Time Received: 9/29/92 9:55:00

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 0 | 63 |
| Ethylbenzene | 2.3 | 80 |
| m,p-Xylenes | 2.3 | 84 |
| o-Xylene | 2.5 | 88 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 1.5 | 81 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32754

**Project Description:** B&E Sit Investigation
**Sample Name:** T-2 Horiz. trench #2 2.5-3' **Matrix:** soil
**Date/Time Taken:** 9/23/92 11:10:00 **Date/Time Received:** 9/29/92 9:55:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 0 | 63 |
| Ethylbenzene | 2.3 | 80 |
| m,p-Xylenes | 2.3 | 84 |
| o-Xylene | 2.5 | 88 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 1.5 | 81 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32755 |

**Project Description:** B&E Sit Investigation
**Sample Name:** T-3 Horiz. trench #3 3-3.5' **Matrix:** soil
**Date/Time Taken:** 9/23/92 11:30:00 **Date/Time Received:** 9/29/92 9:55:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 0 | 63 |
| Ethylbenzene | 2.3 | 80 |
| m,p-Xylenes | 2.3 | 84 |
| o-Xylene | 2.5 | 88 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 1.5 | 81 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

**Client:** Remediation Technologies, Inc.
1301 West 25th Street, Suite 406
Austin TX 78705
Attn: Fred Closman 512-477-8661

**Report #:** 32756

**Project Description:** B&E Sit Investigation
**Sample Name:** T-4 Horiz. trench #4 10-11' **Matrix:** soil
**Date/Time Taken:** 9/23/92 12:15:00 **Date/Time Received:** 9/29/92 9:55:00

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 0 | 63 |
| Ethylbenzene | 2.3 | 80 |
| m,p-Xylenes | 2.3 | 84 |
| o-Xylene | 2.5 | 88 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 1.5 | 81 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32757 |

**Project Description:** B&E Sit Investigation
**Sample Name:** T-5 Horiz. trench #5 6.5-7' **Matrix:** soil
**Date/Time Taken:** 9/23/92 16:15:00 **Date/Time Received:** 9/29/92 9:55:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Petroleum hydrocarbons | 0 | -NA- |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32758 |

**Project Description:** B&E Sit Investigation
**Sample Name:** T-6 Horiz. trench #6 9.2-9.7' **Matrix:** soil
**Date/Time Taken:** 9/23/92 17:00:00 **Date/Time Received:** 9/29/92 9:55:00

---

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 0 | 63 |
| Ethylbenzene | 2.3 | 80 |
| m,p-Xylenes | 2.3 | 84 |
| o-Xylene | 2.5 | 88 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 1.5 | 81 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

| | | | |
|---|---|---|---|
| **Client:** | Remediation Technologies, Inc.<br>1301 West 25th Street, Suite 406<br>Austin TX 78705<br>Attn: Fred Closman 512-477-8661 | **Report #:** | 32759 |

**Project Description:** B&E Sit Investigation
**Sample Name:** BG-1 Background at Laguna Tres. **Matrix:** soil
**Date/Time Taken:** 9/23/92 10:30:00 **Date/Time Received:** 9/29/92 9:55:00

## Q.A. Data Report [1]

| Parameter | Precision [2] | Recovery [3] |
|---|---|---|
| Benzene | 0 | 63 |
| Ethylbenzene | 2.3 | 80 |
| m,p-Xylenes | 2.3 | 84 |
| o-Xylene | 2.5 | 88 |
| Petroleum hydrocarbons | 0 | -NA- |
| Toluene | 1.5 | 81 |
| Calcium/ICP | 0.4 | 99 |
| Iron/ICP | 0.3 | 104 |
| Manganese/ICP | 0.2 | 99 |

1. QA data reported is for the lot analyzed which included this sample.
2. Precision is the absolute value of the percent difference between duplicate measurements.
3. Recovery is the percent of analyte recovered from spiked samples.

Nº A 658

# CHAIN OF CUSTODY RECORD

PROJ. NO. 3-1017-200

PROJECT NAME: B + E Site Investigation

SAMPLERS: (Signature) [signatures]

| SAMPLE NO. | DATE 1992 | TIME | SAMPLE LOCATION | NO. OF CONTAINERS | 16oz soil jar | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Analyze for: |
| 32574 | 9/22 | 1800 | Total Pit Composite | 1 | 1 | | | | | Appendix IX excluding dioxins; herbicides + pesticides; and TCLP (metals). *Rush turnaround. (FAX results ASAP) |
| 32575 | 9/22 | 1000 | Pit #1 Composite ✓ | 1 | 1 | | | | | (1), (2), RCI, TPH |
| 32576 | 9/22 | 1730 | Pit #2 Composite ✓ | 1 | 1 | | | | | (1), (2), RCI, TPH |
| 32577 | 9/21 | 1800 | Pit #3 Composite | 1 | 1 | | | | | (1), (2), RCI, TPH |
| 32578 | 9/22 | 1200 | Pit #1 2.3'-2.7' | 1 | 1 | | | | | (1), (2) |
| 32579 | 9/22 | 1530 | Pit #2 3.7'-4.2' ✓ | 1 | 1 | | | | | (1), (2) |
| 32580 | 9/22 | 0845 | Pit #3 1.5'-1.7' | 1 | 1 | | | | | (1), (2) |
| ~~[illegible]~~ | ~~9/21~~ | ~~1645~~ | ~~BG [illegible]~~ | ~~1~~ | ~~1~~ | | | | | ~~(1), (2), TPH~~ Replaced |
| 32582 | 9/21 | 1715 | BG-2 0-1.0 ✓ | 1 | 1 | | | | | (1), (2), TPH |

| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
|---|---|---|---|---|---|
| [signature] | 9/23/92 2:00 PM | Analysys 9/24/92 10:00 AM Heather Foley | | | |
| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
| | | | | | |
| Relinquished by: (Signature) | Date / Time | Received for Laboratory by: (Signature) | Date / Time | | |
| | | | | | |

REMARKS: (1) metals: arsenic, barium, cadmium, chromium, lead, mercury, silver.
volatiles: benzene, ethylbenzene, toluene, ~~total~~ xylenes.
semi-volatiles: naphthalene, phenols, benzo(a) pyrene.
(2) additional Appendix IX subset based upon Total Pit Composite results.


RETEC
REMEDIATION TECHNOLOGIES INC

REMEDIATION TECHNOLOGIES
1301 West 25th Street, Suite 406
Austin, Texas 78705
(512) 477-8661

No A 059

# CHAIN OF CUSTODY RECORD

PROJ. NO.: 3-1017-200

PROJECT NAME: B+E Site Investigation

SAMPLERS: (Signature) Fred Chan

| SAMPLE NO. | DATE | TIME | SAMPLE LOCATION | NO. OF CONTAINERS | 1 16 oz jar | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T-1 | 9/23 | 10:00 | Horizontal Trench #1 (0.5-1.0 ft) | 1 | 1 | | | | | | (1), (2), TPH 32753 |
| T-2 | 9/23 | 11:10 | Horizontal Trench #2 (2.5-3.0 ft) | 1 | 1 | | | | | | (1), (2), TPH 32754 |
| T-3 | 9/23 | 11:30 | Horizontal Trench #3 (3.0-3.5 ft) | 1 | 1 | | | | | | (1), (2), TPH 32755 |
| T-4 | 9/23 | 12:15 | Horizontal Trench #4 (10-11 ft) | 1 | 1 | | | | | | (1), (2), TPH 32756 |
| T-5 | 9/23 | 16:15 | Horizontal Trench #5 (6.5-7.0 ft) | 1 | 1 | | | | | | (1), (2), TPH 32757 |
| T-6 | 9/23 | 17:00 | Horizontal Trench #6 (9.2-9.7 ft) | 1 | 1 | | | | | | (1), (2), TPH 32758 |
| | | | | | | | | | | | |
| BG-1 | 9/24 | 10:30 | Background at Loyang Tree | 1 | 1 | | | | | | (1)(2), TPH 32759 |

| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
|---|---|---|---|---|---|
| Fred Chan | 9/23/92 10:30 | | | | |
| Relinquished by: (Signature) | 9/25/92 7:55 | Received by: (Signature) K. Stanford Analysis | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
| Relinquished by: (Signature) | Date / Time | Received for Laboratory by: (Signature) | Date / Time | | |

REMARKS: (1) metals: arsenic, barium, cadmium, chromium, lead, mercury, silver
volatiles: benzene, ethylbenzene, toluene, xylene
semivolatiles: naphthalene, phenols, benzo(a)pyrene
(2) Additional Appendix IX constituents based upon Total Pit Composite Results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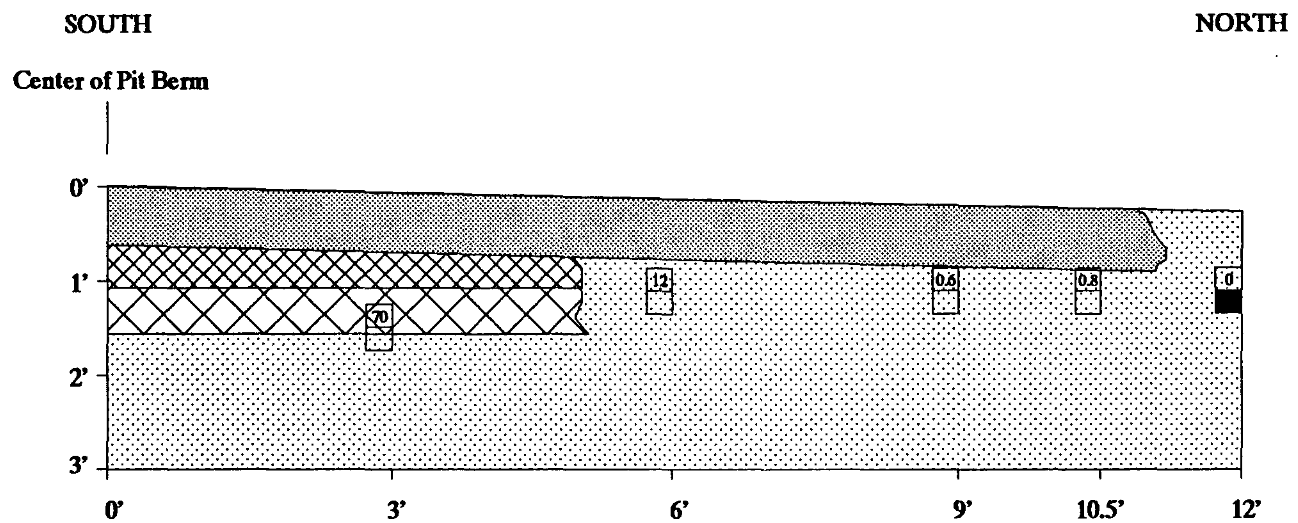
APPENDIX G

# APPENDIX G
# HORIZONTAL TRENCH LOGS

# HORIZONTAL TRENCH T-1




Sand; coarse-grained; 30% iron-stained metallic flakes.

Source material; black (10YR2/0); slightly moist; firm; hydrocarbon odor.

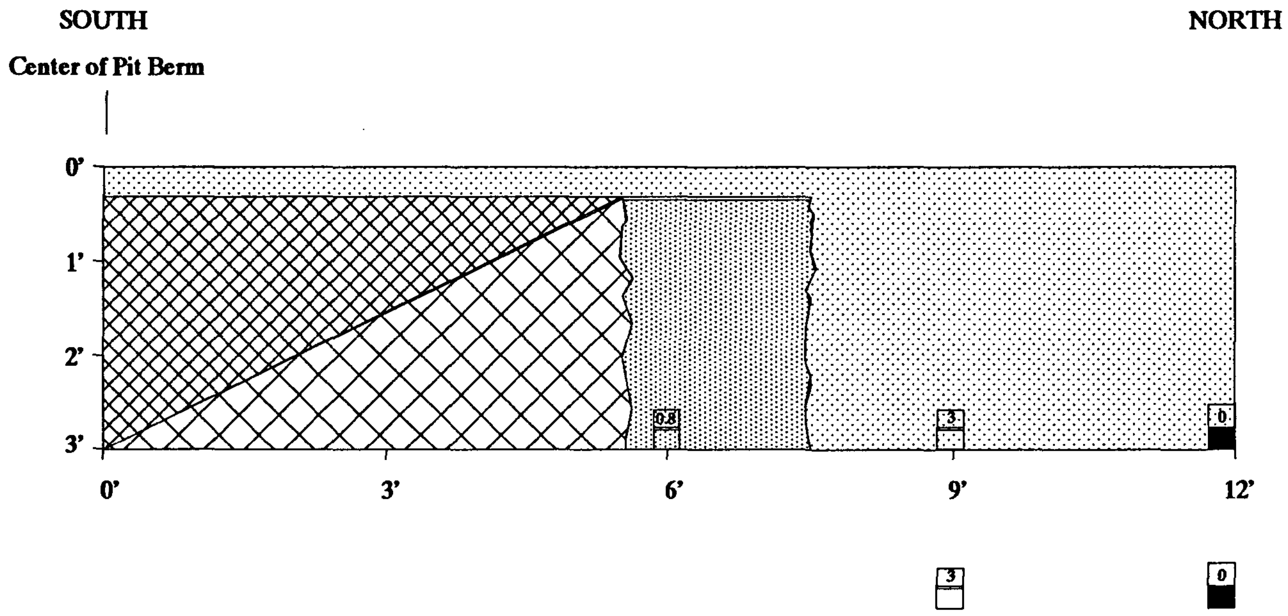
Sand; very fine-grained; stained dark gray (5Y4/1) with black mottling; slightly moist; firm; slight hydrocarbon odor.

Sand; very fine-grained; light gray (2.5Y4/0); slightly moist; firm

0.6 Field Headspace Sample (field headspace reading expressed in ppm)

0 Analytical Sample (field headspace reading expressed in ppm)

# HORIZONTAL TRENCH T-2




Sand; very fine-grained; light gray (2.5Y4/0); slightly moist; firm

Sand; very fine-grained; stained olive (5Y5/3); moist; firm; strong hydrocarbon odor.

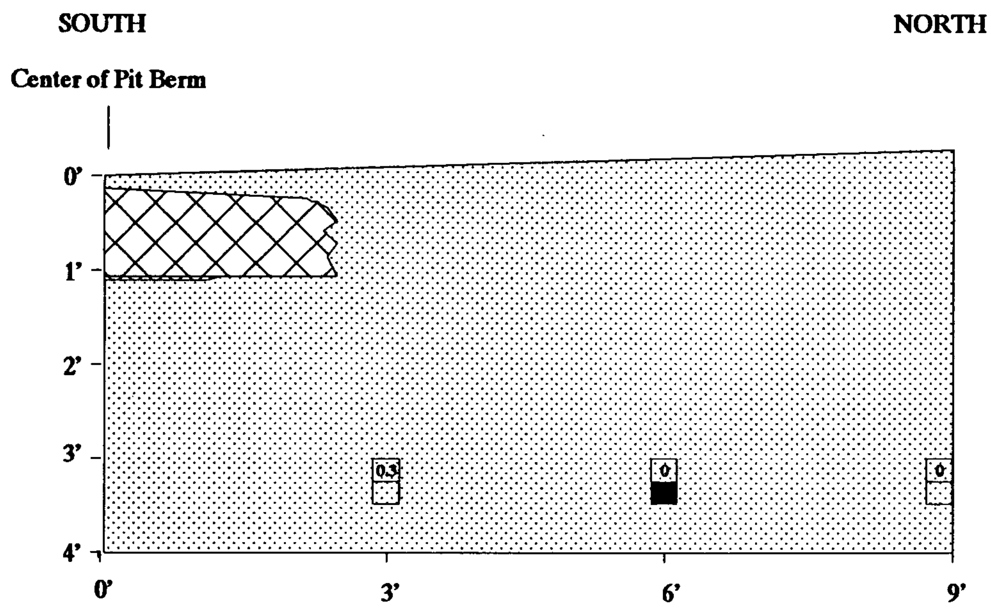
Source material; black (10YR2/0); slightly moist; firm; hydrocarbon odor.

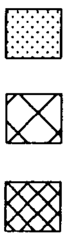
Sand; very fine-grained; heavily stained dark gray (5Y4/1) with black mottling; slightly moist; firm; strong hydrocarbon odor.

0.6 Field Headspace Sample (field headspace reading expressed in ppm)

0 Analytical Sample (field headspace reading expressed in ppm)

# HORIZONTAL TRENCH T-3



Sand; very fine-grained; light gray (2.5Y7/2); slightly moist; firm

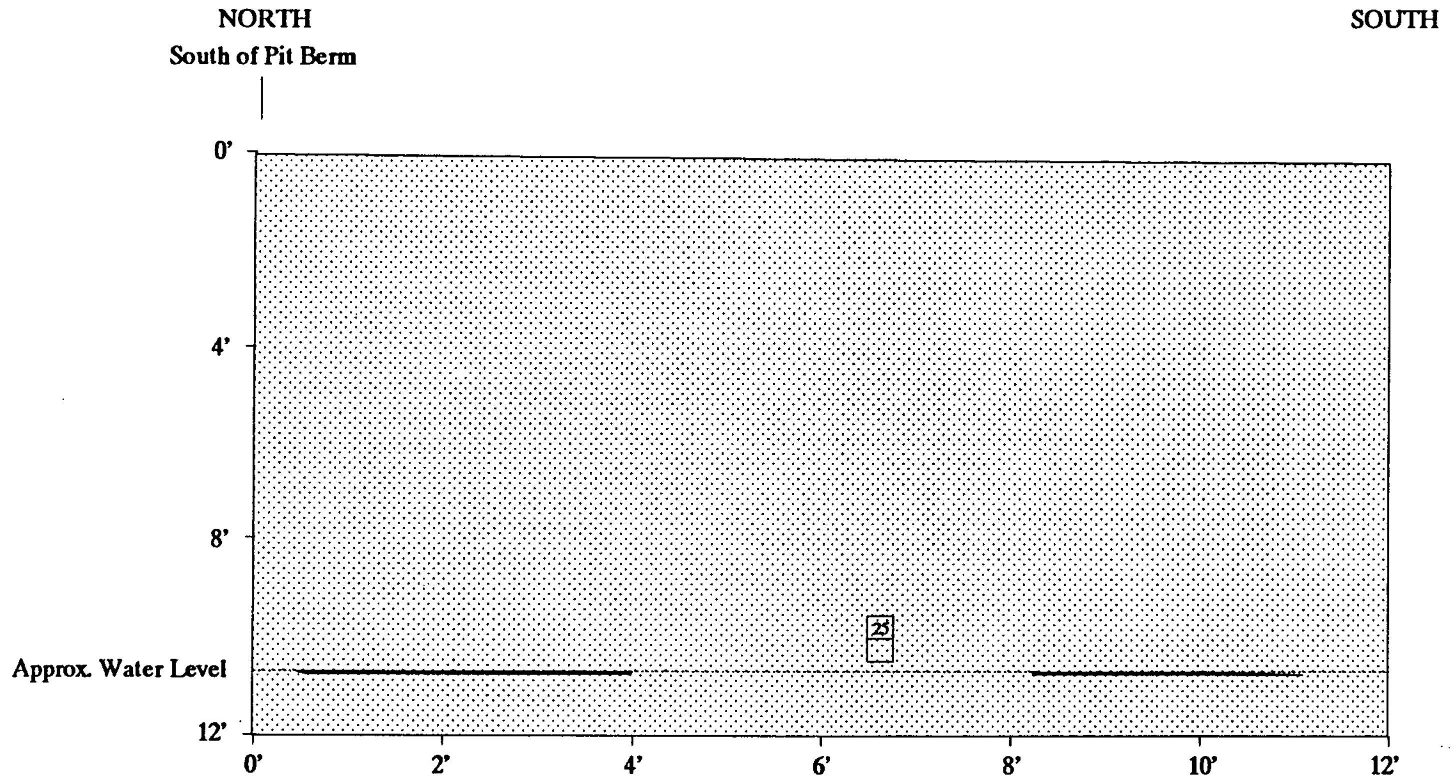
Sand; very fine-grained; stained light yellowish brown (2.5Y6/4); slightly moist; firm; slight hydrocarbon odor.

Source material; black (10YR2/0); slightly moist; firm; hydrocarbon odor.

0.6 Field Headspace Sample (field headspace reading expressed in ppm)

0 Analytical Sample (field headspace reading expressed in ppm)

# HORIZONTAL TRENCH T-4

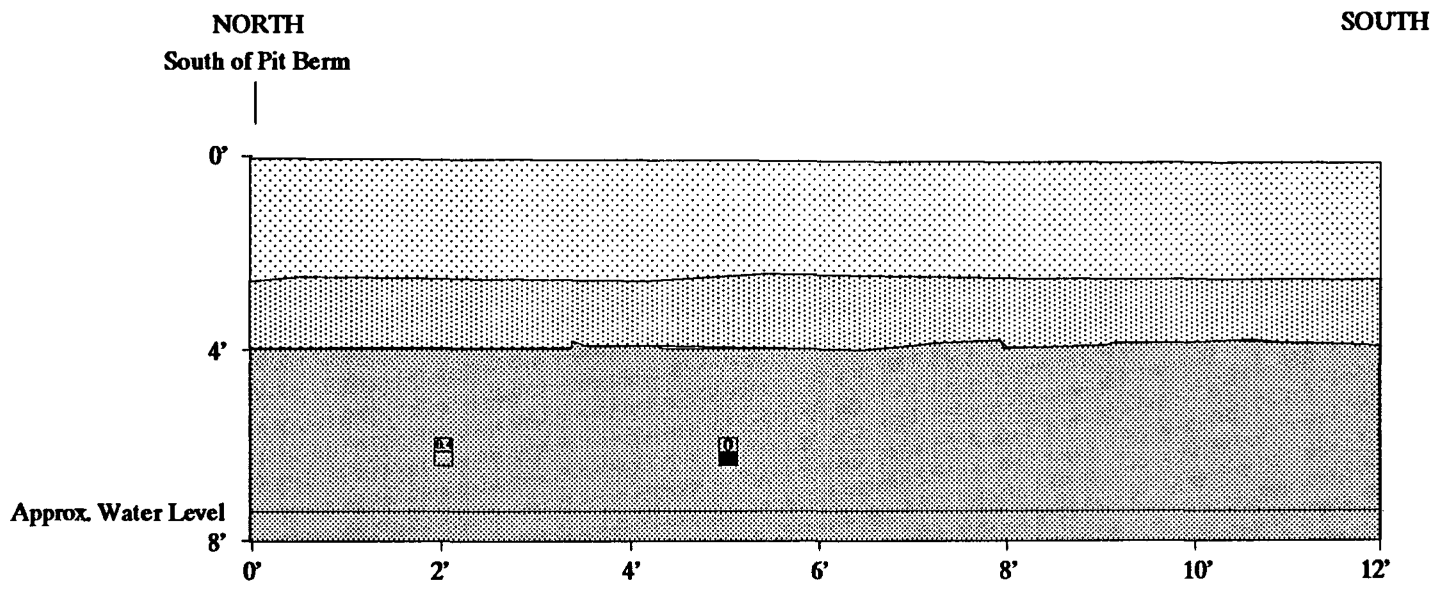


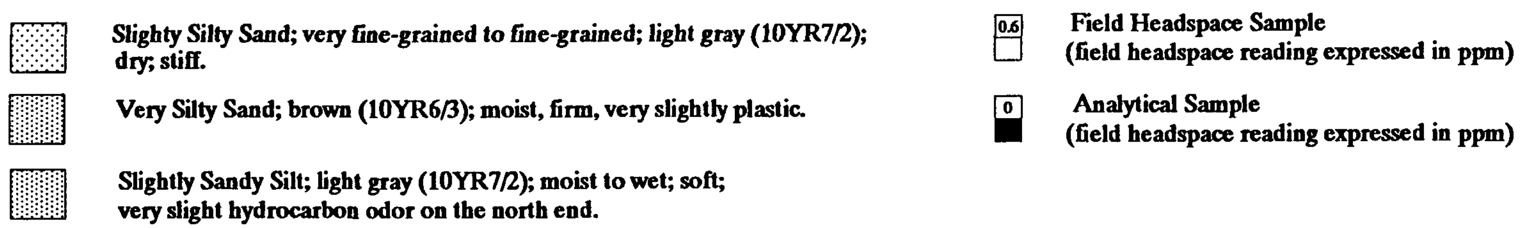

Sand; very fine-grained; light gray (2.5Y7/2); slightly moist; firm; hydrocarbon odor in lower portion of trench.

Light Nonaqueous Phase Liquid

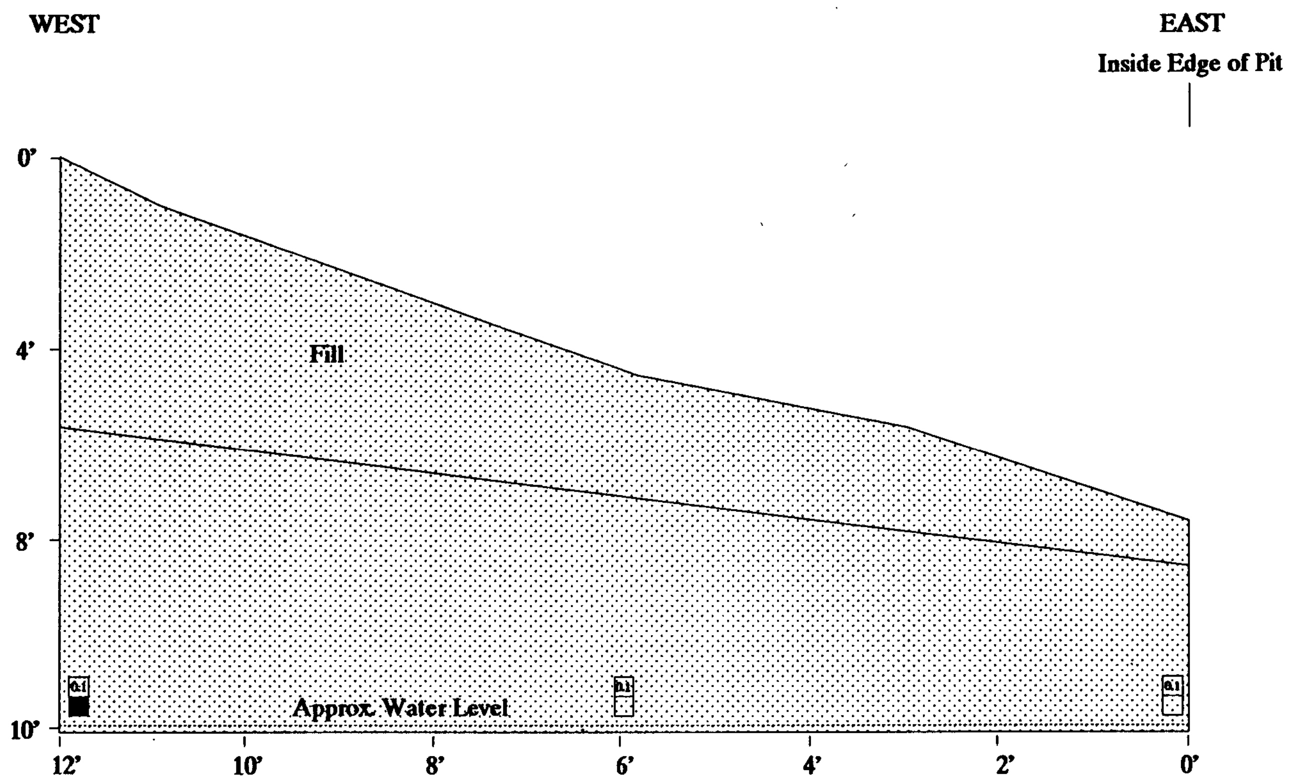
0.6 Field Headspace Sample (field headspace reading expressed in ppm)

# HORIZONTAL TRENCH T-5



# HORIZONTAL TRENCH T-6




Silty Sand; very fine-grained; light gray (10YR7/2); moist to wet; firm.

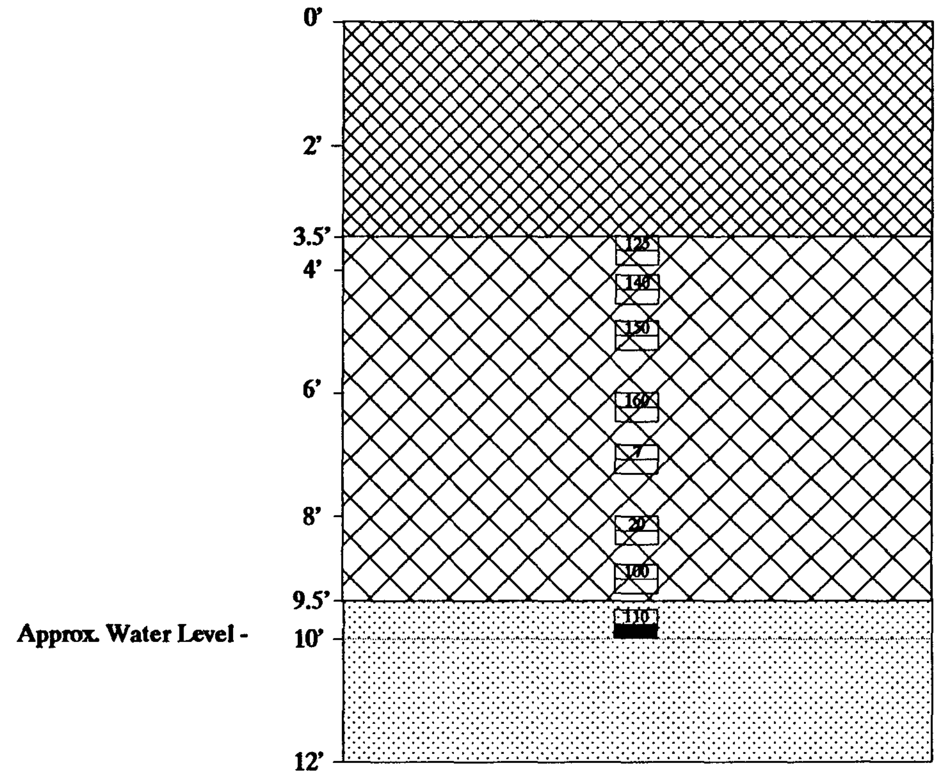
Field Headspace Sample
(field headspace reading expressed in ppm)

Analytical Sample
(field headspace reading expressed in ppm)

APPENDIX H

# APPENDIX H
# VERTICAL TRENCH LOGS

# VERTICAL TRENCH T-1V




Source material; black; slightly moist; firm; hydrocarbon and hydrogen sulfide odor.

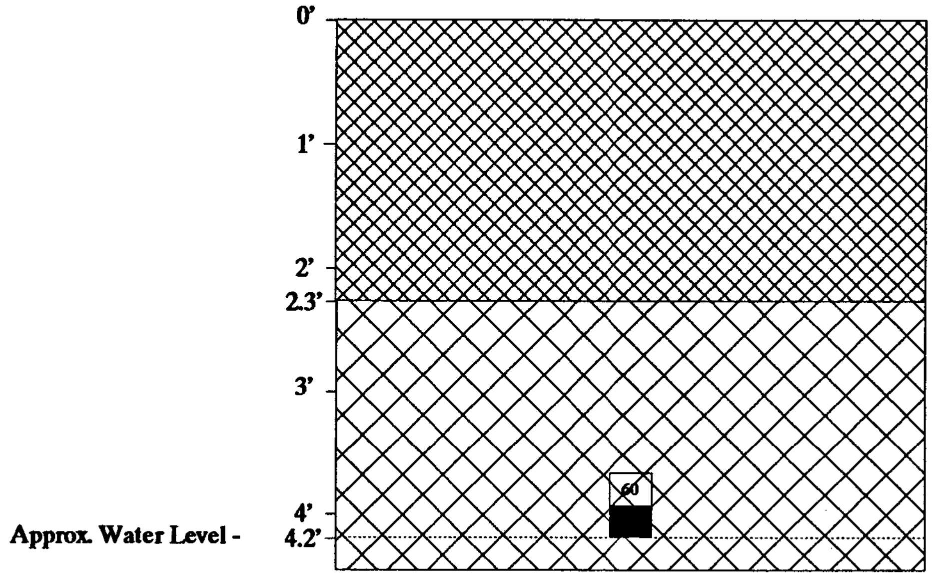
Sand; very fine-grained; stained dark gray (10YR5/1); moist; firm; slight hydrocarbon and hydrogen sulfide odor.

Sand; very fine-grained; light gray (2.5Y4/0); wet below 10'; stiff; odorless. Slight sheen noted on water surface.

100 Field Headspace Sample (field headspace reading expressed in ppm)

110 Analytical Sample (field headspace reading expressed in ppm)

# VERTICAL TRENCH T-2V

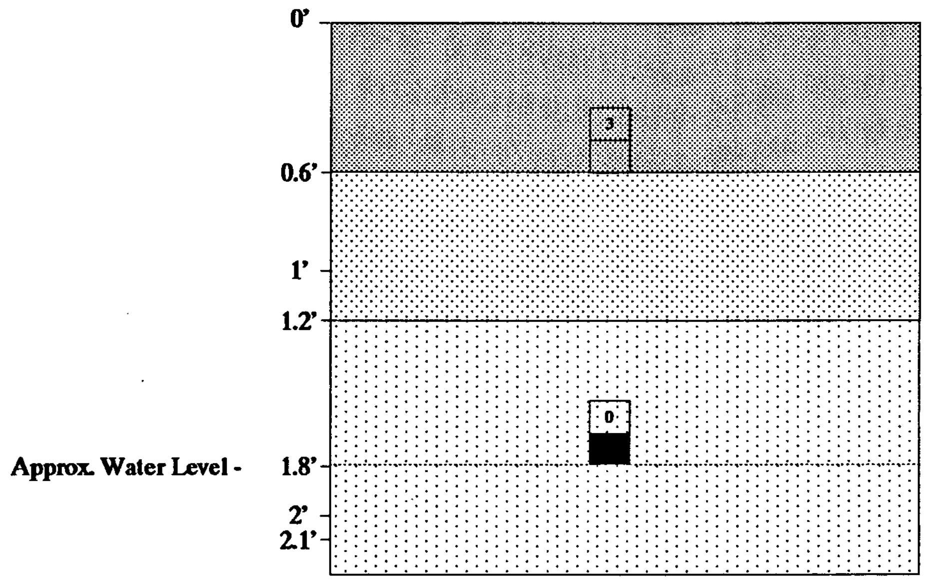


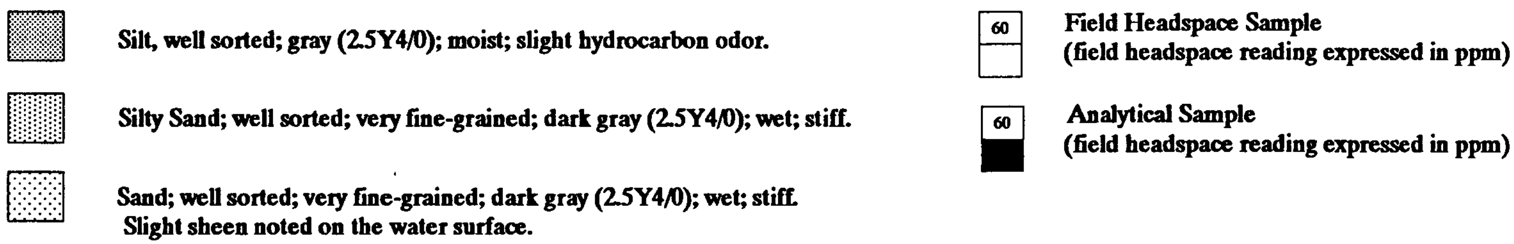

Source material; black; moist; very soft; hydrocarbon and hydrogen sulfide odor.

Sand; very fine-grained; stained gray (10YR5/1); moist; soft; slight hydrocarbon and hydrogen sulfide odor.
Slight sheen noted on water surface.

60 Analytical Sample
(field headspace reading expressed in ppm)

# VERTICAL TRENCH T-3V



# APPENDIX I
# NEW MEXICO ENVIRONMENTAL DEPARTMENT'S "RISK ASSESSMENT CALCULATIONS"

## Risk Assessment Calculations for Carcinogens and Noncarcinogens

Following are the two types of calculations for acceptable residual soil contaminants based on risk assessment calculations. These calculations assume a daily exposure duration of 8 hours/day, 40 hrs/week. The resulting figure for acceptable contamination (C), should be modified to reflect a larger value for C if the daily or weekly exposure is less, and a smaller value for C if the soil ingested is greater than the assumption due to local conditions. The first two equations below are suitable for situations involving only one contaminant, the second two are for multiple contaminant scenarios.

**For single, noncarcinogenic contaminants**

Where C, the acceptable residual soil concentration, C will be equal to the RfD* divided by the amount of soil ingested daily per kilogram of body weight (the standard RCRA model for noncarcinogenic contaminant exposure is a 10 kg child ingesting 200 mg soil/day) = 20 mg/kg weight per day:

$$C = \frac{RfD\left(\frac{\text{mg constituent}}{\text{kg*day}}\right)}{20\ \frac{\text{mg soil}}{\text{kg*day}}}$$

*RfD is the reference dose. RCRA clean closures require use of the assumption that intake is by direct soil ingestion, so you will want to use the oral intake RfD for noncarcinogens. The Integrated Risk Information System (IRIS) will supply this data [(513 569-7254].

**For single, carcinogenic contaminants**

Where C is the acceptable residual contamination, R is the acceptable risk and is generally set at $1x10^{-6}$, SF is the carcinogenic slope factor. IRIS data includes this value in the carcinogen, oral intake data section. DI is the average daily soil ingestion. This calculation assumes a 70 kg adult consuming 100 mg of soil daily, so the DI is 100 mg/70 kg = 1.42 mg soil/kg weight per day.

$$C = \frac{R}{SF\ (\text{day/mg*kg}) \times 1.42\ \text{mg/(kg*day)}}$$

If the total constituent concentration of any chemical in the residual soil is above the limit calculated, the contaminated media must be removed to a permitted hazardous waste treatment, disposal or storage facility. Site specific factors may allow an adustment of the assumptions used in the above calculations.

For situations involving multiple contaminants, the risk from each is summed and the total risk from residual contaminants must be acceptable.

**For multiple, carcinogenic contaminants**

R = Risk and is set at $1 \times 10^{-6}$ incidences of cancer (one incidence in a population of one million). CDI = chronic daily intake of the carcinogen not of contaminated soil. CDI is equal to the daily soil intake times the concentration of the individual contaminant. SF is the slope factor (same as in the previous example).

$$R = 1 \times 10^{-(CDI \times SF)}$$

Total R will equal the calculated R from carcinogen 1 + R from carcinogen 2, etc. Cleanup levels will be considered adequate with respect to the carcinogens when $R_{total}$ is less than $1 \times 10^{-6}$.

**For multiple, noncarcinogenic contaminants**

CDI is as immediately above, RfD is as in the first example, above. Calculate the total Chronic Hazard Index as follows:

$$\text{Total hazard index} = CDI_1 \times RfD_1 + CDI_2 \times RfD_2 + \text{etc.}$$

The total hazard index must be less than 1, i.e., 0.99 or less.

**All analytical data must be submitted to the New Mexico Environment Department (NMED) and must be accompanied by complete QA/QC data documenting that the laboratory has followed appropriate EPA SW-846, chapter one QA/QC procedures, and SW-846 analytical methods.**

Ref: Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part A

# RISK ASSESSMENT CALCULATION CORRECTIONS

Under the procedure for calculating human health risk assessment levels for single, carcinogenic contaminants, the equation for C, the acceptable risk based level, the slope factor (SF) is stated to have units of day/mg contaminant-kg body weight, which is incorrect, because the dosage factor in the numerator of that calculation has units of mg contaminant/(kg body weight-day). Therefore, for C to have units of mg contaminant/kg soil, the correct units for SF are day-kg body weight/mg contaminant.

Under the procedure for calculating multiple, noncarcinogenic contaminants, the Total Hazard Index is printed as the following:

$$HI_{tot} = CDI_1 X RfD_1 + CDI_2 X RfD_2 + etc...$$

However, the correct procedure for calculating $HI_{tot}$ is the following:

$$HI_{tot} = CDI_1/RfD_1 + CDI_2/RfD_2 + etc...$$

This equation will provide a unitless result for the Total Hazard Index, which is correct.