Colorado Department of Public Health and Environment
Radioactive Materials License 1102-01
Renewal Application

Volume 4 of 7

Contents:

Browning-Ferris Industries, Inc. (BFI). 1982. *Chemical Waste Treatment/Solidification & Disposal Facility Plan.* Volume 1 – Technical Report. Highway 36 Land Development Company, Adams County, Colorado, Revised October 1982.

Colorado Geological Survey (CGS). 1986. *Candidate Area Evaluation Report, Low-Level Radioactive Waste Disposal, Colorado.*Open File 86-7.

February 2010

Clean Harbors Deer Trail, LLC
108555 East Highway 36
Deer Trail, CO 80105-9611

RADIOACTIVE MATERIALS LICENSE APPLICATION

CLEAN HARBORS DEER TRAIL, LLC. HAZARDOUS WASTE TREATMENT, STORAGE, DISPOSAL FACILITY

PREPARED BY

CLEAN HARBORS DEER TRAIL, LLC.
108555 EAST US HIGHWAY 36
DEER TRAIL, COLORADO 80105-9611

JANUARY 2005

VOLUME 3 OF 6

RADIOACTIVE MATERIALS LICENSE APPLICATION FOR

CLEAN HARBORS DEER TRAIL, LLC., 108555 EAST US HIGHWAY 36 DEER TRAIL, COLORADO 80105-9611

VOLUME 3 – CONTENTS

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CHEMICAL WASTE TREATMENT/SOLIDIFICATION & DISPOSAL FACILITY PLAN

VOLUME I - TECHNICAL REPORT
REVISED OCTOBER 1982

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS COUNTY, COLORADO

A WHOLLY-OWNED SUBSIDIARY OF
BFI® BROWNING-FERRIS INDUSTRIES, INC

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

LAKEWOOD, COLORADO

Waste Systems™
BROWNING-FERRIS INDUSTRIES
Colorado District

October 20, 1982

The Honorable Steve Cramer, Chairman
Adams County Board of County Commissioners
450 S. 4th Avenue
Brighton, Colorado 80601

Re: Highway 36 Land Development Company
Application for Certificate of Designation

Dear Mr. Cramer:

Enclosed please find the application of Highway 36 Land Development Company ("Highway 36") for a Certificate of Designation to operate a chemical waste treatment/solidification and disposal facility near Last Chance, Colorado. Also enclosed is revised Volume I - Technical Report entitled "Chemical Waste Treatment/Solidification & Disposal Facility Plan" to accompany the application. It should be noted that the originally submitted Volume II - Appendices of the Facility Plan has not been revised and, thus has not been resubmitted with the revised Volume I. The original Volume II does, however, remain a part of the Facility Plan and this application for a Certificate of Designation.

Since June 9, 1982, we have discussed the proposed Highway 36 facility with various individuals, citizen groups, and business groups. Highway 36 has received input from Adams County residents and from all parts of Colorado. We have also carefully studied the June 9, 1982 decision. As a result of these discussions and study, and because of events occurring since June 9, Highway 36 has decided to submit a new application for a modified chemical waste treatment/solidification and disposal facility.

Major modifications in the proposed Highway 36 facility include:

1. Capacity. The Colorado Department of Health conducted a survey after shutdown of the Lowry facility which showed that Colorado businesses were generating 10-12 million gallons of chemical waste per year. Accordingly, Highway 36 has reduced the size of the proposed Highway 36 facility from 48 million gallons to 12 million gallons yearly.

2. Transportation. As a result of this reduced capacity, Highway 36 has revised the projected transportation impacts of the facility. The number of vehicles carrying hazardous waste and facility supplies and personnel will be substantially reduced from the projection contained in the earlier application. We have also clarified the location of the source of the primary solidification reagent (kiln dust).

CHEMICAL WASTE SYSTEMS
14 INVERNESS DRIVE, SUITE 4F • ENGLEWOOD, COLORADO 80112 • (303) 740-7993

3. Emergency Response. Highway 36 has entered into a letter of intent with the Adams County Fire Chiefs Mutual Aid Association (the "Association") for a program of mutual assistance in which Highway 36 will provide assistance in handling any accident involving hazardous material which occurs in the populous, western end of Adams County, and the Association will assist us with any on-site problems which may occur. Highway 36 has agreed to provide training for emergency response groups within Adams County and to provide the equipment needed for the Association's emergency response van. Additionally, we will take the necessary steps to properly dispose of any hazardous material removed from accident sites to which we have responded pursuant to the above described assistance agreement.

4. Land Use. Highway 36 believes that construction and operation of the proposed Highway 36 facility is compatible with Adams County land use policies and is consistent with the goals and policies of the Adams County Waste Management Plan adopted on September 27, 1982.

If you or your staff have any questions concerning the enclosed material, we welcome an opportunity to provide additional information or to answer any questions.

Sincerely,

R. A. Johnson

R. A. Johnson
President

Steve Custer

Stephen G. Custer
District Manager

cc: Commissioner Robert Briggs
Commissioner Leo Younger

CHEMICAL WASTE TREATMENT/SOLIDIFICATION & DISPOSAL FACILITY PLAN

VOLUME I - TECHNICAL REPORT

HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO

A WHOLLY-OWNED SUBSIDIARY OF
BROWNING-FERRIS INDUSTRIES, INC.

APRIL 1981
REVISED OCTOBER 1982

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LIST OF ABBREVIATIONS

A	- area of drainage basin in acres
AA	- atomic absorption spectroscopy
ADT	- average daily traffic
AMC	- antecedient moisture conditions
APHA	- American Public Health Association
BFI	- Browning-Ferris Industries, Inc.
BPI	- buying power index
C	- rainfall runoff coefficient
CC	- continuously cored
CD	- Certificate of Designation
CFR	- Code of the Federal Regulations
cfs	- cubic feet per second
cm/sec.	- centimeters per second
CO	- carbon monoxide
COD	- chemical oxygen demand
cu.ft./min.	- cubic feet per minute
dBA	- decibels
DOT	- U.S. Department of Transportation
EBI	- effective buying income
EEDP	- East End Development Plan
EMSL	- Environmental Monitoring & Support Laboratory
EMT	- emergency medical technician
EPA	- U.S. Environmental Protection Agency
ft./min.	- feet per minute
GC	- gas chromatography
HC	- hydrocarbons
HPLC	- high pressure liquid chromatography
Hwy 36	- U.S. Highway 36
I	- rainfall intensity
$lb./ft.^2$	- pounds per square foot
$lb./ft.^3$	- pounds per cubic foot
LEL	- lower explosion limit
Leq	- equivalent sound level
MG	- million gallons
mg/kg	- milligram per kilogram
mg/l	- milligram per liter
mg/m^3	- milligram per cubic meter
MSL	- mean sea level
MW	- monitoring well
NAAQS	- National Ambient Air Quality Standards
NEPA	- National Environmental Policy Act
NFPA	- National Fire Prevention Association
NHPA	- National Historic Preservation Act
NO_2	- nitrogen dioxide
NWS	- National Weather Service
O_3	- ozone
OSHA	- Occupational Safety & Health Act
pCi/l	- picocuries per liter
PL	- Public Law
POTW	- publically owned treatment works
ppm	- parts per million

List of Abbreviations
(Continued)

PSC	- Public Service Company of Colorado
PVC	- polyvinyl chloride
Q	- maximum rate of runoff
R	- range
RCRA	- Resource Conservation & Recovery Act
SCS	- Soil Conservation Service
S.H.	- State Highway
SO_2	- sulfur dioxide
SPCC	- Spill Prevention Control and Countermeasures
SWDSFA	- Solid Waste Disposal Siting and Facilities Act
T	- township
t_c	- time of concentration
TLV	- threshold limit values
TSD	- treatment/storage/disposal facilities
TSP	- total suspended particulates
TOC	- total organic carbon
TOX	- total organic chlorides
ug/m^3	- micrograms per cubic meter
USDA	- U.S. Department of Agriculture
USGS	- United States Geological Survey
v/c	- velocity to capacity ratio
vph	- vehicles per hour
WMP	- Adams County Waste Management Plan
WW	- water well

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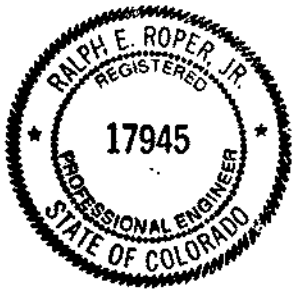

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CHAPTER 1

SUMMARY

1.1 BACKGROUND

In 1980, the Highway 36 Land Development Company, a wholly-owned subsidiary of Browning-Ferris Industries of Colorado, Inc., herein referred to as BFI, acquired nine sections of land in Adams County, Colorado. A portion of the land is to be used for development of a chemical waste treatment, solidification, and disposal facility. The particular location was selected on the basis of a number of favorable factors, and in accordance with existing and anticipated environmental protection regulations. These factors are summarized below.

1.2 SITE SELECTION

Several potential sites were evaluated for the proposed facility. One site investigated was south of Agate, Colorado; however, after a thorough geological investigation, that site was determined to be unsuitable. Additional sites were then investigated in accordance with the state geologic survey report which indicated areas within the state (see Figure 1.1) that generally had favorable geologic conditions for disposal of hazardous waste(1). The first of these sites investigated was in the Pierre shale corridor north and northeast of Cedar Point, Colorado between Agate and Limon. The land in this corridor was found to be unavailable for acquisition. The proposed site, in this same Pierre shale, in Adams County was then geologically investigated, found suitable, and purchased.

When BFI selected the Adams County site, its geologic strengths were considered to be of prime importance. As shown in Figure 1.1, the site

is indeed within the area defined by the Colorado State Department of Health as being most suitable for development of hazardous waste disposal facilities. This map was prepared by the Colorado Department of Health to depict favorable areas for the development of hazardous waste disposal sites(1).

Important considerations and requirements for site selection which are all satisfied at the Highway 36 Land Development Company Adams County site include:

- suitable geologic conditions;
- conveniently located near waste sources;
- sparsely populated area;
- good transportation access;
- no adverse environmental impact anticipated;
- availability of utilities;
- land availability and site size requirements;
- no nearby airports;
- favorable topography;
- soils suitable for liner material;
- not located within a corridor of growth (as a site near Colorado Springs or Pueblo might be);
- not within fault zone;
- not within flood plain of 100 year flood;
- not located within wetland area;
- no impact on endangered or threatened species and critical habitats;
- extensive buffer zone;
- not located in aquifer recharge zone;
- favorable evaporation rates with minimal rainfall.

BFI is constructing a facility complex for the management and disposal of hazardous wastes at the Adams County site. Construction of the first phase of this facility commenced on November 4, 1980. The overall facility is to consist of two levels of operation. In the initial level of operation, hereinafter referred to as Phase I, BFI will utilize state-of-the-art techniques for chemical waste disposal consisting of clay-lined earthen cells for waste solidification. In the second level of operation, hereinafter referred to as Phase II, BFI will utilize concrete

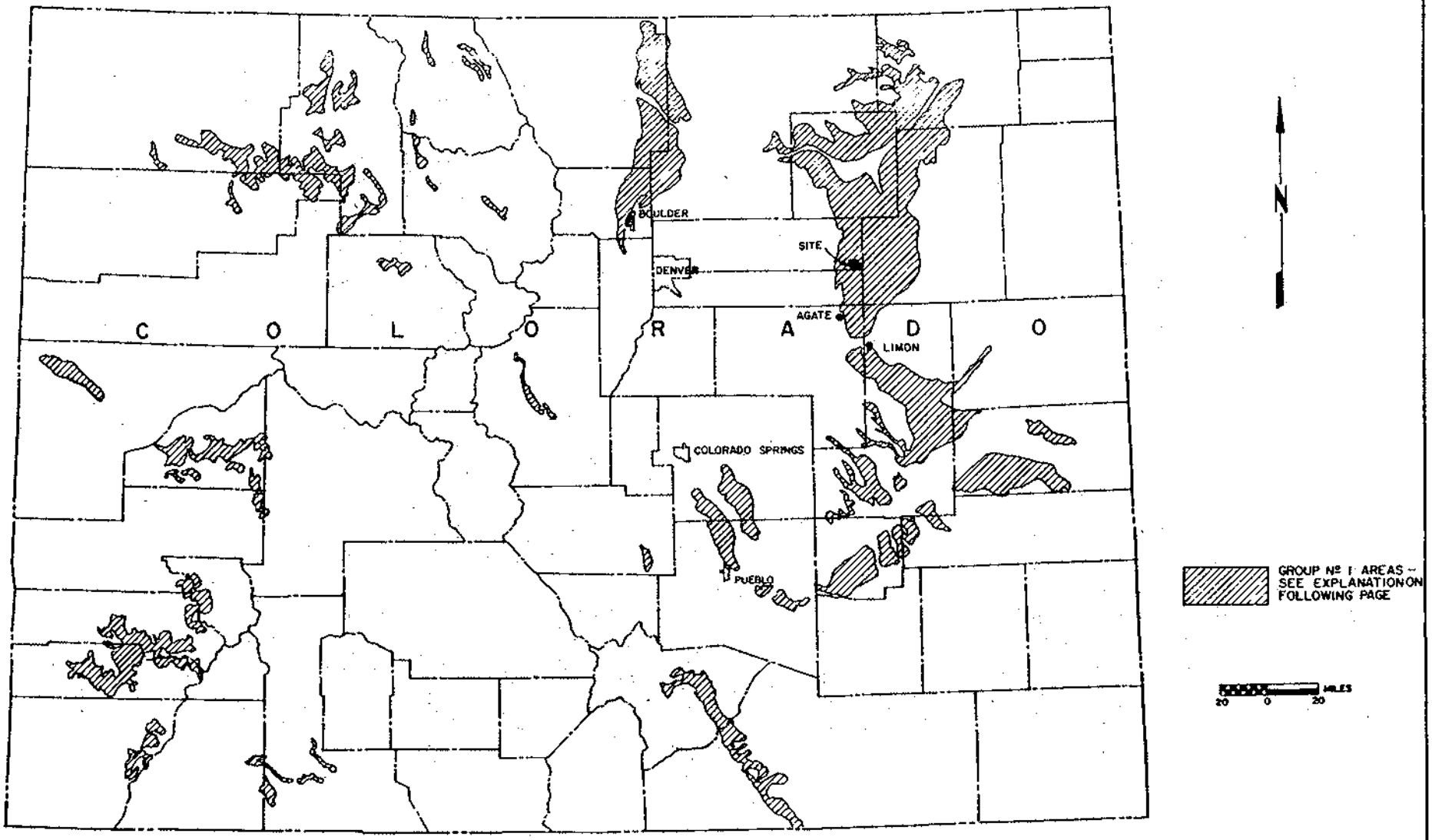


FIGURE Nº 1.1
OPTIMUM AREAS FOR
HAZARDOUS WASTE DISPOSAL
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

SOURCE: REFERENCE I

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

FIGURE Nº. 1.1 EXPLANATION

INFORMATION SERIES 14
PLATE 1
1980

EXPLANATION

HOST ROCK SUITABILITY CLASSIFICATION SCHEME

The formations listed below are divided into most suitable and marginally suitable host media for storage of hazardous waste. This selection is based on the following criteria (further discussed in the explanation and accompanying text):

- Contain a minimum thickness of 150 feet of impermeable shale or clay with in-place permeabilities less than 1 x 10-7 cm/sec. (0.1 ft/yr)
- Outside of ground water recharge/discharge areas.
- Outside of floodplain-Quaternary-Tertiary valley fill basins/drainage.
- Tectonically stable, structurally simple.
- Not within close proximity of igneous or geothermal activity.
- Areas with lowest sediment yield ranging from 0 to 0.2 acre ft/sq mi/yr are ranked "a" and those with sediment yield ranges from 0.2 to 0.5 acre ft/sq mi/yr are ranked "b" to reflect susceptibility to erosion. Covered areas are not ranked with respect to erosion susceptibility.

Group 1 Optimum conditions for potential storage of non-nuclear hazardous industrial waste. Include the following argillaceous formations (except where highly fractured):

Pierre Shale of eastern Colorado (includes upper and lower sections)

Mancos Shale of western Colorado

Lewis Formation of northwestern and west central Colorado

San Jose Formation of southwestern Colorado

Group 2 Marginal suitability potential storage of nonnuclear hazardous industrial waste including the following argillaceous formations.

Pierre Formation - Middle Section of eastern Colorado.

Dawson Arkose, including Denver Formation of east-central Colorado.

Laramie Formation of east-central Colorado

Niobrara Formation of southeastern Colorado

Benton Shale, including Carlile and Graneros Shale members, of southeastern Colorado

Wasatch Formation of northwestern Colorado

Lance Formation of northwestern Colorado

Contact

Covered formation contact

DISCUSSION

Introduction

One of the more common methods employed to achieve long-term isolation of hazardous wastes from the environment is secure burial at a carefully selected and managed hazardous waste disposal site. The purpose of this map is to identify and rank generalized areas within the State of Colorado which, based upon reconnaissance studies, appear to be favorable for storage of non-nuclear, industrial wastes. This map has been generated from sources of information most characterized as regional in nature and therefore is not intended to provide site-specific information pertaining to the suitability of a particular locality for storage of such waste.

The suitability classifications presented here are based on evaluation of geologic, hydrologic, and physiographic conditions only. Other factors, such as access or population density were not considered. Many geologically suitable areas will be eliminated from final consideration on the basis of other such factors.

The map shows the areas where the physical conditions fall into a given category. Suitable sites can be found within these areas. However, detailed analysis may reveal local exceptions where conditions do not conform to the stated criteria. Conversely, there may be suitable locations outside the indicated areas. However, the likelihood of finding and developing such sites is much lower and the expense will probably be significantly greater than in the specified areas. In the great majority of cases, the map will prove accurate as determined by the stated criteria. This map is intended to be an effective tool for generalized hazardous waste planning and should serve as a guide for site selection. It should not be used as a substitute for detailed analysis of specific sites.

Numerous physical characteristics must be considered in the evaluation of potential hazardous waste disposal sites. These include hydrology, ecology, geochemistry, structural geology, geomorphology, climatology, and mineral resources. Pertinent aspects of each of the these criteria and the areal classification scheme for suitable areas within Colorado are summarized here and are discussed in greater detail in the accompanying text.

HYDROLOGY

The single most important consideration in the development of suitability criteria for hazardous waste disposal sites is the protection of ground and surface water from contamination by leaching wastes or secondary byproducts. Surface water can be contaminated by runoff or introduction through recharge of ground water which has been polluted and vice versa. Protection of aquifers--geologic rock units which contain water and are, or can be utilized by man--is extremely important.

General Criteria

- A minimum thickness of 150 ft of impermeable material between the site and any aquifer (or potential aquifer).
- The actual disposal excavation should be below the interface between bedrock and the overlying surficial material. The landfilled waste material should lie entirely within the containing medium below the top of the bedrock.
- A thorough evaluation of specific sites should include:
  1. the direction and rate of groundwater flow,
  2. depth to the water table,
  3. presence of aquifers should be ascertained and their relationship to the site, the surrounding area, and its hydrology should be evaluated.
- A minimum distance of 100 ft of impermeable material must be maintained between the bottom of any proposed excavation and historical high water table.
- A minimum distance of one mile to any perennial stream channel or positive isolation from the stream by local topography.
- Avoidance of physiographic floodplain and low terraces.

ECOLOGY

Geologic conditions in the vicinity of a proposed waste disposal facility must be thoroughly analyzed. The lithology, permeability, thickness, and areal extent of the formation(s) present must be well understood and determined to be well suited for hazardous waste disposal.

Minimum permeability and thickness for suitability as a host rock on this map are 10-7 cm/sec (10-3 gallons/day/ft2-0.1 ft/year) and 150 feet of homogeneous shale or clay.

Geologic hazards such as avalanches, landslides, rockfalls, mudflows, debris fans, unstable slopes, excessive erosion, seismic activity, and ground subsidence must be avoided.

Suitable Host Rock Formations

Group I - Formations with highest potential for safe, long term containment of hazardous waste

1. Pierre Shale - (upper and lower sections) eastern plains area, eastern Colorado
2. Mancos Shale - northwestern, southwestern Colorado
3. Lewis Shale - northwestern Colorado
4. San Jose Formation - southwestern Colorado

Group II - Formations with marginal potential for safe storage of hazardous waste

1. Pierre Shale - (middle section) eastern plains area, eastern Colorado
2. Niobrara Formation, southeastern Colorado
3. Wasatch-Lance Formations - northwestern Colorado
4. Benton Group - eastern Colorado
5. Laramie Formation - eastern plains area, eastern Colorado
6. Denver-Dawson Formation - eastern plains area, eastern Colorado

GEOCHEMISTRY

The chemical and physical compatibility of the host medium and waste material must be such that long term suitability within the closed system can be achieved and maintained. Detailed geochemical, mineralogical, and physical investigations must be conducted by empirical methods in order to precisely demonstrate the exact nature of the compatibility between the waste material and selected formations.

Recommendations

1. Perform detailed mineralogical, physical, and chemical studies on the selected clay mineral(s) in order to determine their exact suitability or compatibility with the various types of pollutants (organic and/or inorganic).
2. Determine the chemical-physical relationship between the clay mineral(s) and the specific wastes to be disposed of by conducting laboratory studies coupled with in situ (on the site) observations. Various physical and chemical parameters to consider include: pH, cation exchange capacities, precipitation products, etc., of the clay mineral and the type(s) of pollutant.
3. Frequent field inspections, such as soil and water sampling, should take place during operation of the facility in order to assure that a closed system between the waste disposal site and the surrounding media is constantly maintained and to verify or modify the assumptions and interpretations utilized in the original suitability studies.

STRUCTURAL GEOLOGY

Structural geology is the study of the deformation of rocks, including folding and faulting. Structural or tectonic activity usually tends to modify the bulk characteristics of rock units in a manner that is deleterious to suitability of the rock as a hazardous waste disposal site.

Faults, joints and fractures can serve as a conduit for the passage of fluids within a rock mass. Known faults should be avoided because of these possible deleterious effects on a site.

General Criteria

- The geologic structure of the area should be simple enough to be well understood and evaluated with respect to site suitability.
- Thorough site investigation to reveal the presence of faulting and jointing within the general study area.
- A minimum of one mile to any major fault/tectonic feature.
- Select areas that are devoid of moderate to severe structural deformation.
- Avoid areas in close proximity to igneous or geothermal activity.
- Avoid areas of anomalous heat flow gradients.

GEOMORPHOLOGY

Topography and slope characteristics should be evaluated to insure long term protection from excessive surface erosion. Low slopes, less than 2%, generally do not provide positive drainage, resulting in surface retention, ponding, and possible high rates of infiltration. Slopes greater than 5% are subject to relatively high rates of erosion which can cause eventual breaching of the repository cells and escape of hazardous materials.

Local topographic highs, such as buttes and mesas, will erode at a faster rate than surrounding areas. Streams tend to dissect these areas and provide a means of transporting hazardous wastes from the disposal site.

Recommendations

- Stable surface, such as low drainage divides, not subject to erosion greater than 0.5 acre ft/mi²/yr
- Areas with base levels which are appreciably higher than surrounding areas should be avoided.
- Natural slope should be between 2% and 5%.

CLIMATOLOGY

Climatic considerations for hazardous waste disposal sites include precipitation, evaporation, wind, and potential erosion. Areas prone to frequent severe thunderstorm activity and flooding should be avoided because of the deleterious effects on a hazardous waste disposal site. Wind velocity and duration should be major factors involved in the analysis of a potential site. Severe winds (greater than 50 mph) can cause containment and handling problems during operation of a landfill, and wind erosion can seriously reduce the integrity of the facility after closure.

Recommendations

- The mean annual evaporation should exceed the mean annual precipitation by 20 in/yr.
- The maximum 24-hour storm should be no greater than 4 inches.

MINERAL RESOURCES

The potential burial site and vicinity should be evaluated for the presence of various potentially commercial or critical mineral commodities. These include uranium, thorium, other trace metals, coal, oil, oil shale, gas, precious and base metals, geothermal localities.

Presence of potentially commercial mineral resources are not necessarily preventive, but should be carefully described so that it can be used in site-search evaluations at all stages.

SOURCE: REFERENCE 1

tanks for treatment and solidification. Further, the entire Phase II treatment/solidification operation will be enclosed within a building. Both phases will utilize clay-lined secure disposal cells for solidified product disposal.

The facility will be operated and maintained under enforcement and regulatory authorities exercised by the Colorado Department of Health and the U.S. Environmental Protection Agency (EPA), according to the requirements established for such facilities under the federal Resource Conservation and Recovery Act (RCRA) and other applicable local, state, and federal environmental protection statues and regulations. The technology being utilized is based on prior experience and proven capability of Browning-Ferris Industries, Inc.

In the Fall of 1980, the facility received "interim status" under the EPA's hazardous waste management regulatory program. The present U.S. EPA identification number assigned to the facility is COD991300484. Interim status notification from the EPA is given in Appendix C.

1.3 NEED FOR THE FACILITY

1.3.1 General

Industrial wastes are an integral and inevitable part of our economy. In supplying America with the abundance of goods and services that contribute to our nation's exceptionally high standard of living, some 750,000 businesses--representing all types of industrial and commercial enterprises--generate by-products which are wastes that can be hazardous. Some of the products whose manufacturing processes result in potentially hazardous wastes are themselves lifegiving--artifical limbs, heart pacemakers, surgical implants, and membranes. Others are so much a part of

the American scene--blue jeans, televisions, cars, telephones, leather--that it is hard to imagine a world without them.

The types of industrial wastes which are to be received and treated at this facility include solid and liquid waste which, if mismanaged, can be harmful to human, animal, aquatic, or plant life. Such industrial wastes include spent acid solutions, sludges, tank bottoms containing heavy metal ions, aqueous solutions of inorganic chemicals, and materials such as paper, metal, cloth, or wood contaminated with industrial waste. In the general public's mind, these wastes are often considered "hazardous wastes." However, these wastes are only truly hazardous when they are mismanaged--that is, dumped in an uncontrolled manner, often illegally, into sewers, open dumps, and other unregulated locations. Fortunately, these wastes can be handled in a safe, environmentally sound manner.

The proper management of hazardous wastes has become a focal point of great concern throughout the nation. EPA has documented over 400 cases of health or environmental damage in the United States due to improper hazardous waste management resulting from one of the following(2):

- direct contact with toxic wastes;
- fire and explosions;
- groundwater contamination via leachate;
- surface water contamination via runoff or overflow;
- air pollution via open burning, evaporation, and wind erosion;
- poison via the food chain (biomagnification).

EPA has estimated that 90% of the 35-50 million metric tons of hazardous chemical wastes generated annually in the United States are handled by practices that will not meet stringent new federal standards(2). Currently, these wastes are being disposed of in non-secure ponds, lagoons, or landfills or are incinerated without proper controls.

1.3.2 Colorado's Need

The State of Colorado has an equally urgent need for proper hazardous waste management, as revealed by Colorado's Department of Health 1980 survey of industrial chemical waste disposal practices(1). Conclusions made from that survey stressed the immediate need for proper hazardous waste management facilities:

- Hazardous wastes are now and have been going to inadequately designed landfills, and the potential exists for serious groundwater and other environmental pollution.

- There are no existing facilities designed for the disposal and "permanent containment" of the hazardous wastes generated in the State of Colorado. The large majority of such wastes are presently going to substandard facilities not designed to handle these wastes and, therefore, the potential exists for widespread contamination of groundwater and the environment throughout the State.

- A hazardous waste disposal site is needed immediately in Colorado to properly dispose of the large volumes of hazardous materials without creating a serious hazard.

- Unless a site is approved and made available, these wastes will have to be shipped out-of-state to acceptable disposal facilities and this would impose considerable costs on industry in Colorado for transportation, packaging, and disposal.

- Geographically the site(s) should be located along the Front Range urban corridor where 99.7% of these wastes are generated. A site should be located somewhere reasonably close to the Denver metropolitan area where almost 40% of the total hazardous waste is generated.

More recently (early September 1982), the Colorado Department of Health conducted a second survey in which the primary generators of hazardous waste in the state were contacted. The purpose of the survey was threefold: (1) to reassess the types and volumes of hazardous waste currently being generated; (2) to determine the present methods of hazardous waste management being practiced in the state and the extent to which they are being applied; and (3) to assess the impact which the closure of the

Denver-Arapahoe Chemical Waste Processing Facility was having upon Colorado industry. Although the final survey report has not yet been completed, the survey data indicate that a total of about 10,000,000 gallons of hazardous wastes are generated within Colorado annually, excluding that which is recycled or disposed of on-site. The survey also indicates that there continues to be a strong need for a new, safe facility in the state to properly manage the wastes produced by Colorado industries. Industries which are now storing wastes on-site cannot continue to do so indefinitely. Firms which are having to pay 300% to 500% more to dispose of their wastes out-of-state may not be able to remain in business with these expenses over the long term(3).

1.3.3 Need for Secure Landfill

Acceptable disposal of hazardous waste may be accomplished using one or more of the following general techniques:

1. incineration;
2. on-site treatment and discharge to a publically owned treatment works (POTW);
3. reclamation and recycle;
4. treatment to render the waste non-hazardous for subsequent disposal in a non-secure landfill;
5. treatment and disposal in a secure landfill.

It is emphasized that there is no single waste management method that is universally applicable to all types of hazardous wastes. For instance, incineration is best suited for disposal of volatile organic wastes. Even if a large-scale hazardous waste incinerator was available in Colorado, incineration of wastes containing inorganic material would result

in a secondary waste in the form of ash or sludge generated in gas cleaning streams which themselves may be classified as hazardous waste. On-site treatment of wastes prior to discharge to a POTW or prior to disposal in a non-secure landfill is not always practical due to low volume generation rates. It is often times much more cost-effective to dispose of the waste off-site. Even when on-site treatment by the manufacturer is cost-effective, a by-product of sludge containing the concentrated hazardous materials is generally produced. Thus, a secondary disposal method, such as a secure landfill, must be employed.

Recovery and reuse can provide an economical and environmentally sound method of dealing with some hazardous waste materials. Unfortunately, not all materials can be reclaimed and reused due to technological limitations and cost limitations. Even if materials are recovered and reused, the recovery process normally involves the separation of contaminants resulting in a liquid or sludge product which cannot be used and must be disposed of by other means.

The final acceptable hazardous waste disposal option is the use of a secure landfill. This method of disposal is both environmentally sound and economical when designed and operated in an appropriate manner. As indicated by the previous discussion regarding (1) non-compatibility of wastes to other methods of disposal and (2) by-product generation of hazardous wastes via other waste management technologies, the need for secure landfill facilities is mandatory, regardless of economics. The need for such facilities in the State of Colorado is particularly acute because the only landfill within the state that was available for disposal of hazardous waste has been barred by the EPA and the State of Colorado from accepting any additional wastes.

Opposition to land disposal of hazardous wastes has generally arisen from the significant environmental problems associated with past land disposal of such wastes in inadequately designed, operated, and sited facilities. The "out of sight, out of mind" approach used in the past has lead to serious environmental problems which must not be continued. Because of the seriousness of the problems, land disposal of hazardous waste has become an extremely sensitive public issue. Fortunately, federal and state regulatory agencies have responded to the urgent need for environmentally safe facilities by developing stringent requirements for future hazardous waste treatment and disposal facilities.

The facilities described herein for the Adams County site will meet and/or exceed the present federal and state requirements. These facilities were sited, designed, and will be operated in a manner representing state-of-the-art technology. Although the facilities will be subsequently described in Section 1.5, the major criteria establishing these facilities as state-of-the-art are as follows:

- o Site Selection
  - Located in area with extremely low subsoil permeabilities
  - Not located in or above an aquifer recharge zone
  - In non-urbanized area with extensive buffer zone
- o Design
  - Hydraulic head dissipating system in each disposal cell
  - Highly impermeable, five-foot thick clay liner and four-foot thick liner cap in each disposal cell
  - Leachate collection/detection system in each disposal cell
  - Enclosed facilities (Phase II) for storage, treatment, and solidification of wastes
  - Extensive grading plan for minimum disruption of existing topography and maximum control of contaminated run-off

- Operation

  - No disposal of liquid wastes, i.e., only solid waste or solidified product will be placed in the secure disposal cell

  - Extensive six tiered groundwater, surface water, air, and soil monitoring program during the design life of the facility

  - Extensive groundwater monitoring program for up to 30 years after site closure

1.3.4 Summary

In summary, it is the intent of BFI to provide a facility for the treatment, solidification, and disposal of hazardous wastes generated in Colorado in a fashion that meets or exceeds the requirements of federal, state, and local governments. A facility of this type would afford the following advantages to Adams County and the State of Colorado:

- provide environmental protection for disposed wastes;

- reduce the amount of hazardous wastes going to unsuitable landfills and other inadequate facilities;

- provide incentives for industrial growth due to the availability of adequate, secure, hazardous waste disposal facilities;

- reduce costs of hazardous waste disposal to industries in Colorado which must now transport wastes long distances out of state to get to approved disposal facilities.

- provide Colorado with a suitable site for hazardous waste disposal in accordance with the Federal Comprehensive Environmental Release Compensation and Liability Act of 1980 ("Superfund Bill"). The EPA requires that a suitable site be available to qualify for and obtain superfund monies which allow for the clean-up of areas contaminated by hazardous wastes.

Secure landfills can be designed, operated, and located in such a manner as to provide an environmentally sound method of hazardous waste disposal. The facility proposed herein would satisfy a definite and urgent need for cost-effective disposal of these wastes which cannot be recovered or disposed of by any other technical or more practical means.

As a pioneer in hazardous waste disposal technology, BFI feels it is far better to provide state-of-the-art facilities for treatment, solidification, and secure landfill disposal of hazardous waste than to encourage inadequate and/or illegal disposal of such wastes by requiring impractical disposal methods, by disallowing secure disposal facilities, or by ignoring the operation of inadequate facilities.

1.4 CHEMICAL WASTE TREATMENT MANAGEMENT PHILOSOPHY

BFI has supported RCRA and EPA's strategy in implementing the Congressional mandates of the Act. BFI worked with the National Association of Solid Waste Management, the U.S. EPA, the American Association of State and Territorial Solid Waste Management Officials, the U.S. Congress, and others prior to the passage of RCRA to support development of comprehensive legislation for proper hazardous waste management. With respect to the overall hazardous waste control program being developed by the U.S. EPA, BFI has supported, and continues to support, the objectives of RCRA; particularly, to promote the protection of health and the environment and to conserve valuable material and energy resources. These objectives have been reached by regulating the treatment, storage, transportation, and disposal of hazardous wastes which can have adverse effects on health and the environment. BFI believes there is a national need for the proper management of hazardous wastes and that such management can be safely assured in the public's interest by establishing a cooperative effort among federal, state, and local governments and private enterprise.

Furthermore, BFI recognizes the importance of incorporating new waste management technologies into its operations as soon as such technologies are proven effective and economically practical. If, during the course

of operation of the disposal facilities discussed in this report, waste surveys and/or technological advances are made suggesting a portion of the Colorado waste stream might be managed in a more economical and environmentally acceptable manner, BFI will adjust its operations to incorporate such new or additional technology. Examples of alternative management technologies include:

- solvent recovery;
- metals recovery;
- recovery and/or reuse of spent acids and caustic;
- incineration;
- oil recovery and reclamation.

Hazardous waste management techniques such as these are consistent with the RCRA philosophy of reclamation and recycle. However, at the present time and with information available regarding the types of wastes to be received at the proposed BFI facility, the above hazardous waste management alternatives do not appear to be feasible. Nevertheless, it should be pointed out that tankage will be provided at the proposed facility to allow segregation, accumulation, and trans-shipment of those wastes which, where practical, can be reclaimed or reused.

1.5 FACILITY OVERVIEW

1.5.1 General

Chemical wastes are received in one of three forms: solid, liquid, or an intermediate sludge, and may be in bulk quantities or containerized in drums. Solids normally present the fewest management problems. Liquid wastes can transmit hydraulic forces and, if merely buried, cannot readily be rendered immobile. BFI's management philosophy is to treat the wastes in such a manner that they become inert and/or physically immobile to the greatest extent possible. The result of the addition of the solidifying agent is for chemical bonding to form new compounds and/or

physical stabilization to convert a potentially mobile semi-solid or liquid waste into an immobile solid waste. Each waste stream is custom engineered to ascertain the best treatment and disposal methods.

Before BFI contracts for the treatment and disposal of an industrial waste, a sample of the material is sent to the BFI central laboratory in Houston, Texas. There the materials are evaluated and classified by trained chemists, using tests recognized by scientific authorities and the U.S. EPA. The results of these tests are used to determine the best, most environmentally acceptable treatment and disposal method. The wastes are then re-checked when received at the facility to ensure that the material being received is indeed the material expected.

Liquid and semi-solid wastes will be treated, as necessary, and solidified prior to disposal in a secure disposal cell, while solid wastes will be placed directly into the secure disposal cell. The primary treatment methods to be used are neutralization, oxidation, reduction, and stabilization. The neutralization process is particularly applicable to spent pickle liquors and other industrial waste acids. Lime or other alkaline additives, including compatible waste caustics are used to bring about the neutralization. Elevation of the pH allows heavy metals to precipitate from the neutralized wastes. The neutralized sludges are then solidified and deposited in secure disposal cells.

More advanced treatment may involve oxidation-reduction reactions such as the reduction of hexavalent chromium, which is water soluble, with ferrous iron. In this reaction, the chromium is reduced to trivalent chromium which is essentially insoluble at an alkaline pH. Final treatment consists of neutralization and solidification.

Many industrial chemical wastes are of a semisolid nature. They are too high in solids content to treat and discharge to surface waters, yet are not sufficiently immobilized to allow burial in even a properly designed, secure disposal cell. BFI's policy is to use both chemical and physical stabilization for such wastes where this action promotes long-term security in the final disposal environment.

Chemical stabilization consists of neutralization, lime stabilization, or some other "chemical" treatment. Physical stabilization may be accomplished by solidification using moisture absorption with a dry alkaline material such as waste kiln dust or Portland cement. The purpose of the kiln dust or Portland cement is to convert a potentially mobile semisolid waste to an immobile solid waste. BFI utilizes a proprietary chemical fixation process called LIQWACON^R, which combines both chemical and physical stabilization. This state-of-the-art process consists of mixing chemical reagents with certain inorganic waste streams which transforms the waste material from a pumpable semi-solid to a relatively inert solid.

Because the preferred solidifying agents are themselves waste by-products, the operation has the added benefit of conserving natural resources. In addition, where appropriate, further conservation of natural resources will be accomplished by recycling waste acids and caustics for waste-to-waste pH neutralization.

1.5.2 Adams County Treatment/Solidification and Disposal Site Facility Overview

As illustrated in Figure 1.2, the facility is located on a portion of nine sections of land in southeast Adams County, adjoining Washington and

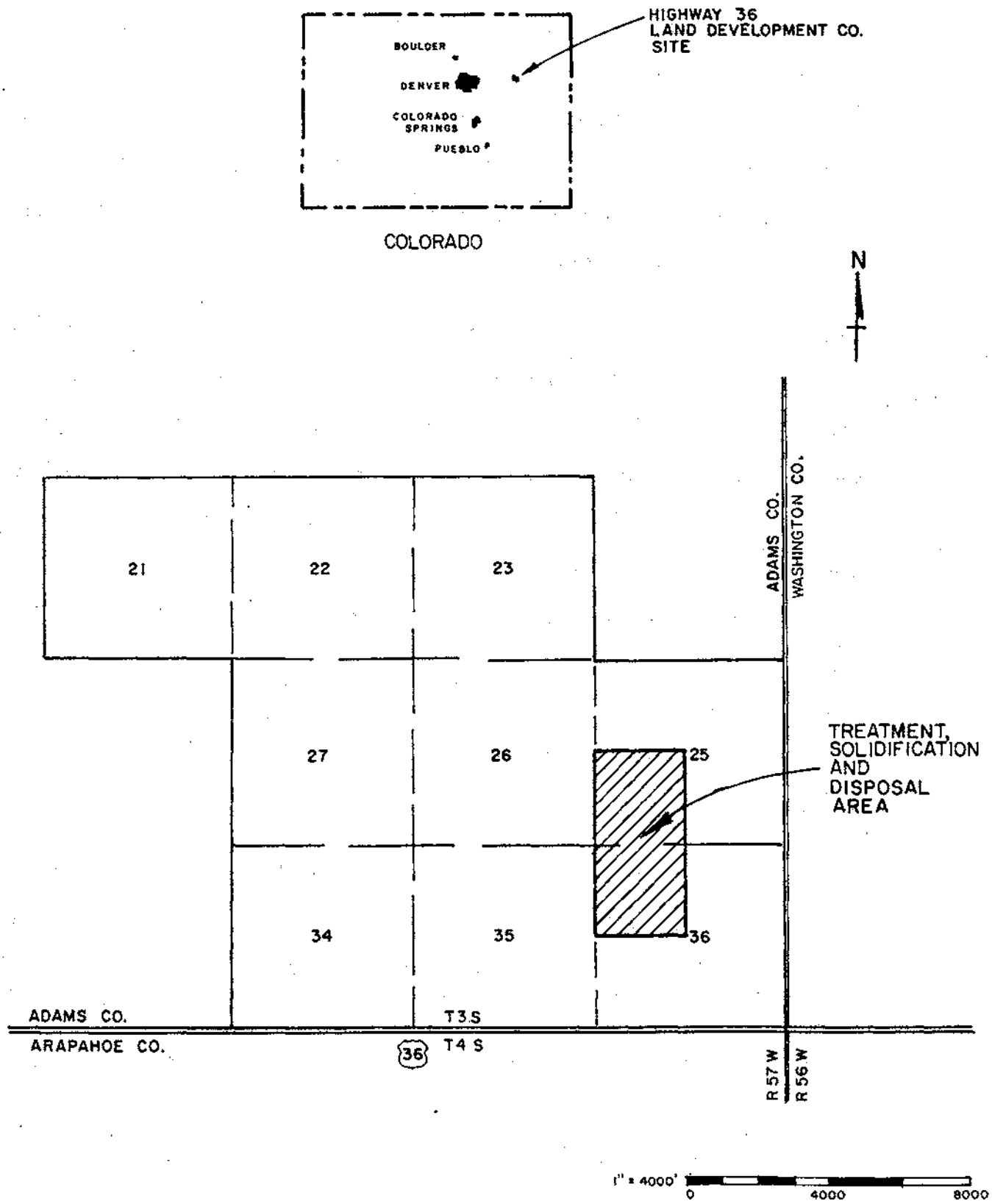


FIGURE Nº 1.2

SITE LOCATION

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Arapahoe Counties. Although the entire parcel is owned by BFI, only the quarter sections indicated in Sections 25 and 36 (a total of 325 acres) will be utilized for waste processing and disposal. Non-agricultural use of the other seven sections (which were purchased as part of a package) is not planned or anticipated.

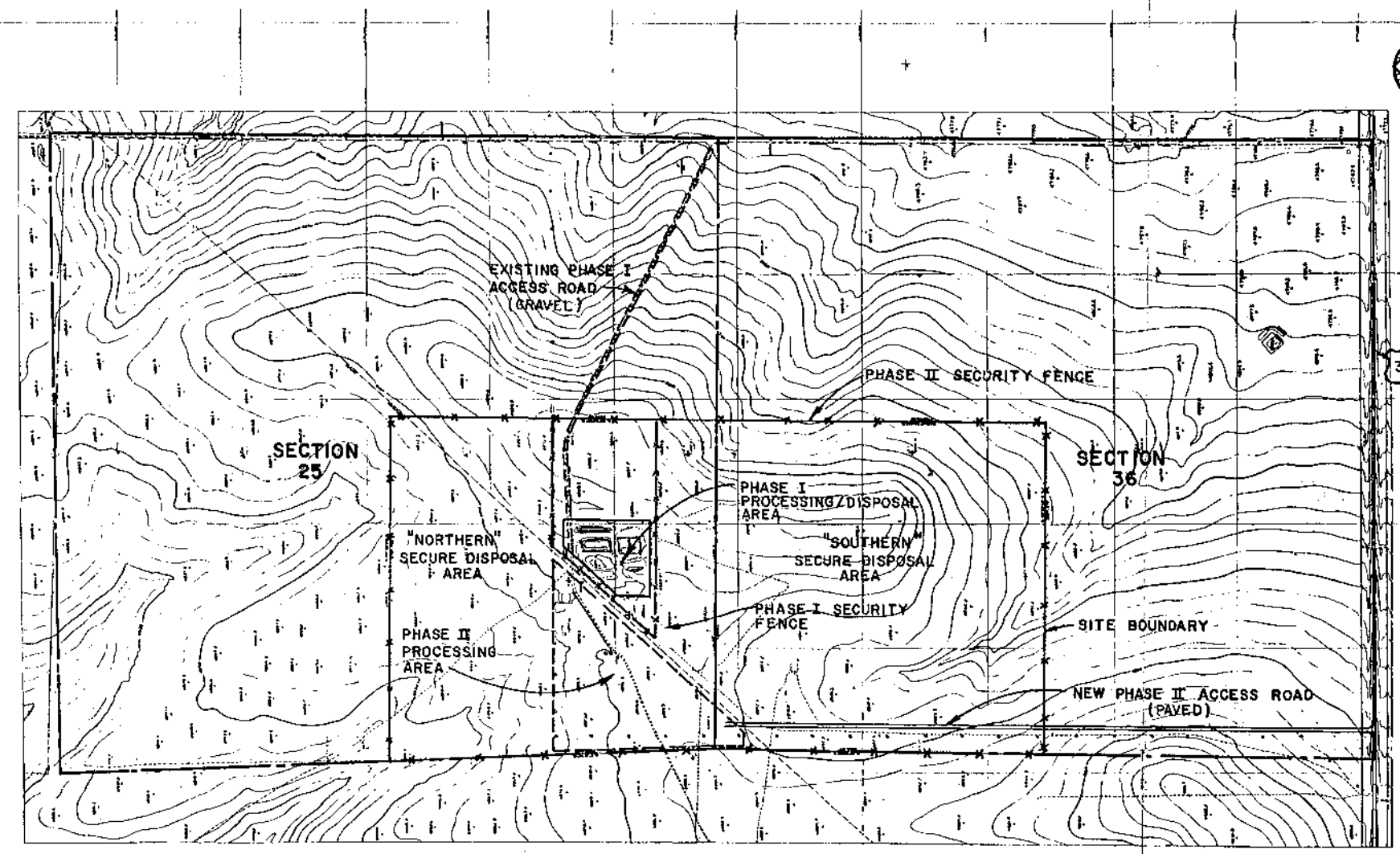
The facility concept consists of two basic operations. The first is treatment and solidification whereby liquid or semi-liquid chemical wastes are neutralized or otherwise treated as required and converted to a solid product by the addition of a dry reagent such as cement kiln dust or fly ash. The resultant treated/solidified product can be handled more easily and is very resistant to formation of leachate. The second operation is disposal of the treated/solidified product by burial in a secure disposal cell designed to prevent any release of contaminants to the environment. It is to be emphasized that only solid waste or solidified product (as opposed to liquids, containers of liquids, or intermediate sludges) will be placed in the secure disposal cell. The design of the secure disposal cells incorporates a head dissipating system, a five-foot clay liner, a leachate detection/collection system, and a four-foot clay cap. The liner was designed to ensure that no leachate could permeate to any clayey sand lenses infrequently encountered in some areas of the site. In addition, monitoring wells are planned at any secure cell site where a clayey sand lense is encountered.

Operation of the facility is anticipated to be conducted in two phases. Within the Phase I processing area, shown in Figure 1.3, the solidification operations would be conducted in clay-lined earthen cells. This "first generation" technique is presently and effectively utilized at the

BFI Calcasieu Parish hazardous waste site near Willow Springs, Louisiana. For Phase II (also shown in Figure 1.3), treatment and solidification would be conducted in concrete tanks like those employed at the BFI Livingston, Louisiana site. The Phase II facilities are regarded as "third generation" because in addition to the use of concrete tanks, the solidification operation would be totally enclosed in a building. The Phase I facilities would be placed into operation following approval from the Adams County Board of County Commissioners. Also upon approval, the detailed design and construction of the Phase II facilities will continue and be completed within about 24 months. Phase I operations would cease as soon as operation of the Phase II facility commences.

Waste processing during either phase will proceed in essentially the same manner, as illustrated in Figure 1.4. All materials will arrive at the facility by truck. Wastes will be unloaded into one of a series of reception chambers, to which the treatment and solidification reagents will be added and then mixed with a hydraulic backhoe. During Phase I, the solidification reagents will be fed to the waste reception chambers from portable storage trailers; whereas for Phase II operations, reagents will be fed from storage silos. A hydraulic backhoe or front end loader will be used to load the off-road dump truck which will be used to transport the finished product to the secure disposal cell. Final disposal operations will be suspended during periods of inclement weather.

The Phase I facility is designed to handle 8,000,000 gallons of waste annually, while the Phase II facility will be designed to handle an annual range of 10,000,000 to 12,000,000 gallons of waste. Assuming a maximum processing rate of 12,000,000 gallons per year, the projected life of the site would be approximately 40 years.



SCALE: 1" = 800'

0 800 1600

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED
	REVISED PHASE I FENCE								

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 15 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF PHASE I & PHASE II PROCESSING AREAS

SHEET NO. FIG. 1.3
OF

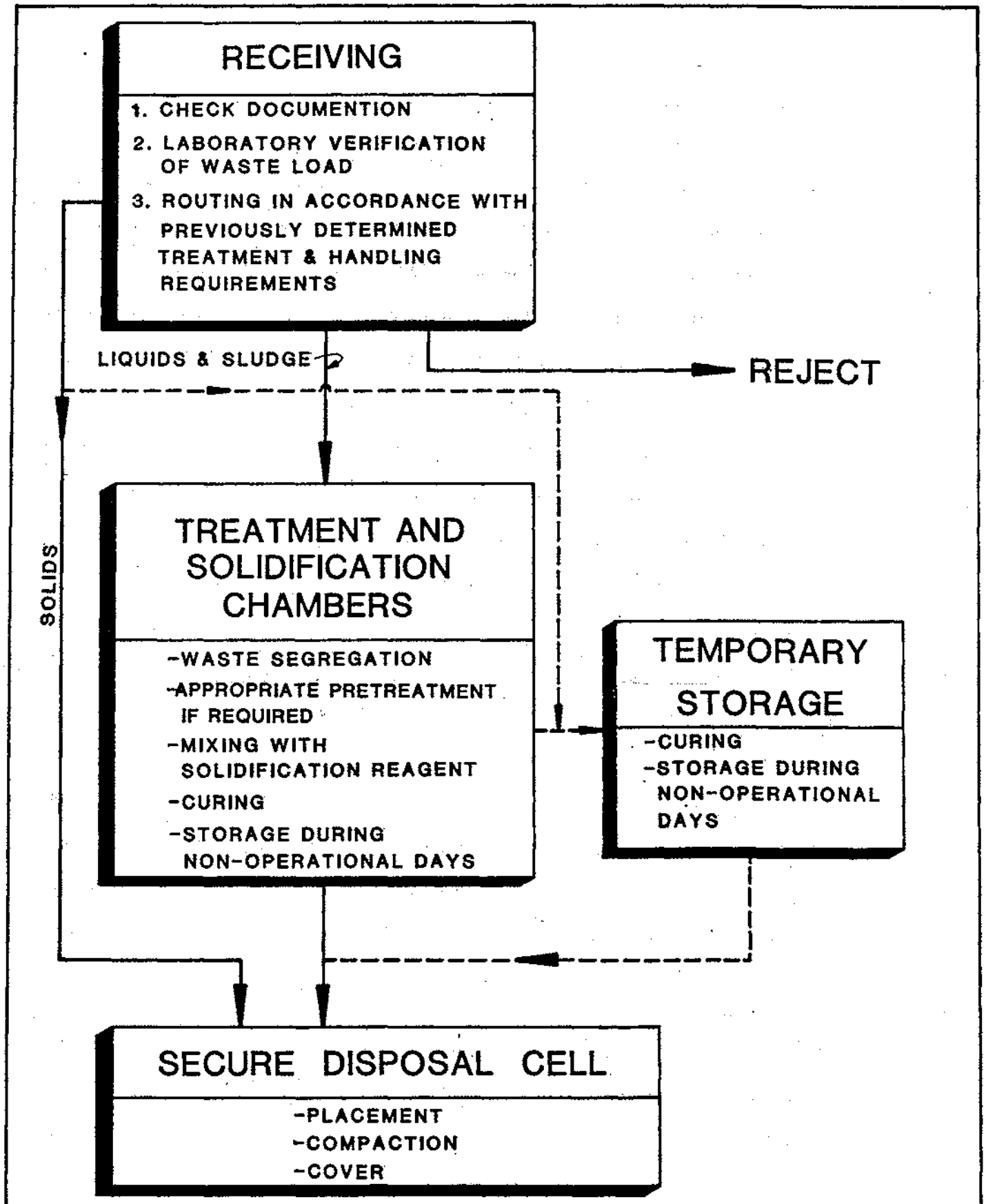


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FIGURE Nº 1.4
GENERAL WASTE PROCESSING FLOW CHART
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

1.5.3 Market Area

A great deal of concern has been expressed that if the hazardous waste disposal facilities proposed herein are constructed, Colorado will become a "dumping ground" for wastes generated outside the state. It is emphasized that this facility has been designed and planned expressly for the wastes that are being generated in Colorado and for the need that exists in Colorado. It is for this reason that the design waste loading for the facility is consistent with the estimated amount generated in Colorado. Although it is not and never will be the intent of the proposed facilities to dispose of significant volumes of out-of-state wastes, it would be impossible to guarantee that no out-of-state wastes will be accepted. However, the quantity should be minimal due to (1) the cost of transportation, (2) the availability of sites in other states (i.e., Oklahoma, Utah, Idaho, and Nevada), and (3) the lack of a significant amount of out-of-state waste generated within a reasonable distance of the site. As has been historically proven on a national level, it is because of factors such as these that no single location will ever become the dumping spot of the nation. Hence, the vast majority of the waste treated and disposed of at the proposed facility will have been generated within the state.

1.6 SCOPE OF REPORT

This report has been prepared to provide the Adams County Board of County Commissioners, the State of Colorado Department of Health, the U.S. Environmental Protection Agency, and interested persons a detailed and comprehensive description of the Phase I and Phase II Facility Plan. The Facility Plan presented herein is intended to meet or exceed the applicable federal requirements under the Resource Conservation and Recovery

Act for hazardous waste treatment and disposal facilities. Accordingly, many of the subsequent chapters have been organized to directly address considerations required by these federal regulations. In a similar vein, this Facility Plan is intended to meet or exceed the Adams County regulations (Appendix J), the Colorado Department of Health regulations (Appendix I), and Senate Bill 519 and related regulations(9). This report addresses the manner in which it is proposed to develop the facility, how decisions were arrived at, and how environmental considerations were taken into account in arriving at those decisions. Major topics developed and discussed herein include the following:

- Chemical Waste Inventory Analysis (Chapter 3);
- Transportation Analysis (Chapter 4);
- Existing On-Site and Off-Site Conditions (Chapter 5);
- Description of Facility (Chapter 6);
- Operational Controls and Monitoring (Chapter 7);
- Environmental Impact Assessment (Chapter 8);
- Qualifications of Proposer (Chapter 9).

An index summary of how the facility will be consistent with the various local, state, and federal regulations is presented in Table 1.1. Included in this table are the locations in the report where additional information (see Appendix K) requested by county and state agencies may be found.

TABLE 1.1

INDEX TO INFORMATION REQUESTED AND/OR REQUIRED BY STATE AND COUNTY

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
Adams County (4)	1. site selection process	Sections 1.1, 1.2, 6.1, 6.2.1
" "	2. qualifications of parent co.	Chapter 9; Appendix A
" "	3. assessment of impacts on migratory bird life	Section 8.6.2.2
" "	4. projected market areas	Sections 1.5.3, 3.1, 3.3
" "	5. housing and population within 10 miles	Section 5.8.3.3
" "	6. projected impacts on air quality	Sections 5.7.1, 8.5.1
" "	7. leachate control	Sections 6.5.2.4, 6.6.1, 7.6, 7.7.2.8.3, 8.4.2
" "	8. waste analysis list of materials expected to be received at the facility	Sections 3.2.4, 3.3; Appendix B
" "	9. plan for reporting monitoring results to Adams County	Sections 7.5.5, 7.6.6, 7.6.7
" "	10. summary of how proposed facility is consistent with local ordinances and plans	Sections 1.6, 8.6.3.1; Chapter 7
" "	11. resource recovery potential	Section 1.5.1
Adams County (5)	4.410 development drainage design	Sections 6.2.3, 6.2.7.2.2, 6.2.8, 6.3.3, 6.6
" "	4.420 areas subject to flooding	Sections 5.5.3, 8.4.1
" "	4.510 (2) site location	Sections 1.2, 1.5.2, 5.3, 6.1
	type of facility	Sections 1.1, 1.5.2, 3.2.1
	hours of operation	Sections 3.3, 6.4.1.2, 7.2.3
	method of supervision	Section 6.3.9
	rates to be charged	Section 6.7
	other information requested	Section 1.6
	engineering, geological, hydrological, operational data	Chapters 5, 6, 7, 8
" "	4.510 (3) names and addresses of nearby property owners	submitted under separate cover (4/6/81)
" "	4.510 (4) site plan	Sections 6.2, 6.3
" "	4.510 (6) certified boundary survey	Section 5.3
" "	4.510 (7) drainage and drainage facilities	Sections 6.2.3, 6.2.7.2.2, 6.2.8, 6.3.3, 6.6

Table 1.1
(Continued)

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
Adams County (5)	4.510 (8) additional information	Section 1.6
" "	4.530 (1) effect on surrounding property	Sections 8.6.3, 8.6.4
" "	4.530 (2) site access for potential users	Chapter 4
" "	4.530 (3) ability to comply with health standards, etc.	Chpater 7; Appendix A
" "	4.600 (3) legal description of property	Section 5.3.1
" "	4.600 (4) description of area	Section 5.8
" "	4.600 (5) description of operation	Chapters 6, 7, 8
" "	4.600 (6) description of site after use	Sections 6.2.2, 7.1, 8.6.2.1
Col.Dept.of Health(6)	1. feasibility of alternative sites	Sections 1.1, 1.2, 6.1, 6.2.1
" " " "	2. size and anticipated life of site	Sections 1.5.2, 6.1, 6.2.5, 6.2.6
" " " "	3. geotechnical evaluation of site	Section 5.4
" " " "	4. final location and design of all improvements proposed at the site	Chapter 6; Section 7.6.1
" " " "	5. construction reports for all improvements	to be submitted under separate cover
" " " "	6. equipment/area inspection schedules	Section 7.2.4
" " " "	7. sample manifest form	Sections 7.2.2, 7.5
" " " "	8. contractual agreements	Appendix M
" " " "	9. description of operational procedures	Chapter 7
" " " "	10. list of types of wastes anticipated	Sections 3.2.4, 3.3; Appendix B
" " " "	11. location of and procedures for monitoring of air, surface water, and groundwater quality	Sections 5.6, 5.7, 7.6
" " " "	12. corporate structure charts	Section 6.3.9
" " " "	13. qualifications and training of key site personnel	Sections 6.3.9, 7.2.5
" " " "	14. ability and intentions to respond to accidental chemical spills	Sections 4.2, 7.4
" " " "	15. provisions to contain and extinguish fires	Sections 7.3, 7.4
" " " "	16. plans for closure of the site	Section 7.7
" " " "	17. present zoning and land use of adjacent areas and impacts on surrounding properties	Sections 5.8.3, 8.6.3, 8.6.4

Table 1.1
(Continued)

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
Col.Dept.of Health(6)	18. provisions to restrict site access	Sections 7.2.3, 7.7.1.7
" " " "	19. inclement weather operating contingencies	Sections 1.5.2, 6.4.1.4, 6.4.3
Col.Dept.of Health(7)	1. potential waste sources and estimated quantities	Sections 3.2.5, 3.3; Appendix B
" " " "	2. potential air contaminants and control measures	Sections 5.7.1, 6.4.3.2.4, 6.4.3.2.5, 7.6.3, 8.5.1, 8.6.2.1.1
" " " "	3. base line hi-vol monitoring data	Section 5.7.1.3
" " " "	4. information relevant to fugitive dust emissions	Section 8.5.1
" " " "	5. site specific meteorological data	Sectioin 5.7.1.4
S.W.D.S.F.A. (8)	3.b. nuisance vector control	Section 8.6.2.2
"	3.c. compliance with laws, standards, etc.	Section 1.6; Chapter 7
"	3.d. radioactive wastes	Section 3.2.5
"	3.f. fencing	Sections 7.2.3, 7.7.1.7
"	3.g. prevention of waste burning	Section 7.2.6
"	4.a. protection of surface and subsurface waters from contamination	Sections 6.2.3, 6.2.7.2.2, 6.2.8, 6.3.3, 6.3.7, 6.3.8, 6.4.3.1, 6.4.3.2.1, 6.5.1.2, 6.5.2, 6.6, 8.3, 8.4
"	4.b. protection of water quality in nearby wells	Section 8.4
"	4.c. location of site relative to waste sources	Section 4.3
"	4.d. access routes to and from site and on site	Sections 4.3, 4.6.3, 6.3
"	4.e. compaction and cover of waste materials to prevent nuisance vectors	Sections 6.5.2, 8.6.2.2
"	4.f. compaction of waste materials	Section 6.5.2
"	4.g. windblown debris	Section 8.6.7
"	4.h. recycling operations	Sections 1.4, 1.5.1
"	4.i. prevention of waste burning; extinguishing of fires	Sections 7.2.6, 7.4
"	4.j. final closure	Section 7.7
"	4.k. flood protection	Section 5.5.3
"	6.a. person in charge of facility	List of Preparers

Table 1.1
(Continued)

Agency or Regulation (Ref.)	Subject	Location in Facility Plan Report
S.W.D.S.F.A. (8)	6.b. list of equipment to be used	Section 6.3
"	6.c. hours of operation	Sections 3.3, 6.4.1.2, 7.2.3
"	6.d. fire fighting equipment	Sections 7.4.9, 7.4.10
"	6.e. frequency of cover in disposal cells	Section 6.5.2.1
"	6.f. windblown debris	Section 8.6.7
"	6.g. plan for eradication of rodents and insects	Section 8.6.2.2
"	6.h. procedures for implementing other aspects of design	Chapters 6, 7, 8
Senate Bill 519(9)	2.3.1 CD application	Appendix D
"	2.3.2 names of owners, legal description, operation details	Chapters 4, 6, Appendix B
"	2.3.3 engineering report	Entire facility plan
"	2.3.4 demonstration of design performance	Chapters 6, 7
	2.3.5 info. for determination of compliance with design standards	Chapters 6, 7
"	2.4.1 maintenance of human health and environment	Chapter 8
"	2.4.2 prevent adverse groundwater impacts	Section 8.4.2
"	2.4.3 prevent adverse surface water impacts	Section 8.4.1
"	2.4.4 prevent adverse air quality impacts	Section 8.5.1
"	2.4.5 prevent adverse public health/environmental impacts	Sections 8.6, 8.7
"	2.4.6 protection of liner	Sections 6.5, 7.7
"	2.4.7 leachate and runoff control	Sections 6.5, 6.6
"	2.4.8 facility closure	Section 7.7
"	2.4.9 environmental monitoring	Section 7.6
"	2.4.10 construction certification	Section 6.5
"	2.5.1 guarantee of minimum performance standards	Chapter 7
"	2.5.2 demonstrate adequate fire protection, transportation, security, liner construction, staffing	Chapters 6, 7
"	2.5.3 adequate geohydrological conditions	Section 5.4
"	2.5.4 liner design	Section 6.5
"	2.5.5 leachate and runoff control systems	Sections 6.5, 6.6
"	2.5.6 minimum buffer zone	Section 8.6

1.7 REFERENCES

1. Hynes, Jeffrey L. and Sutton, Christopher J., "Hazardous Waste in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal," Colorado Department of Health and Colorado Geologic Survey, Denver, CO., 1980.

2. "Hazardous Waste Fact Sheet," EPA Journal, 5(2) 12 (February, 1979).

3. Executive Chambers, "Fact Sheet - Colorado Hazardous Waste Strategy," Sept. 14, 1982.

4. Mr. Jim L. Considine, Asst. Planning Director, Adams County Colorado, Letter of Correspondence to Mr. Robert Anzia, HNTB, Feb. 17, 1981.

5. 1980 Zoning Regulations of Adams County, Colorado.

6. Mr. Kenneth L. Waesche, Geologist, Radiation and Hazardous Wastes Control, Colorado. Dept. of Health, Letter of Correspondence to Mr. Fritz Easterberg, Highway 36 Land Development Co., Jan. 14, 1981.

7. Dr. James M. Lents, Director, Air Pollution Control Div., Colorado Dept. of Health, Letter of Correspondence to Mr. Fritz Easterberg, Feb. 13, 1981.

8. Solid Wastes Disposal Sites and Facilities Act, 30-20, 101 et seq. C.R.S. 1973, as amended.

9. "Rules and Regulations Pertaining to Solid and Hazardous Wastes, Part 2, Requirements for Siting of Hazardous Waste Disposal Sites." The Code of Colorado Regulations 6 CCR 1007-2 (promulgated as a result of Senate Bill 519).

CHAPTER 2

OBJECTIVES AND METHODOLOGY

2.1 FACILITY PLAN OBJECTIVES

The overall goal of this project is to develop an environmentally safe, technically feasible, cost-effective facility to treat and solidify liquid and semi-liquid chemical wastes and to dispose of solid chemical wastes on the selected site in specially constructed secure cells. To accomplish this goal, criteria were necessary to establish basic design requirements, to compare alternatives, and to evaluate the effects of the undertaking. The first step in the process was the identification of objectives which could subsequently be used as the basis for such criteria. As discussed below, these objectives are of two major types: objectives which refer to the procedure for undertaking the study, and objectives to be used for designing the facility.

2.1.1 Procedural Objectives

Procedural objectives are those which serve to ensure that the facility plan addresses the full range of environmental, technical, and regulatory issues. Specifically, these objectives are as follows:

- Obtain and review all relevant local, state, and federal regulations and guidelines.
- Ensure broadly based technical participation by county, state, and federal governments.
- Discuss preliminary facility plan concepts with governmental agencies to aid in identifying all applicable concerns.
- Ensure that the study process facilitates the preparation of an environmental assessment in accordance with the requirements of the Resource Conservation and Recovery Act and requests made by state and local agencies. (See Appendix K.)

- Ensure that the facility plan is documented in a form which is suitable for review and detailed evaluation by local, state, and federal authorities and for presentation at a formal public hearing.

- Incorporate within the facility plan all relevant federal, state, local, and public review comments concerning the full range of environmental and technical issues.

To assist in achieving these objectives, a multitude of informal and formal meetings and discussions have been held with governmental agencies as well as interested local persons, as summarized below:

- January 7, 1981 Meeting with Adams County Planning Department staff, representatives of EPA, Colorado Department of Health, Tri-County District Health Department, and members of the design team to discuss the nature of the project, permitting procedures, and issues to be addressed in the facility planning report.

- January 14, 1981 Presentation by representatives of BFI to the Governmental Refuse Collection and Disposal Association (GRCDA) regarding the hazardous waste solidification process. Members of GRCDA include private haulers, various county planning department officials, EPA officials, and public officials in the solid waste field.

- January 15, 1981 Meeting with Adams County Planning Department staff and design team representatives to outline the facility planning information under development.

- January 22, 1981 Public meeting initiated by CDH at Woodlin School.

- February 17, 1981 Presentation by representatives of BFI, Highway 36 Land Development Company, and design team members regarding the specific nature of the facility to representatives of state and local government, state and local agencies, and interested persons.

- February 26, 1981 Meeting at the Capitol Building of BFI, state agencies, general public, CCEC, and county officials.

- April 15, 1981 State agency coordinated review meeting to set up the CDH review process.

- April 23, 1981 Background water sampling meeting with CDH, EPA, Tri-County Health Department, CCEC, Brush officials, Northeastern Colorado Health Department, and BFI.

- May 19, 1981 Emergency response system discussion by BFI with CDH.

- May 21, 1981 Emergency response system discussion by BFI with local officials.
- June 10, 1981 Meeting with EPA and BFI regarding technical assistance for Adams County.
- July 1, 1981 Meeting with CDH and BFI regarding water quality sampling procedures.
- September 21, 1981 Meeting with CDH, Department of Natural Resources, and BFI to discuss the design of the secure disposal cells.
- October 1, 1981 Meeting with CDH, CGS, and BFI to discuss the groundwater monitoring program.
- October 7, 1981 Discussion of most recent groundwater analyses by CDH and BFI.
- November 23, 1981 Representatives of state agencies met with BFI to discuss the BFI hazardous waste facility application.
- December 16, 1981 CDH and Adams County officials met with EPA to request technical assistance on a groundwater predictive model for the facility.
- February 25, 1982 BFI presentation on facility to Adams County Waste Advisory Committee.
- March 4, 1982 Public meeting on BFI site at Woodlin School.
- April 14, 1982 BFI presentation to Strasburg Service Club.
- April 15, 1982 Question/answer session presented by BFI on radio station KFTM.
- April 15, 1982 Presentation by BFI to Fort Morgan Chamber of Commerce.
- May 10, 1982 Adams County Planning Commission hearing for a conditional use permit.
- May 24, 1982 Certificate of Designation hearing before Adams County Commissioners.
- June 2, 1982 BFI presentation to Commerce City Rotary Club.
- July 13, 1982 Meeting with EPA and BFI representatives.

In addition to the above, site visits were conducted by representatives of BFI or the design team on the following occasions:

October 31, 1980	- Colorado Department of Health and Colorado Geological Survey: Pre-construction meeting.
Janaury 7, 1981	- Representatives from the EPA, Tri-County District Health Department, and the Colorado Department of Health.
January 22, 1981	- Colorado Department of Health.
February 13, 1981	- Colorado Division of Wildlife.
July 13, 1981	- Colorado Department of Health visit to split water samples.

Additional public participation will take place during the formal public hearing stage after this revised facility plan report has been resubmitted to the various reviewing authorities.

2.1.2 Design Objectives

The design objectives were divided into six major categories: risk, service, acceptability, uncertainty, flexibility, and costs. Particular emphasis has been placed upon the development of a facility design which eliminates the risk to human health and safety, both in the work place and in the general environment.

Service objectives were considered important because a waste handling system that is efficient in terms of its operating procedures, monitoring programs, and remedial action plans has a greater likelihood that:

- the potential for accidental release of waste materials at the site will be minimized;
- accidental releases will be detected and the necessary remedial action taken to prevent off-site effects.

Both of these service considerations relate directly to the need to eliminate risk to human health.

The acceptability objective was considered in the sense that the facility and associated handling systems must conform with all appropriate federal, state, and local regulations. Similarly, the project must recognize all appropriate federal, state, and local guidelines, policies, and programs. The uncertainty of the process has been mitigated through the use of proven technologies.

The flexibility objective was considered so that the viability of the facility can be continually reassessed to assure that the needs of the State of Colorado are being met as far as hazardous waste management is concerned. Therefore, the need exists to incorporate sufficient flexibility into the facility design such that it will be feasible to increase the throughput of chemical wastes. Further, the need also exists to reserve on-site space for alternative methods of chemical waste handling procedures, such as resource recovery or incineration, so that a greater diversity of wastes can be accommodated if required.

Despite the importance of the cost objective, costs cannot be traded off for risk to human health. Consequently, only when alternatives remained after consideration of the other objectives were cost constraints a factor in the decision.

In summary, the facility plan objectives were as follows:

- o Risk
  - Eliminate risk to human health
  - Eliminate risk to natural environment
  - Avoid risk of community disruption
- o Service
  - Maximize efficiency in operation of waste handling system
  - Maximize efficiency of monitoring of facility and environmental conditions
  - Maximize efficiency of remedial actions

- Acceptability
  - Ensure compliance with federal, state, and local regulations
  - Recognize federal, state, and local guidelines, policies, and programs

- Uncertainty
  - Ensure use of proven technologies in waste handling and processing systems

- Flexibility
  - Provide flexibility for alternate future disposal options for chemical wastes, if necessary
  - Provide flexibility to accommodate variations in waste quantity and quality

- Cost
  - Minimize development and operational costs for disposal facility consistent with other objectives outlined above

2.2 FACILITY PLANNING METHODOLOGY

2.2.1 Introduction

The facility planning methodology involved six major thrusts of activity:

- inventory of chemical wastes within the State of Colorado that are compatible with the solidification process;

- assessment of the adequacy of transportation routes;

- characterization of existing on-site and off-site conditions;

- design and layout of the facility complex and the selected site;

- development of operational plans, monitoring plans, contingency plans, and closure plans;

- assessment of effects that the facility would have on existing on-site and off-site conditions.

Although these activities are described in separate sections of the report, they are closely interrelated. Because of the iterative nature of the decision-making process, the flow of information from one activity to another was of paramount importance during the entire facility planning effort. In general, this facility plan evolved in the following manner:

- Initial consideration given to the functional requirements of the facility and to existing site conditions resulted in various alternatives for facility layout, design, and operation.

- Evaluation of these alternatives in terms of their engineering and environmental suitability formed the basis for selecting a preferred concept.

- Detailed evaluation of the operational requirements and environmental impacts then served to refine and optimize the facility design.

- Review of the original facility plan by regulatory agencies and the public allowed all parties an opportunity to express their concerns relative to the environmental and technical issues.

- Revision of the original facility plan provided a means of integrating previous review comments and responses into the facility plan, and clarifying issues of public concern raised during the public hearing for the original plan(1,2,3,4,).

2.2.2 Study Process

As noted previously, the initial step in the study process was to establish the facility plan objectives so as to provide overall direction to the study. Concurrent with the formulation of these objectives, the waste inventory analysis, transportation analysis, site characterization, and preliminary design activities were initiated, as discussed below.

Estimates of waste types, quantities, and sources that might be received at the facility were initially derived from the hazardous waste inventory report prepared by the Colorado Departments of Health and Natural Resources(5). These estimates were then revised on the basis of more recent inventory data obtained from the Colorado Department of Health(6). Technical data regarding the treatment and solidification process to be used were supplied by BFI. A review of comparable projects was undertaken including visits to existing BFI facilities.

Based on the anticipated range of waste volumes to be processed and the related quantities of reagents required, estimates could then be made regarding the amount of traffic that would be generated by the site and the adequacy of existing transportation routes.

Extensive field studies were performed to characterize the existing on-site and off-site conditions. These included the following:

- general and site specific geological and hydrogeological investigations;
- boundary surveys;
- aerial photography (detailed site topography);
- sampling and analysis (baseline water qualities);
- biological reconnaissance;
- historical and archaeological surveys;
- land use and population surveys;
- surface drainage studies;
- other baseline environmental data (e.g., climate, noise levels, etc.).

The baseline data for the site and its environs together with preliminary design concepts were used to develop alternative facility layouts. Consideration given to on-site traffic patterns, secure disposal cell development, space utilization and cut and fill requirements provided the basis for selecting the optimum site plan layout.

With the conceptual layout of the facilities completed, the facility operational plans, monitoring plans, and contingency plans were then developed. These, in turn, resulted in refinements made to the facility layout.

A detailed evaluation of the effects of the project was then undertaken, based on:

- the likely characteristics of the facility and access to it;
- the potential effects the facility could have on people and the environment;
- the experience of the study team members.

Where required, mitigative measures were formulated and the residual effects identified.

2.2.3 Review Process

The final phase of the facility planning process involved review of the facility plan by regulatory agencies at the federal, state, and local levels; referral agencies; potentially affected local governmental entities; and concerned citizens/groups. In April 1981, a total of 85 copies of the original facility plan(1) were made available for review by the agencies and citizens/groups listed in Table 2.1. The review of the facility plan was coordinated with several state agencies, and numerous public meetings were held to receive public input on the proposed project. These meetings included the following in addition to those previously listed in Section 2.1.1:

- April 13, 1981 - Public meeting initiated by CDH at Bennett High School.
- April 30, 1981 - BFI presentation of proposed facility to general public and Bennett High School Science Club.
- May 15, 1981 - Meeting of officials of concerned municipalities.
- May 16, 1981 - Meeting with Fort Morgan Chamber of Commerce.
- June 18, 1981 - Public meeting initiated by CDH at Woodlin School.
- August 8, 1981 - Meeting to discuss how proposed CDH regulations affect BFI facility.

TABLE 2.1

DISTRIBUTION LIST FOR FACILITY PLAN REVIEW

ADAMS COUNTY

Planning Staff
Commissioners Office
County Attorney
Planning Commission Members
Engineering Department
Building Department

AGENCIES

Colorado Department of Health
Environmental Protection Agency
Tri-County District Health Department
Colorado Wildlife Division
State Land Use Commission
State Engineers Office
Colorado Geological Survey
State Highway Department
Soil Conservation Service
Byers School District
State Highway Patrol
Deer Trail Fire District
FEMA
Public Service
Adams County Farm Bureau
Byers Fire Department
Strasburg Fire Department
Bennett Fire Department
Hazardous Response District

AFFECTED GOVERNMENT ENTITIES

Washington County
Arapahoe County
Lincoln County
Denver County
Last Chance
Fort Morgan
Brush
Byers
DRCOG

INTEREST GROUPS

Concerned Citizens of Eastern Colorado

The comments received from reviewing state agencies and the public were incorporated into a list of 231 questions, compiled by the Waste Management Division of the Colorado Department of Health. These were submitted to BFI for response(2). The original facility plan, and related documents including the responses to the 231 comments, constituted the complete application package which Adams County forwarded to the Department of Health on December 23, 1981 for a finding of fact. The Waste Management Division of the Department of Health determined that "the site proposed by Browning-Ferris Industries would be able to comply with the regulations adopted by the Board of Health pursuant to Section 25-15-208 of the Hazardous Waste Act C.R.S. 1973 as amended, if it was constructed and operated in accordance with the design and procedures contained in the application documents..."(8). Other technical reviews and evaluations, e.g., those prepared by SCS Engineers, Inc.(9) and Sheaffer Roland, Inc.(10), were similarly favorable.

The most recent stage of the review process involved a public hearing held by the Adams County Board of Commissioners to receive testimony regarding facilities proposed by BFI's first application. This public hearing was a requirement for obtaining a Certificate of Designation to operate the facilities described in that application, such Certificate to be issued by the Adams County Board of Commissioners. The public hearing was held on May 24-25, 1982 from 9:00 A.M. to 4:45 A.M. At this hearing, the Adams County Commissioners heard testimony from parties both for and against the facilities prior to their decision regarding the Certificate of Designation.

Based on the original facility plan, as submitted at that time, the Adams County Board of Commissioners voted to reject BFI's application. Shortly thereafter, however, there became a clearer need for this facility due to (1) the recent closure of the Lowry Landfill and (2) the results from a new hazardous waste inventory survey. In response to the need, the revised facility plan contained herein was prepared. For clarity, it incorporates the responses to the previous review comments. In addition, it further addresses concerns brought up at the public hearing. Thus, numerous minor changes and, in some cases, major revisions have been made to the facility plan document submitted in April 1981. The most notable revisions are as follows.

- Reduction of the peak annual design processing rate during Phase II operations from 48,000,000 gallons to 12,000,000 gallons, and reduction of the average annual design processing rate from 24,000,000 gallons to 10,000,000 gallons. These reduced waste processing rates are in accordance with estimates derived from recent inventory data obtained from the Colorado Department of Health(6). As a consequence, the size of related Phase II treatment/solidification processing facilities has been scaled down accordingly.

- Secure disposal cell design modifications, including the following:

  - A separate leachate detection/collection system will be installed in addition to the head dissipating/collection system.

  - The thickness of the sidewall liners has been increased from 5 feet to 6.7 feet.

  - The minimum thickness of the compacted clay cap has been increased from 3 feet to 4 feet.

  - The minimum thickness of topsoil cover has been increased to 2 feet.

- A more comprehensive environmental monitoring plan, particularly with respect to the groundwater monitoring program(7). Groundwater in the vicinity of the secure cells will be monitored by a network system consisting of six "levels of monitoring." The various levels are based on the geologic and hydrologic conditions beneath the site and the design and location of the disposal cells.

- Modification of the overburden placement plan to avoid construction of secure cells in overburden.

The bulk of these major revisions have been incorporated into Chapters 6 and 7 of this facility plan. Table 2.2 indexes the sections of the facility plan which have been revised and the nature of the revision.

2.3 REFERENCES

1. Highway 36 Land Development Company, "Chemical Waste Treatment/ Solidification & Disposal Facility Plan," April 6, 1981.

2. Hazle, A. J., Director of Radiation and Hazardous Waste Control Division, Colorado Department of Health, letter of transmittal to Mr. Steve Custer (BFI), July 21, 1981.

3. Custer, S., District Manager, BFI, letter of transmittal to Mr. Jim L. Considine (Adams County Planning Commission) regarding responses to facility plan review comments, December 7, 1981.

4. Public Hearing, "Application of Highway 36 Land Development Corporation for a Conditional Use Permit and a Certificate of Designation to Operate a Chemical Waste Treatment and Disposal Facility in Adams County, Colorado," May 24, 1982.

5. Hynes, Jeffrey L. and Sutton, Christopher J., "Hazardous Waste in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal," Colorado Department of Health and Colorado Geologic Survey, Denver, Colorado, 1980.

6. Colorado Department of Health, "1982 Hazardous Waste Survey," September 2, 1982.

7. Fox and Associates, "Environmental Monitoring Plan for Highway 36 Land Development Company," Adams County, Colorado, December 2, 1981.

8. Colorado Department of Health, Waste Management Division, "Finding of Fact," letter to Mr. Steve Cramer (Chairman, Adams County Commissioners) from Mr. Kenneth L. Waesche (Acting Director, Waste Management Division), March 19, 1982.

9. SCS Engineers, Inc., "Review of Proposed Highway 36 Land Development Company Hazardous Waste Treatment/Disposal Facility Plan," letter report to Mr. J. L. Considine, May 19, 1982.

TABLE 2.2

CHAPTER SUMMARY OF MAJOR REVISIONS TO ORIGINAL FACILITY PLAN

Chapter 1 - Summary

- Expanded description of site selection process.
- Emphasized need for the facility based upon new CDH waste survey and closure of other existing facilities.
- Reduced annual peak processing rate from 48,000,000 gallons to 12,000,000 gallons.
- Emphasized BFI philosophy to maintain treatment by state-of-the-art techniques throughout the site life.

Chapter 2 - Objectives and Methodology

- Updated list of formal and informal public meetings/hearing on facility and related matters.
- Described previous CD application history.

Chapter 3 - Chemical Waste Inventory and Compatibility Analysis

- Updated estimate of Colorado hazardous waste inventory based on recent CDH survey information.
- Reduced peak hazardous waste processing rate by 75% from 48 to 12 million gallons annually, per revised survey.
- Included analytical data for actual kiln dust to be employed as the solidification reagent.

Chapter 4 - Transportation Analysis

- Revised volume split by liquid/solid/drummed materials consistent with new CDH survey information.
- Reduced employee, reagent and waste traffic in accordance with reviseed waste load.
- Incorporated actual traffic survey data and traffic safety analysis.

Chapter 5 - Existing On-site and Off-site Conditions

- Added discussions to clarify issues regarding mining activities, water rights, land use, plans and zoning.
- Revised surface runoff calculations to more accurately estimate actual rainfall runoff availability.
- Updated baseline water quality data (summary of one year of monitoring data).
- Expanded inventory of historical rainfall data.

Chapter 6 - Description of the Facility

- Revised placement of overburden outside of the active site to avoid constructing secure disposal cells in overburden.
- Reduced the peak annual processing rate by 75% from 48 to 12 million gallons. Average processing rate was reduced from 24 to 10 million gallons. The solidification and maintenance buildings and general facility operations during Phase II operations were scaled-down proportionately.
- Reduced the number of 6,000 gallon tanks within the tank farm from 14 each to 4 each.
- Revised hours of operation.
- Provided seepage detection system under Phase II mixing tanks.
- Improved secure disposal cell liner and cap design.
- Improved liner design in non-contaminated, potentially contaminated and contaminated water holding ponds.

Chapter 7 - Operational Controls and Monitoring

- Revised chemical compatibility decision tree.
- Expanded emergency response system including contact priority, equipment, and off-site spill response.
- Expanded groundwater monitoring plan to incorporate six level monitoring program.
- Updated closure and post-closure cost estimates.

Chapter 8 - Environmental Impact Assessment and Mitigating Measures

- Expanded discussion regarding land use and zoning impacts.
- Revised revegetation plan.

Chapter 9 - Qualifications of BFI

- Updated information regarding BFI facilities.

10. Sheaffer & Roland, Inc., "Review and Evaluation of Browning-Ferris Industries Application for Certificate of Designation," summary findings report, prepared for City of Aurora, Colorado, February 1982.

11. Ertec, Inc., "Program Management Assistance Predictive Flow Models for the Proposed Highway 36 Land Development Company Facility, Adams County, Colorado," report prepared for U.S. EPA Region VIII, May 18, 1982.

CHAPTER 3

CHEMICAL WASTE INVENTORY AND COMPATIBILITY ANALYSIS

3.1 CHEMICAL WASTE INVENTORY IN COLORADO

In the original facility plan submitted in April 1981, the estimates of waste types and quantities that could be received at the facilities were based on a survey conducted jointly by the Colorado Geological Survey's Department of Natural Resources and the Colorado Department of Health(1). This survey was published in 1980. A more recent survey has since been conducted in September 1982 by the Colorado Department of Health(2). The results of this latter survey indicated that the volume of hazardous waste generated in Colorado was significantly less than that indicated by the 1980 survey. Although the volume of hazardous waste produced was much less, the geographical distribution of hazardous waste generators and the proportionate quantities generated in the various geographical locations would probably be the same as in the 1980 survey. Because the 1980 survey established the geographical locations of hazardous waste generation in Colorado and because the 1982 survey reflects the most recent estimate of the volume of hazardous waste generated in Colorado, both surveys are discussed in the following sections.

3.1.1 1980 Chemical Waste Inventory in Colorado

An inventory of industrial wastes in Colorado was jointly compiled by the Colorado Geological Survey's Department of Natural Resources and the Colorado Department of Health and was published in a 1980 report entitled "Hazardous Wastes in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal"(1). For that report, the University of Colorado Business Research Division was contracted to provide a list, by

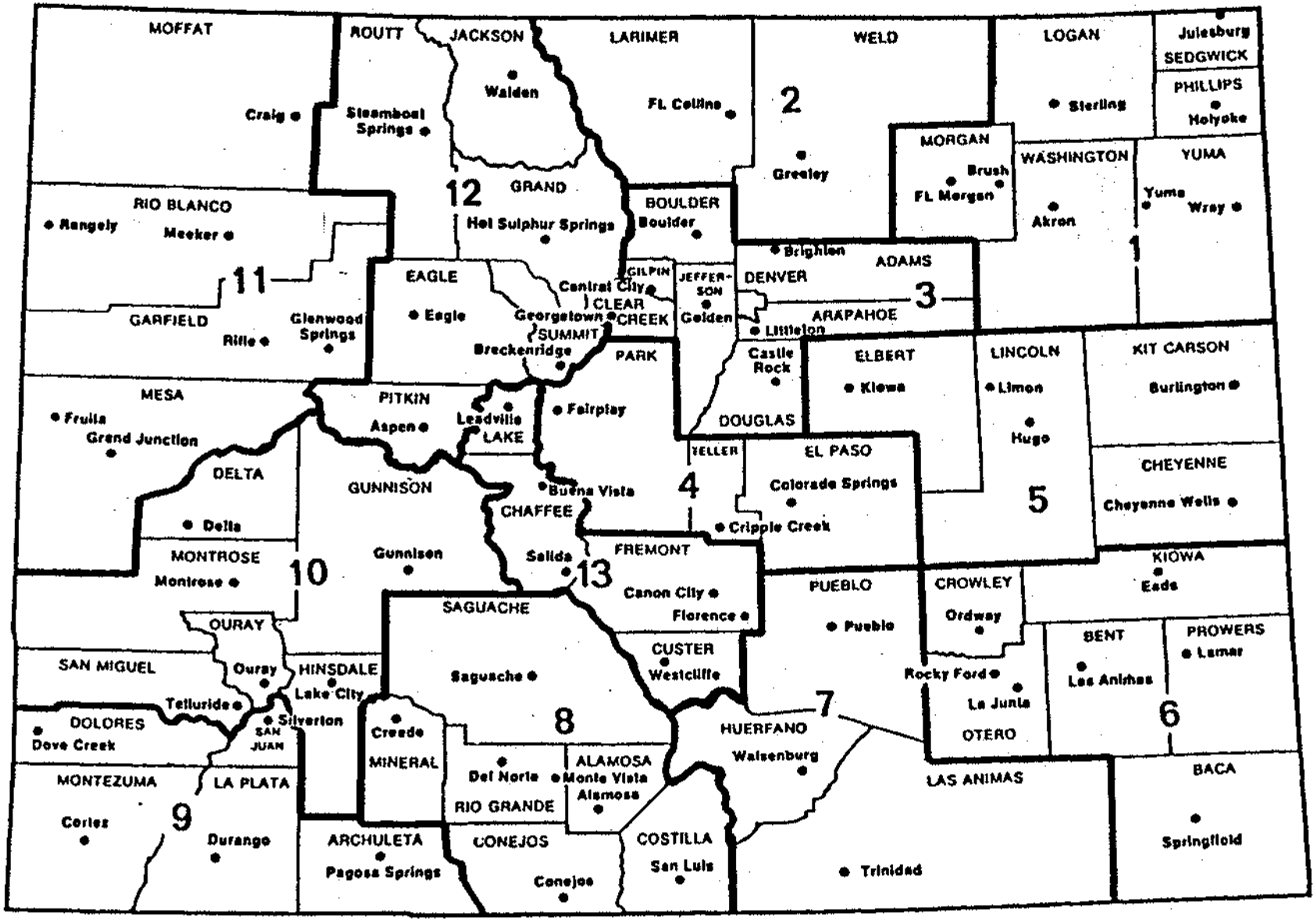
county, of all companies registered in Colorado that were potential generators of hazardous wastes. The State canvassed additional potential hazardous waste sources, including hospitals, universities, and State and Federal facilities.

The hazardous waste inventory was accomplished through a questionnaire which served to characterize the wastes in terms of waste type (using a code system), composition, concentration, and present and projected volumes for the next five years. Of the 1,562 questionnaires that were sent out statewide, 61.5% responded. It is important to point out that 92% of the largest firms (greater than 250 employees) responded. Thus, it was felt that the inventory provided a reasonable assessment of the geographic distribution of hazardous waste generators in Colorado.

For the purposes of reporting the inventory results, the State was broken down into the 13 regions illustrated in Figure 3.1. Table 3.1 presents a regional breakdown of the hazardous wastes quantities generated throughout the regions. As can be seen, the study indicated that 99.7% of the hazardous wastes in Colorado are generated in the Front Range Regions 2, 3, 4, and 7.

3.1.2 1982 Chemical Waste Inventory in Colorado

During September 1982, the Colorado Department of Health conducted a survey of the primary generators of hazardous waste in the state. The survey was conducted to collect information on the types and volumes of hazardous wastes produced and the disposal methods used by Colorado generators. A total of 239 hazardous waste generators were contacted in the survey, 211 of which agreed to participate.



HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

FIGURE Nº 3.1
COLORADO PLANNING & MANAGEMENT REGIONS
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TABLE 3.1

REGIONAL BREAKDOWN OF HAZARDOUS WASTES GENERATION IN THE STATE OF COLORADO(1)

Colorado Region	Hazardous		Extremely Hazardous		Total Tonnage**	% of Colorado Annual Waste Inventory
	Gallons	Tons**	Gallons	Tons**		
1	40	-	-	3	3	-
2*	4,578,247	1,266	45,513	92	24,477	2.86
3*	25,589,483	150,831	1,361,519	47,541	333,127	38.94
4*	45,240,105	482	6,143,755	308	257,710	30.13
5	-	-	-	-	-	-
6	131,610	69	600	-	730	0.08
7*	521,367	236,028	600	-	238,636	27.94
8	-	-	-	-	-	-
9	3,300	226	-	-	243	0.03
10	150	93	-	15	109	0.01
11	300	29	-	-	31	.004
12	-	-	-	-	-	-
13	-	20	-	-	20	.002
TOTAL	76,064,602	389,044	7,551,987	47,959	855,086	100.0%

*Front Range Regions 2, 3, 4, and 7 account for 99.7% of hazardous waste generated statewide.

**A factor of 10 pounds per gallon was used for converting gallons to tons.

The survey was divided into three basic categories: (1) bulk-liquid non-hazardous waste; (2) bulk-liquid hazardous waste; and (3) non-bulk containerized liquid and solid hazardous waste. The waste generated by each participant was further subdivided into a general waste type, approximate volume range, and present disposal method.

Although the 1982 survey was not as detailed as the 1980 survey, it was felt that the 1982 survey results should be used in projecting potential waste volumes that could be received at the disposal facilities. The survey results, as received by BFI, were analyzed and then used to project the waste volumes summarized in Table 3.2.

TABLE 3.2

ESTIMATED WASTE VOLUMES IN COLORADO

Category	Total Gallons Produced		
	Minimum	Maximum	Average
1. Non-Hazardous Liquids	4,361,000	7,117,000	5,739,000
2. Hazardous Liquids	6,603,000	11,844,000	9,224,000
3. Containerized Liquid & Solid Hazardous Waste	660,000	2,546,000	1,603,000
Subtotal, Hazardous Waste (Gallons)	7,263,000	14,390,000	10,827,000
(Tons)*	30,300	60,000	45,100
Total (Gallons)	11,624,000	21,507,000	16,566,000
(Tons)*	48,500	89,600	69,000

*Using a conversion factor of 8.34 lbs./gallon.

As can be seen by comparison of the data presented in Tables 3.1 and 3.2, the 1982 projected volume of hazardous waste generated in Colorado is approximately one-tenth of the volume indicated during the 1980 survey.

The results of the 1982 survey are not expected to alter the proportionate geographical location of hazardous waste generation. It is anticipated that the Front Range Regions 2, 3, 4, and 7 will still account for 99.7% of the hazardous waste generated statewide.

3.2 WASTE COMPATIBILITY WITH THE TREATMENT/SOLIDIFICATION PROCESS

3.2.1 Description of Treatment/Solidification Process

The main function of the facility will be the treatment and solidification of liquid and semi-liquid chemical wastes with reagents for subsequent burial in a secure disposal cell and the direct landfill burial of solid chemical wastes. There is no liquid effluent produced from this process, and, therefore no need for surface discharge. Solidification of the wastes produces a product that is easier and safer to handle and is very resistant to the formation of leachate.

As mentioned in Chapter 1, the Phase I solidification process will take place in clay-lined earthen cells. Liquid and semi-liquid wastes will be mixed with reagents from portable bulk storage vehicles. The Phase II process will take place in a large metal building which will contain several large mixing tanks and solidified product storage areas with outdoor reagent storage silos. The liquid and semi-liquid wastes will be mixed in the tanks with the reagent from the silos.

The resultant product will be a solid of relatively low permeability. This solidified product will be buried in specially constructed secure disposal cells at adjacent portions of the site. Areas will be provided for temporary storage in the solidification building during inclement weather. A more complete description of the facility is presented in Chapter 6.

3.2.2 Types of Reagents

The two primary reagents to be used in the treatment/solidification process are cement kiln dust and/or fly ash. Typical leachate characteristics of these reagents are given in Table 3.3. Also given are characteristics of Portland cement, which could also be employed in the event of shortages of the other materials.

Kiln dust is a waste product from the manufacture of Portland cement and is the preferred reagent. Generally, it takes about two volumes of kiln dust to one volume of liquid waste to carry out the solidification process. The solidified product has a volume about twice that of the original waste.

BFI intends to obtain kiln dust from the Martin Marietta Cement Plant at Lyons, Colorado. A recent analysis of the kiln baghouse dust, performed by Martin Marietta, is given in Table 3.4.

Fly ash is a waste product from the generation of electricity at coal fired power plants. This reagent is normally less effective than the kiln dust and its use would generally be restricted to those instances where either the kiln dust would react adversely with the wastes or inadequate volumes of other reagents were available. Typical waste types not suitable for solidification with fly ash are strong acids (depending upon the pH of the fly ash), volatile solvents, and flammables. Generally, about three volumes of fly ash per unit volume of waste is required for the solidification process.

TABLE 3.3

LEACHATE CHARACTERISTICS OF SOLIDIFICATION REAGENTS

Parameters	Kiln Dust(3)	Kiln Dust(4)	Cement(4)	Fly Ash(4)
pH	>12.0 (5% slurry)	12.8	12.0	4.7
Total Solids Wt. (%)	-	1.06	0.33	2.40
Chloride	-	585	76	<15
Sulfate	-	3,000	1,500	1,450
Color (Alpha Units)	-	<20	<20	<20
Barium	2.4	0.5	0.3	0.1
Manganese	-	<0.10	<0.10	0.23
Boron	-	<0.5	<0.50	11
Arsenic	0.049	<0.010	<0.010	<0.010
Cadmium	<0.01	<0.010	<0.010	0.028
Copper	-	<0.10	<0.10	0.28
Chromium	<0.10	<0.1	<0.10	<0.1
Mercury	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	-	<0.10	<0.10	0.13
Silver	<0.10	<0.10	<0.10	<0.10
Zinc	-	<0.10	<0.10	0.44
Lead	<0.10	<0.1	<0.10	0.1
Selenium	0.056	<0.010	<0.01	<0.010
Total Organic Carbon	-	24	9	<5

NOTES:

A. Units are mg/l unless otherwise stated.

B. The leaching tests for the above samples from Ref. 4 were performed using a shake test based on the ASTM proposed procedure, Method "A" now designated ASTM Method D3987-81, "Standard Test Method for Shake Extraction of Solid Waste with Water." The RCRA leachate test procedure, used for the above sample from Ref. 3 (except pH), is described in 40 CFR Part 261, Appendix II, "EP Toxicity Test Procedures." Both methods are intended as a means of obtaining an extract from a solid waste. In both cases, deionized water is used as the extractant, but the ASTM method makes no attempt to adjust the pH of the extract. The RCRA method requires that a pH of 5.0 or less be maintained by the use of 0.5 N acetic acid. The RCRA method agitates the mixture for 24 hours, while the ASTM method uses a 48-hour extraction period.

C. Both the cement and the cement kiln dust were obtained from manufacturing plants in the United States. The fly ash was obtained from a power generating station in Ontario, Canada. Although three of the four samples were not obtained from the exact sources that would be used at the solidification facility, they do show the characteristics typical of the materials which would be used as reagents. The first set of data given above for kiln dust leachate characteristics was obtained from the specific kiln dust that will be used at the site.

TABLE 3.4

ANALYSIS OF MARTIN MARIETTA KILN DUST

Parameter	Concentration (% by Weight)
SiO_2	17.02
Al_2O_3	4.74
Fe_2O_3	2.66
CaO	53.92
MgO	0.90
SO_3	6.25
Na_2O	0.12
K_2O	0.71
Cl^-	<0.10
Loss of Ignition (Moisture & Organics)	14.83
	101.15

BFI intends to use fly ash obtained from the Cherokee Plant, when needed, at the disposal facility. Samples of this fly ash were collected May 10, 1978, by Burke Lokey of the Radiation and Hazardous Waste Control Division of the Colorado State Health Department and analyzed in the Colorado State Health Department's Water Quality Laboratory. The results of this analysis are given in Table 3.5.

There are major cement plants in Colorado that generate waste kiln dust. Also, there are major coal fired power plants in the Front Range with an adequate supply of fly ash. On the basis of potential reagent sources surveyed, adequate volumes of reagents will be available for the treatment/solidification facility. Should these reagent sources become inadequate, commercial absorbents or Portland cement would be employed.

3.2.3 Solidification Process Reactions

Different reagent and waste combinations will be used at the site because the chemistry of the solidification process varies somewhat. BFI determines a waste is solidifiable by its physical properties not by leachate characteristics. Treatment and solidification involves the following physical and/or chemical reactions:

- hydration of cementitious materials in the reagents;
- absorption of the liquid by the solid reagent;
- precipitation of metal hydroxides;
- neutralization of acidic wastes by the excess alkalinity of the reagents.

The curing time of the solidified material is a function of the temperature, type of waste, and type of reagent used. Solidification retardation which might occur from sodium and other metal salts is not important

TABLE 3.5

ANALYSIS OF FLY ASH FROM CHEROKEE PLANT

Parameter	1% Solution CDH Sample #7143	10% Solution CDH Sample #7144
Aluminum (mg/l)	4.8	1.7
Total Hardness as $CaCO_3$ (mg/l)	180	820
Calcium as $CaCO_3$ (mg/l)	170	800
Magnesium (mg/l)	2	8
Sodium (mg/l)	1	6
Potassium (mg/l)	<1	2
Sulfate (mg/l)	35	200
Arsenic (mg/l)	0	0
Molybdenum (mg/l)	0.02	0.09
Chloride (mg/l)	6	8
Zinc (mg/l)	0	0
pH	11.4	12.1
Total Alkalinity as $CaCO_3$ (mg/l)	150	620
Dissolved Solids (mg/l)	200	880
Specific Conductance @ 25°C (umhos)	340	2280

because it is BFI policy not to place liquids or semi-liquids into a secure landfill. Wastes cure as long as necessary for proper solidification. It is noted that detergent cleaner does not have any effect upon the solidification process.

3.2.4 Product Characteristics

3.2.4.1 Appearance

When the chemical wastes are mixed with the reagents, the resultant product is a moist solid that will not flow. Over the next 24 to 72 hours, the product "cures" and becomes a soil-like product. A soil-like product is used as a descriptive term for a soil/cement type product which hydrates in a similar manner as concrete but ends up like a granular clay-type material. As indicated in Table 3.6, depending upon the reagent used, the solidified waste has a moisture content of around 30-45%.

It is important to point out that the moisture content range of 30-45% represents bound water within the material and essentially no free liquids. The fact that a material can have a significant moisture content and not contain any significant amount of extractable free liquid is further illustrated by the data presented in Appendix G relative to the moisture content of the subsoils at the site. Although the subsoils appear extremely dry, the moisture content at depths between 4 to 10 feet averaged about 12%, while at depths between 30 to 60 feet the moisture content averaged about 20%.

3.2.4.2 Leaching

Solidified wastes are very resistant to the formation of leachate. The characteristics of the leachate from solidified wastes are substantially

TABLE 3.6

PERMEABILITY TESTS ON SOLIDIFIED WASTE SAMPLES(4)

Sample Identification	Moisture Content Beginning of Test %	Dry Density ($lb./ft.^3$)	Permeability at 20°C (cm/sec.)
7149 kiln dust	44.7	71.1	1.8×10^{-6}
7150 kiln dust	48.3	72.7	4.4×10^{-6}
7151 kiln dust	44.4	74.4	2.5×10^{-7}
7152 kiln dust	33.9	77.0	1.2×10^{-7}
7153 kiln dust	40.0	75.9	9.3×10^{-7}
7093 fly ash	28.6	68.2	8.0×10^{-5}
7150 fly ash	31.7	81.2	2.6×10^{-5}
7151 fly ash	30.4	83.5	2.5×10^{-5}
7927 fly ash	31.4	78.9	4.1×10^{-5}

Permeabilities of samples solidified with Portland Cement were so low that difficulty was experienced in running the tests. For example, the results for sample 7151 Portland cement indicated a permeability of 2.1×10^{-10} cm/sec. It was estimated that all the samples solidified with Portland cement had a permeability of less than 10^{-8} cm/sec.

improved over the characteristics of the original waste material. Selected samples from typical industrial wastes have been solidified both with kiln dust and fly ash. The leachate test results are presented in Appendix E(4). The moisture retention capacity of the various materials used for treatment/solidification will be determined. The solidified product will be tested periodically to ensure that the moisture retention capacity remains within the desired range.

3.2.4.3 Permeability

Permeability tests have been performed on industrial wastes solidified with kiln dust, fly ash, and cement powder. The results, presented in Table 3.6, show the fly ash samples have permeabilities of 8×10^{-5} to 2.5×10^{-5} centimeter per second (cm/sec). The kiln dust ranges between 1×10^{-7} and 2×10^{-6} cm/sec., while the cement powder permeabilities are estimated to be less than 1×10^{-8} cm/sec. For comparison, the kiln dust samples have a permeability 1,000 (10^3) to 10,000 (10^4) times less than a fine sand.

There has been no documentation that decomposition of organics in the solidified sludge mass results in an increased product permeability. Because the solidified waste will be placed in a secure disposal cell, the permeability of the sludge mass is not a critical factor.

3.2.4.4 Strength

Another advantage of the solidified wastes is that they are strong enough to support conventional construction equipment during moving and disposal operations. To verify this, unconfined compressive strength tests have been conducted on solidified wastes(4). The results are presented in Table 3.7. This compressive strength has been further verified by

TABLE 3.7

UNCONFINED COMPRESSION TESTS ON SOLIDIFIED WASTE SAMPLES(4)

Sample Identification	Moisture Content Beginning of Test %	Dry Density ($lb./ft.^3$)	Strain (%)	Unconfined Compressive Strength ($lb./ft^2.$)
7149 kiln dust	49.0	68.7	13.0	516
7150 kiln dust	40.2	73.8	4.4	1,655
7151 kiln dust	45.2	71.7	11.0	1,784
7152 kiln dust	37.5	73.8	6.8	1,667
7153 kiln dust	44.2	72.5	11.1	2,007
7149 cement	22.6	103.1	0.8	21,946
7150 cement	24.6	82.2	1.4	67,392
7151 cement	19.2	92.9	1.5	187,258
7152 cement	26.2	74.4	0.9	15,293
7153 cement	17.8	93.6	1.1	160,963
7149 fly ash	31.0	78.3	3.9	1,483
7150 fly ash	-	-	2.9	2,534
7151 fly ash	32.3	80.7	4.6	2,938
7152 fly ash	21.3	81.3	2.3	1,728
7153 fly ash	27.9	82.1	1.8	2,736

experience at existing BFI treatment/solidification facilities. The compacted solidified product resulting from landfilling operations results in a dense landfill, reducing the potential for subsequent consolidation.

It is not anticipated that the decomposition of organics within the solidified waste will decrease the strength of the solidified material. Because of the volume of the reagent materials used, it is anticipated that the grain-to-grain relationships for the reagent material cannot be changed by decomposition of the material between the grains. However, to ensure that physical changes in the solidified waste are not occurring, a sampling and testing program will be established, as discussed in Section 7.6.

3.2.5 Waste Acceptability

Prior to accepting each waste stream at the facility, it will be subjected to rigorous chemical analysis and testing to ensure that it is compatible with the method of treatment and disposal proposed herein (see Chapters 6 and 7). Although the site will be capable of accepting a great variety of waste streams, those listed below will not be accepted.

- "Hydrophoric" Reactives
- Pyrophoric Reactives
- Class A Explosives
- Shock Sensitive
- Polychlorinated Biphenyls (PCB's)
- Dioxin (Agent Orange)
- Hexachlorocyclopentadiene (C 56)
- Radioactive Waste

A "hydrophoric" waste stream is one that will produce a violent reaction with water, such as aluminum alkyls and metallic sodium. Examples of pyrophoric wastes (those that produce violent reactions in air) are sodium, butyllithium, and lithium hydroxide. Class A explosive wastes include dynamite and fulminate of mercury. Shock sensitive wastes include trinitrobenzene and picric acid.

Some wastes may contain part per million (ppm) concentrations of some of the materials listed above, such as dioxins, PCB's, or C 56. As in the case of a waste such as a contaminated soil that contains less than 50 ppm of PCB, the waste is not classified as a PCB waste by the EPA and would be accepted.

As for dioxin contaminated waste, notification must be made to the EPA prior to disposal (40 CFR Part 775). This notification is required for any waste material resulting from the production of 2, 4, 5 trichlorophenol and/or its pesticide derivatives. If there is any reason to suspect that a waste stream is contaminated with dioxin or any other unacceptable waste, a representative sample will be sent to the BFI Houston lab or an approved lab in Colorado for verification.

Hexachlorocyclopentadiene is listed specifically because it is an intermediate for resins, dyes, fungicides, and pharmaceuticals as well as pesticides. It is excluded because this material has an extremely low threshold limit valve (TLV) of 0.01 ppm in air. Therefore, it is highly toxic by ingestion, inhalation, and skin absorption.

Disposal of radioactive wastes in any BFI landfill is strictly prohibitied. The term" "radioactive waste" is defined as follows:

> Radioactive waste means any waste which contains radioactive material in concentrations which exceed those listed in 10 CFR Part 20, Appendix B, Table II, Column 2, or exceeds the "Criteria for Identifying and Applying Characteristics of Hazardous Waste" in 40 CFR Part 261, whichever is applicable.

Organic liquids and sludges will be accepted if they meet the requirements of the BFI decision tree (see Chapter 6). The treatment and disposal depends upon characteristics of the individual waste streams. Some

disposal methods would be (a) solidification, depending on organic contaminates and concentrations in the waste; and (b) transshipment, in which the waste would be transshipped to an approved recycling or incineration site.

Flammable liquids can be accepted at the site and then transshipped to an approved recycling or incineration facility. In considering all flammable wastes, only drummed flammable solids will be disposed in the secure disposal cells.

Flammable solids in drums are the only drummed materials which will be buried directly in the secure landfill. All other drummed waste will be opened, mixed with reagent, and solidified. This procedure will assure BFI that no free liquids are being disposed of in the secure landfill. Although the percentage of solids may vary between wastes, in no case will any waste with free liquids be disposed of in the secure landfill.

Free liquids (or releaseable liquids) are defined by the EPA in Section 260.10 (25) of Federal Register. Free liquids mean any liquid waste which readily separates from the solid portion of waste under ambient temperature and pressure. The EPA recommended test is to place a one to five kilogram (2.2 to 11.0 lb.) sample of waste on a level or slightly sloping plate of glass or other similarly flat and smooth solid material for at least five minutes. If a liquid phase separation is observed, the waste contains "free liquid." All drums received, with the exception of drummed flammable solids, will be opened, mixed with reagent, and solidified to assure BFI that no free liquids are being disposed of in the secure landfill.

3.3 ANTICIPATED WASTE LOAD

In order to estimate the waste load that might be expected at the site, the data presented previously in Table 3.2 were studied and adjusted to reflect the volume of waste that could be disposed of at the facility. Adjustments to the data included the following:

- Waste volume reductions in each category proportionate to the percentage of participants in the 1982 survey using recycling and on-site disposal waste management techniques. The remaining portion of the waste volume indicated by the survey was considered available for disposal at the site.
- Drummed waste quantity was converted to gallons by using 55 gallons per drum.
- Waste quantity reported in tons was converted to gallons assuming 8.34 lbs./gallon.
- In relatively few instances, when the quantity of waste generated was unknown, it was assumed to be equal to the average of the ranges of values designated in the survey.
- The waste volumes indicated by the survey were increased by a factor of 239/211 to adjust the waste volume in proportion to the number of major generators asked to participate and those that responded to the survey.

In addition to the hazardous waste volume indicated by the 1982 survey, an additional waste volume may be available for disposal as a result of clean-up of existing hazardous waste disposal facilities and/or hazardous waste spills. BFI has estimated that this quantity of waste may account for an additional 500,000 to 2,500,000 gallons per year, or an average of about 1,500,000 gallons per year. The total volume of waste produced in Colorado, based on the 1982 survey and the net amount available for disposal at the facility, including clean-up of the existing facilities and spills, is summarized in Table 3.8.

TABLE 3.8

ESTIMATED WASTE VOLUMES

Category	Total Gallons Produced[1]			Net Amount Available for Disposal at the Facility		
	Minimum	Maximum	Average	Minimum	Maximum	Average
1. Non-Hazardous Liquids[2]	4,361,000	7,117,000	5,739,000	1,744,000	2,847,000	2,296,000
2. Hazardous Liquids[3]	6,603,000	11,844,000	9,224,000	4,094,000	7,343,000	5,719,000
3. Containerized Liquid and Solid Hazardous Waste[4]	660,000	2,546,000	1,603,000	567,000	2,190,000	1,379,000
Subtotal	11,624,000	21,507,000	16,566,000	6,405,000	12,380,000	9,394,000
4. Clean-up of Other Existing Disposal Sites in Colorado	-0-	-0-	-0-	500,000	2,500,000	1,500,000
TOTAL	11,624,000	21,507,000	16,566,000	6,905,000	14,880,000	10,894,000

[1]Based on 1982 survey.

[2]60% recycled, treated on-site, or disposed of by other means.

[3]38% recycled or treated on-site.

[4]14% recycled.

As indicated in Table 3.8, the net amount of waste available for disposal at the facility ranges between 6,905,000 to 14,880,000 gallons per year with an average of 10,894,000 gallons per year. Based on these quantities of waste, the design loadings for the Phase II treatment facilities have been reduced substantially from those in the original facility plan. In the facility plan submitted in April 1981, the Phase II average design loading was 24,000,000 gallons per year with a peak loading of 48,000,000 gallons per year. After adjusting the waste available for disposal in accordance with the 1982 survey, the new design loading will be a peak of 12,000,000 gallons per year with an average loading of 10,000,000 gallons per year. These design values are based on receiving slightly less waste than the volume indicated in Table 3.8. The major factors considered in selecting the capacity of the facility are summarized as follows:

- In estimating the net volume of waste available for disposal, an allowance was made for recycling and on-site treatment. However, further reductions in waste volumes available for disposal may be realized through process modifications, by-product recovery, product substitution, waste exchange programs, and future on-site treatment.

- The BFI facility may be the only facility available for hazardous waste disposal within the state and, therefore, may receive a large share of the waste volume generated in Colorado.

- The method used in conducting the survey resulted in a wide range of estimated hazardous waste generation. The design values represent approximately the mean of the estimated range.

- Waste quantities may be greater than those reflected by the 1982 survey since not all major generators responded; however, an adjustment was made to estimate the additional waste quantity.

- The 1982 survey only included 211 major waste generators identified by the Colorado Department of Health, whereas the 1980 survey, which indicated ten times more hazardous waste generated in Colorado, included a total of 960 generators.

- Future waste quantities may increase due to recent and upcoming promulgation of EPA industrial wastewater pretreatment guidelines which will inevitably result in an increase in industrial sludges to be disposed.

- Quantities of waste generated out-of-state were neglected because of (1) availability of out-of-state disposal sites, (2) lack of out-of-state generators within a reasonable range of the site, and (3) excessive transportation costs. The need and capacity of this facility is based on the volume of waste produced within the State of Colorado alone.

In view of these factors, the anticipated waste load to the Phase II facilities was estimated to range from 10,000,000 to 12,000,000 gallons per year. Although this appears to be about all of the waste generated in the state, excluding that presently recycled or treated on-site, it was felt that this design loading was an accurate projection of potential waste loadings. The quantity of waste generated will be a function of each individual generator's initiatives and disposal requirements promulgated by the state and federal governments. As such, future reductions in hazardous waste generation will likely be offset by increases in generation due to regulatory legislation and limitations on the amount of waste that can be recycled or treated on-site.

Only wastes that would be compatible with the treatment/solidification process will be accepted at the disposal facilities. These types of waste include the following:

- acids
- alkalies
- inorganic liquids and sludges
- sludges
- spill residuals
- miscellaneous contaminated items
- spent catalyst
- waste lime
- other miscellaneous inorganic wastes

In the original 1980 survey, it was determined that these types of waste constituted 75-80% of the waste generated in Colorado. Since the 1982 survey results were not as detailed and due to the large recycling effort

of Colorado waste generators, it was assumed that the percentage of compatible wastes would not decrease and would, in fact, probably increase.

Representative compositions of some of the compatible waste types are presented in Table 3.9(4). The analyses in Table 3.9 are presented only for the purpose of showing general composition of wastes as a factor in establishing facility capacity and anticipated site life. They are not meant to show the kind and amount of all constituents, which will certainly vary with each waste received.

Phase I operation will process approximately 8,000,000 gallons per year, consistent with the Part A application (included in Appendix B) submitted to the EPA to receive interim status. Table 3.10 lists each anticipated waste, given in Appendix B, that is registered in the State of Colorado; the volumes are approximate and may vary. The anticipated basis of Phase I operation will be a one shift per day, five day per week schedule.

For Phase II, to accommodate the estimated range of waste loadings in Colorado, the facility must be able to process about 12,000,000 gallons per year when operated on a split shift, 12 hours per day, five day per week basis.

3.4 REFERENCES

1. Hynes, Jeffrey L. and Sutton, Christopher J., Hazardous Waste in Colorado, A Preliminary Evaluation of Generation and Geological Criteria for Disposal, "Colorado Department of Health and Colorado Geological Survey," Denver, Co., (1980).

2. Colorado Depatment of Health, "1982 Hazardous Waste Survey," September 2,1982.

3. Analytical Report for Martin Marietta Kiln Dust, BFI Sample No. 18346, Browning-Ferris Industries Houston Laboratory, August 26, 1982.

4. Dillon, Consulting Engineers and Planners, Solidification Facilities for Liquid Industrial Wastes, Environmental Assessment Report, Vol. II (May, 1980).

TABLE 3.9
CHARACTERISTICS OF RAW WASTES FROM SEVERAL INDUSTRIAL CATEGORIES

Parameter	Metal Finishing-Plating 1	Metal Finishing-Plating 2	Metal Finishing	Metal Finishing-Spent Alkaline Degreaser	Automotive Oily Water	Petrochemical-Spent Alkaline Cleaner	Metal Fabrication-Detergent Cleaner	Aluminum Parts Manufacture-Plating
Flash Point (COC)° F	200	200	200	-	200	-	200	-
pH	2.2	8.6	9.5	14.2	8.4	13.9	9.6	6.0
Total Solids Wt. (%)	25.6	6.3	8.0	-	21.1	-	1.1	37.3
Chloride	-	-	-	533	-	82	-	-
Sulfate	-	-	-	2,250	-	100	-	-
Barium	4.2	0.1	0.1	0.5	0.5	0.1	0.2	22.5
Iron	880	1.0	0.36	-	19	1.80	140	7,111
Manganese	24	0.1	0.10	0.1	0.4	0.10	0.1	12.7
Boron	0.3	80	60	-	19	0.8	58	-
Arsenic	0.26	0.01	0.01	0.5	0.01	0.73	0.066	-
Cadmium	0.8	0.01	0.024	0.01	0.02	0.010	0.01	11.2
Copper	26	0.2	0.48	0.01	0.8	0.65	0.8	64.3
Chromium	200	0.4	0.40	0.4	0.6	10.0	2.1	1,693
Mercury	0.005	0.02	0.04	0.018	0.001	0.0060	0.0050	12.7
Nickel	210	12	3.28	0.1	4.3	0.10	410	11.2
Silver	0.1	0.1	0.1	0.1	0.1	0.10	0.1	12.4
Zinc	2,300	0.5	0.1	52	13	32	2.0	191.9
Lead	5.9	0.1	0.1	17	0.6	0.2	0.1	146.7
Selenium	0.6	0.3	0.3	1.5	0.1	3.0	0.1	-
Total Organic Carbon	1,360	748	185	4,500	7,925	495	1,450	-
Cyanide	-	-	-	-	-	0.180	-	-
Phenol	-	-	-	0.200	-	1.08	-	-

NOTE: Units are mg/l unless otherwise stated.

TABLE 3.10

TYPES OF WASTES TO BE RECEIVED

EPA WASTE NO.	WASTE TYPE	TONS PER YEAR	GALLONS PER YEAR*
D001	Ignitable Wastes	100	20,000
D002	Corrosive Wastes	5,000	1,000,000
D003	Reactive Wastes	100	20,000
D004	Wastes Toxic Due to Arsenic	1,100	220,000
D005	Wastes Toxic Due to Barium	505	101,000
D006	Wastes Toxic Due to Cadmium	1,010	202,000
D007	Wastes Toxic Due to Chromium	1,500	300,000
D008	Wastes Toxic Due to Lead	550	110,000
D009	Wastes Toxic Due to Mercury	105	21,000
D010	Wastes Toxic Due to Selenium	105	21,000
D011	Wastes Toxic Due to Silver	510	102,000
D012	Wastes Toxic Due to Endrin	105	21,000
D013	Wastes Toxic Due to Lindane	105	21,000
D014	Wastes Toxic Due to Methoxychlor	105	21,000
D015	Wastes Toxic Due to Toxaphene	105	21,000
D016	Wastes Toxic Due to 2,4-D	105	21,000
D017	Wastes Toxic Due to 2,4,5-TP Silvex	105	21,000
F001	The spent halogenated solvents used in degreasing, tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and the chlorinated fluorocarbons; and sludges from the recovery of these solvents in degreasing operations.	100	20,000
F002	The spent halogenated solvents, tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethylene, chlorobenzene, 1,1,2-trichloro-1,2,2 trifluoroethane, o-dichlorobenzene, trichlorofluoromethane and the still bottoms from the recovery of these solvents.	100	20,000
F003	The spent non-halogenated solvents, xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, n-butyl alcohol, cyclohexanone and the still bottoms from the recovery of these solvents.	500	100,000
F004	The spent non-halogenated solvents, cresols and cresylic acid, nitrobenzene, and the still bottoms from the recovery of these solvents.	100	20,000
F005	The spent non-halogenated solvents, methanol, toluene, methyl ethyl ketone, methyl isobutyl ketone, carbon disulfide, isobutanol, pyridine and the still bottoms from the recovery of these solvents.	500	100,000
F006	Wastewater treatment sludges from electroplating operations.	100	20,000
F007	ent plating bath solutions from electroplating erations.	100	20,000
F008	Plating bath sludges from the bottom of plating baths from electroplating operations.	100	20,000
F009	Spent stripping and cleaning bath solutions from electroplating operations.	100	20,000
F010	Quenching bath sludge from oil baths from metal heat treating operations.	100	20,000
F011	Spent solutions from salt bath pot cleaning from metal heat treating operations.	10	2,000
F012	Quenching wastewater treatment sludges from metal heat treating operations.	100	20,000
F013	Flotation tailings from selective flotation from mineral metals recovery operations.	6,000	1,200,000
F014	Cyanidation wastewater treatment tailing pond sediment from mineral metals recovery operations.	100	20,000
F015	Spent cyanide bath solutions from mineral metals recovery operations.	100	20,000
F016	Dewatered air pollution control scrubber sludges from coke ovens and blast furnaces.	2,000	400,000
F017	Paint residues or sludges from industrial painting in the mechanical and electrical products industry.	7,500	1,500,000
F018	Wastewater treatment sludge from industrial painting in the mechanical and electrical products industry.	5,000	1,000,000
K001	Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol.	500	100,000
K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments.	250	50,000
K003	Wastewater treatment sludge from the production of molybdate orange pigments.	250	50,000
K004	Wastewater treatment sludge from the production of zinc yellow pigments.	250	50,000
K005	Wastewater treatment sludge from the production of chrome green pigments.	250	50,000
K006	Wastewater treatment sludge from the production of chrome oxide green pigments (anhydrous and hydrated).	250	50,000
K007	Wastewater treatment sludge from the production of iron blue pigments.	250	50,000
K008	Oven residue from the production of chrome oxide green pigments.	250	50,000
K021	Aqueous spent antimony catalyst waste from fluoromethanes production.	10	2,000
K023	Distillation light ends from the production of phthalic anhydride from naphthalene.	5	1,000
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene.	5	1,000

TABLE 3.10
TYPES OF WASTES TO BE RECEIVED
(Continued)

EPA WASTE NO.	WASTE TYPE	TONS PER YEAR	GALLONS PER YEAR*
K027	Centrifuge residue from toluene diisocyanate production.	5	1,000
K028	Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane.	10	2,000
K031	By-products salts generated in the production of MSMA and cacodylic acid.	100	20,000
K032	Wastewater treatment sludge from the production of chlordane.	10	2,000
K033	Wastewater and scrub water from the chlorination of cyclopentadiene in the production of chlordane.	10	2,000
K034	Filter solids from the filtration of hexachlorocyclopentadiene.	20	4,000
K035	Wastewater treatment sludges generated in the production of creosote.	25	5,000
K037	Wastewater treatment sludges from the production of disulfoton.	5	1,000
K038	Wastewater from the washing and stripping of phorate production.	5	1,000
K039	Filter cake from the filtration of diethylphosphorodithoric acid in the production of phorate.	10	2,000
K040	Wastewater treatment sludge from the production of phorate.	10	2,000
K041	Wastewater treatment sludge from the production of toxaphene.	10	2,000
K044	Wastewater treatment sludges from the manufacturing and processing of explosives.	5	1,000
K045	Spent carbon from the treatment of wastewater containing explosives.	10	2,000
K046	Wastewater treatment sludges from the manufacturing formulation and loading of lead-based initiating compounds.	5	1,000
K047	Pink/red water from TNT operations.	5	1,000
K048	Dissolved air flotation (DAF) float from the petroleum refining industry.	25	5,000
K049	Slop oil emulsion solids from the petroleum refining industry.	50	10,000
K050	Heat exchanger bundle cleaning sludge from the petroleum refining industry.	100	20,000
K051	API separator sludge from the petroleum refining industry.	250	50,000
K052	Tank bottoms (leaded) from the petroleum refining industry.	1,100	220,000
K053	Chrome (blue) trimmings generated by the following subcategories of the leather tanning and finishing industry, hair pulp/chrome tan/retan/wet finish hair save/chrome tan/retan/wet finish/retan wet finish, no beamhouse, through-the-blue, and shearling.	10	2,000
K054	Chrome (blue) shavings generated by the following subcategories of the leather tanning and finishing industry: hair pulp/chrome tan/retan/wet finish; hair save/chrome tan/retan/wet finish; retan/wet finish, no beamhouse; through-the-blue and shearling.	10	2,000
K055	Buffing dust generated by the following subcategories of the leather tanning and finishing industry: hair pulp/chrome tan/retan/wet finish; hair save/chrome tan/retan/wet finish; retan/wet finish; no beamhouse and through-the-blue.	10	2,000
K056	Sewer screenings generated by the following subcategories of the leather tanning and finishing industry: hair pulp/chrome tan/retan/wet finish; hair save/chrome tan/retan/wet finish; no beamhouse, through-the-blue and shearling.	10	2,000
K057	Wastewater treatment sludges generated by the following subcategories of the leather tanning and finishing industry: hair pulp/chrome tan/retan/wet finish; hair save/chrome tan/retan/wet finish; retan/wet finish; no beamhouse; through-the-blue and shearling.	10	2,000
K058	Wastewater treatment sludges generated by the following subcategories of the leather tanning and finishing industry: hair pulp/chrome tan/retan/wet finish; hair save/chrome tan/retan/wet finish; and through-the-blue.	10	2,000
K059	Wastewater treatment sludges generated by the following subcategory of the leather tanning and finishing industry: hair save/non-chrome tan/retan/wet finish.	10	2,000
K060	Ammonia still lime sludge from coking operations.	100	20,000
K061	Emission control dust/sludge from the electric furnace production of steel.	500	100,000
K062	Spent pickle liquor from steel finishing operations.	1,000	200,000
K063	Sludge from lime treatment of spent pickle liquor from steel finishing operations.	1,000	200,000
K064	Acid plant blowdown slurry/sludge resulting from the thickening of blowdown slurry from primary copper production.	500	100,000
K065	Surface impoundment solids contained in and dredged from surface impoundments at primary lead smelting facilities.	50	10,000
K066	Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production.	25	5,000
K067	Electrolytic anode slimes/sludges from primary zinc production.	10	2,000
K068	Cadmium plant lesch residue (iron oxide) from primary zinc production.	50	10,000
K069	Emission control dust/sludge from secondary lead smelting.	50	10,000
K070	Woven fabric dying and finishing wastewater treatment sludge.	50	10,000

TABLE 3.10
TYPES OF WASTES TO BE RECEIVED
(Continued)

EPA WASTE NO.	WASTE TYPE	TONS PER YEAR	GALLONS PER YEAR*
K071	Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used.	5	1,000
K072	Wastewater treatment sludge from the diaphragm cell process using graphite anodes in the production of chlorine.	5	1,000
K073	Chlorinated hydrocarbon wastes from the purification step of the diaphragm cell process using graphite anodes in chlorine production.	5	1,000
K074	Wastewater treatment sludges from the production of TiO_2 pigment using chromium bearing ores by the chloride process.	50	10,000
K075	Wastewater treatment sludges from the production of TiO_2 pigment using chromium bearing ores by the sulfate process.	50	10,000
K076	Arsenic bearing sludges from the purification process in the production of antimony oxide.	10	2,000
K077	Antimony bearing wastewater treatment sludge from the production of antimony oxide.	10	2,000
K079	Water or caustic cleaning wastes from equipment and tank cleaning from paint manufacturing.	100	20,000
K080	Caustic cleaning wastes from paint manufacturing.	100	20,000
K081	Wastewater treatment sludges from paint manufacturing.	250	50,000
K082	Emission control dust or sludge from paint manufacturing.	100	20,000
K084	Wastewater treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organoarsenic compounds.	5	1,000
K086	Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tube and equipment used in the formation of ink from pigments, driers, soaps and stabilizers containing chromium and lead.	25	5,000
K087	Decanter tank tar sludge from coking operation.	200	40,000
K088	Spent potliners from primary aluminum reduction.	5	1,000
K089	Lead bearing wastewater treatment sludges from gray iron foundries.	100	20,000
K090	Emission control dust or sludge from ferrochromium-silicon production.	50	10,000
K091	Emission control dust or sludge from ferrochromium production.	50	10,000
K092	[illegible]ssion control dust or sludge from ferromanganese [illegible]ction.	50	10,000

EPA WASTE NO.	WASTE TYPE	TONS PER YEAR	GALLONS PER YEAR*
U013	Asbestos	2,500	500,000
U015	Azaserine	50	10,000
U165	Naphthalene	10	2,000
	TOTAL:	45,000	9,000,000*

* Assumes 10 lbs. per gallon.

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RECEIVED
JUN 29 1983

June 22, 1983

Rebecca Parker, Esq.
Assistant County Attorney
Adams County
450 South 4th Avenue
Brighton, Colorado 80601

HAND DELIVER WITH ENCLOSURES

RE: Highway 36 Land Development Company
Preliminary List of Witnesses and Exhibits,
Case No. 147-82-C.

Dear Ms. Parker:

Pursuant to the Resolution of the Adams County Board of County Commissioners Regarding Hearing Procedures dated June 13, 1983, and received by Highway 36 on June 16, Highway 36 Land Development Company (Highway 36) hereby provides its preliminary list of witnesses and exhibits for the July 21-22, 1983 C.D. hearing. Highway 36 reserves the right to endorse additional witnesses and exhibits at the pre-hearing conference scheduled for July 19, 1983. Highway 36 further reserves the right to endorse additional witnesses and exhibits after it receives the staff recommendation or any report relied upon in preparation of the staff recommendation. Highway 36 also reserves the right to introduce rebuttal exhibits or to call rebuttal witnesses not identified herein. Highway 36 finally reserves the right to call any witness listed by any other party and reserves the right to introduce any exhibit listed by any other party.

WITNESSES

Highway 36 may call the following witnesses:

1. Bob Johnson
Vice President
Browning-Ferris Industries
Post Office Box 3151
Houston, Texas 77001
(713) 870-8100

Mr. Johnson will testify concerning alternatives presently available for hazardous waste disposal in Colorado and the need for the Highway 36 facility. He will also testify concerning Browning-Ferris Industries, its operations and its operating capabilities, and closure/post closure matters including financial responsibility. Mr. Johnson will provide information regarding the financial ability, reliability, expertise, and competency of Highway 36 to operate and manage the proposed facility.

2. One or more Colorado generators of hazardous waste may be called to testify concerning the need for the proposed facility. Such witnesses will be endorsed as soon as their identities are known.

3. Mike E. Brazie
F. M. Fox and Associates
4765 Independence Street
Wheat Ridge, Colorado 80033
(303) 424-5578

Mr. Brazie may testify concerning the geologic suitability of the proposed site.

4. Regan A. Heath
F. M. Fox and Associates
4765 Independence Street
Wheat Ridge, Colorado 80033
(303) 424-5578

Mr. Heath may testify concerning the geotechnical and hydrological conditions of the site. Mr. Heath may also testify concerning cell design and construction and facility monitoring.

5. Joe Merino
Woodward Clyde Associates
Denver, Colorado
(303) 694-2770

Mr. Merino may testify concerning revegetation matters.

6. Cheryl Signs, P. E.
Cheryl Signs Engineering
70 West 6th Avenue
Suite 301
Denver, Colorado 80204
(303) 893-0822

Ms. Signs may testify concerning water issues.

7. Mark T. Carter, Ph.D.
Rocky Mountain Analytical Lab.
5530 Munhall Street
Arvada, Colorado 80002

Dr. Carter may testify concerning project monitoring and testing of water and soil samples.

8. Steve Custer
District Manager
Browning-Ferris Industries
5590 East 55th Avenue
Commerce City, Colorado 80022
(303) 740-7993

Mr. Custer may testify concerning design and operation of the facility and emergency response capabilities, equipment, and procedures of the facility.

9. Steve R. Thompson
Divisional Vice President, Technical Controls
Chemical Waste Operations
Browning-Ferris Industries
P. O. Box 3151
Houston, Texas 77001
(713) 870-8700

Mr. Thompson may testify concerning waste solidification and operating policies and procedures to be followed at the facility.

10. Tom Ragland
CH_2M Hill
P. O. Box 22508
Denver, Colorado 80022
(303) 771-0900

Mr. Ragland may testify concerning transportation and emergency response issues.

11. Don Fitch
Vice President
Browning-Ferris Industries
P. O. Box 3151
Houston, Texas 77001

Mr. Fitch may testify concerning other BFI operations.

12. Land Use Experts

BFI may call one or more experts to testify concerning land use issues.

EXHIBITS

Highway 36 will present slides in connection with its presentation. Such slides are a part of the record of the hearings held in May, 1982 and are available for inspection upon request to Adams County. Such slides will also be available for inspection by all parties at the pre-hearing conference to be held on July 19, 1983. Highway 36 may present any of the slides it has endorsed for the July 14, Planning Commission hearing. A list of such slides is attached. Highway 36 may present any exhibit endorsed for or introduced at the July 14, 1983 Planning Commission hearing by any party. Highway 36 reserves the right to introduce rebuttal exhibits not identified herein.

Highway 36 will also present written statements in connection with the above presentations. Such statements are in preparation and are not presently available. Highway 36 will make such written statements available at the July 19 pre-hearing conference.

Highway 36 is in receipt of Mr. French's letter to the County of June 16, 1983 wherein Mr. French objects to the scheduling of a pre-hearing conference on this date. We have also received telephone calls from Clay Douglas, City Attorney, City of Aurora, also objecting to this June 22 date. To assure the full participation of the parties represented by Mr. French and Mr. Douglas, Highway 36 would not object to the scheduling of an additional pre-hearing conference on July 7, 1983 or some other mutually agreeable date.

You should also note that BFI continues to object to the procedure for cross-examination contained in the Commissioners' Resolution. Taken literally, such resolution has the effect of precluding Highway 36 from cross-examining adverse witnesses. To avoid what we believe to be this unintended result, Highway 36 hereby requests the right to reserve some of its allotted time to cross-examine witnesses called by parties in opposition to its application.

If you have any questions, please contact me.

Very truly yours,

Paul F. Hultin

Paul F. Hultin

PFH:jfc

Enclosures

SISK, FOLEY, HULTIN & DRIVER

HIGHWAY 36 LAND DEVELOPMENT COMPANY

List of Exhibits 6/22/83

1. Location of Site
2. Geologic Cross Section of Denver Basin
3. Optimum Areas for Hazardous Waste Disposal
4. Slide of Drilling Reg.
5. 150 Feet Cross Section
6. Cell Excavation
7. Leachate Detection System
8. Head Dissapation System
9. Waste Placement in Cell
10 Final Configuration
11. 6 Level Monitoring
12. Monitoring Locations
13. Backhoe Mixing Waste #1
14. Was' ' in Disposal Cell
15. General Layout
16. Rendering of Site
17.
18. Carter Outline I
19. Carter Outline IB
20. Carter Outline IC
21. Carter Outline IC.3
22. Carter Outline II

23. Carter Outline IIB
24. Carter Outline IIC
25. Carter Outline IID
26. Carter Outline IID.3
27. Carter Outline III
28. Carter Outline IIIB
29. Carter Outline IIIB.4
30.
31. Thomson #5 - Types of reagents
32. Kiln Schematic
33. Thompson #1 - Principal reaction
34. Thompson #2 - Neutralization
35. Thompson #3 - Precipitation
36. Thompson #4 - Sorption
37. Backhoe Mixing
38. Waste in Cell
39. Solidification Decision Tree
40. Waste Compatibility
41.
42. Location of Facility
43. General Arrangement Phase I
44. Rendering of Layout
45. Berming Slide
46. "Phase I"
47. Phase I Layout
48. Phase I Elevation "typical"

49. "Phase II Facilities"
50. Phase II Layout
51. Guard House: Floor Plan and Elevations
52. Administration Building Elevation
53. Administration Floor Plan
54. Old Jolly Ranch
55. Lloyd Linnebur Maintenance Building
56. Employee/Lab Building Elevation
57. Employee/Lab Building Floor Plan
58. Maintenance/Truck Wash Building Elevation
59. Gene Linnebur Maintenance Building
60. Gene Linnebur Grain Storage
61. Maintenance/Truck Wash Floor Plan Building
62. Solidification Building Elevation
63. Emmet Linnebur Grain Storage
64. Solidification Building Floor Plan
65. Section 36 Oil Separation
66. Section 36 Oil Storage
67. Solidification Cross Section A
68. Solidification Cross Section B
69. Bag House
70. Quonset Hut

CHAPTER 4

TRANSPORTATION ANALYSIS

The chemical wastes and solidification reagents will be transported to the site by truck. BFI does not plan to have a rail spur to the site. Currently, no rail line exists in the vicinity of Last Chance; and, as of the latest State Rail Plan (1979), none is proposed for the area. A highway transportation analysis was therefore performed to assess the adequacy of existing roads within the regional network. The scope of this analysis included the following tasks:

- Identify regulations governing the transportation of chemical wastes;
- Determine existing access routes to the site;
- Estimate traffic volumes generated by the site;
- Determine existing traffic volumes associated with the access routes;
- Compare site generated traffic volumes to existing traffic volumes;
- Evaluate highway safety.

4.1 TRANSPORTATION MANAGEMENT PHILOSOPHY

Chemical wastes will be received at the facility in one of three forms: solid, liquid, or an intermediate sludge. They will be either in bulk quantities or contained in drums. Solidification reagents, such as cement kiln dust, will be delivered to the facility in bulk. In general, four types of specialized vehicles will be utilized for collection and transport of these materials: vacuum type tank trucks (liquids), roll-off container trucks (solids and sludges), flat-bed trucks (drums), and pneumatic-type bulk material trucks (dry reagents). These vehicles are shown in Figures 4.1 through 4.4.

BFI's specialized fleet of collection vehicles and/or subcontract vehicles, or their equivalent, will be utilized for transportation. These vehicles are classified according to U.S. Department of Transportation (DOT) specifications. Trucks receive this DOT approval only when every step in their construction and operation--from the way in which the welding was done to the installation of all safety devices--has met Federal standards. Inspection and operation of subcontract vehicles will be monitored by BFI.

4.2 TRANSPORTATION REGULATIONS AND PRECAUTIONS

Transporters of hazardous wastes are required to comply with the applicable regulations of the Department of Transportation, Environmental Protection Agency, and the State of Colorado governing the transportation of hazardous wastes(1). All waste transporters will be required to obtain an EPA identification number in accordance with 40 CFR Part 263.11, as well as maintain and comply with the manifest system in accordance with 40 CFR Part 263, Subpart B(2).

The Department of Transportation regulations under 49 CFR Part 172, Subpart F, require labeling of hazardous material transports. All BFI vehicles and subcontract vehicles carrying hazardous wastes will be appropriately labeled or placarded. All vehicles will be maintained in secure and roadworthy condition.

40 CFR Part 263, Subpart C, requires the transporter of a pollutant which has spilled to take immediate action to protect the environment and to give notice of the discharge to local authorities and the State Highway Patrol, as required by 49 CFR 171(2). Subpart C places the responsibility of discharge clean-up on the transporter. There is also a provision

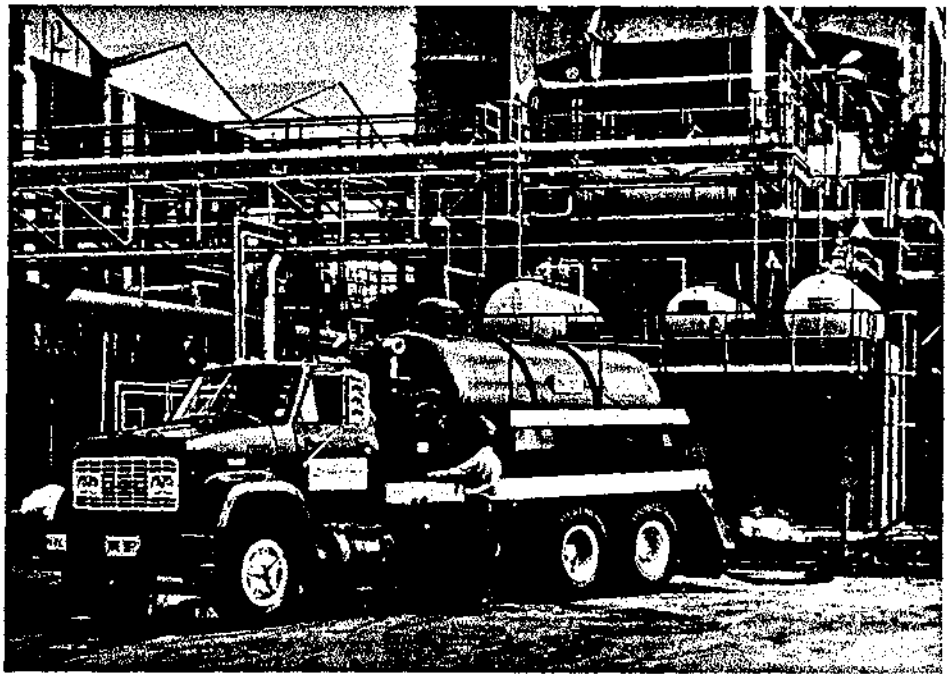

FIGURE Nº. 4.1

TYPICAL VACUUM TYPE TANK TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

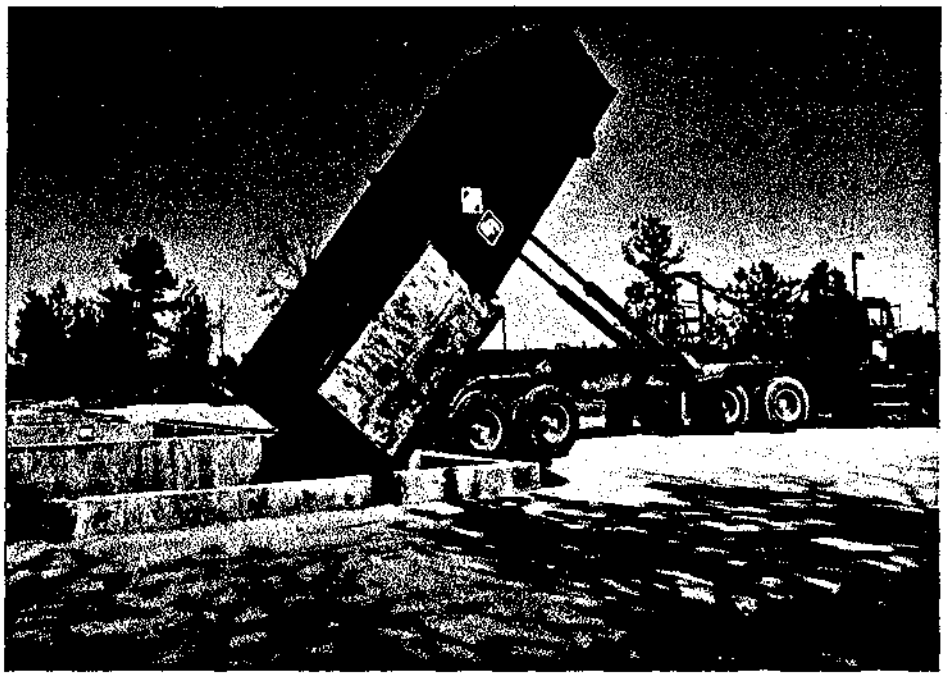

FIGURE Nº. 4.2

ROLL-OFF CONTAINER TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

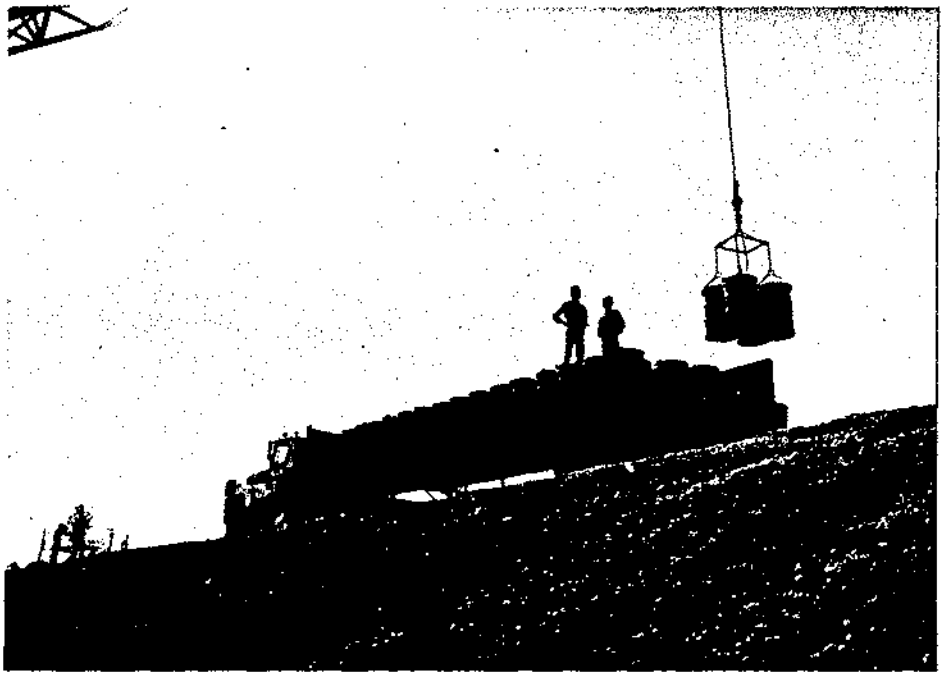

FIGURE Nº. 4.3

FLAT-BED TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
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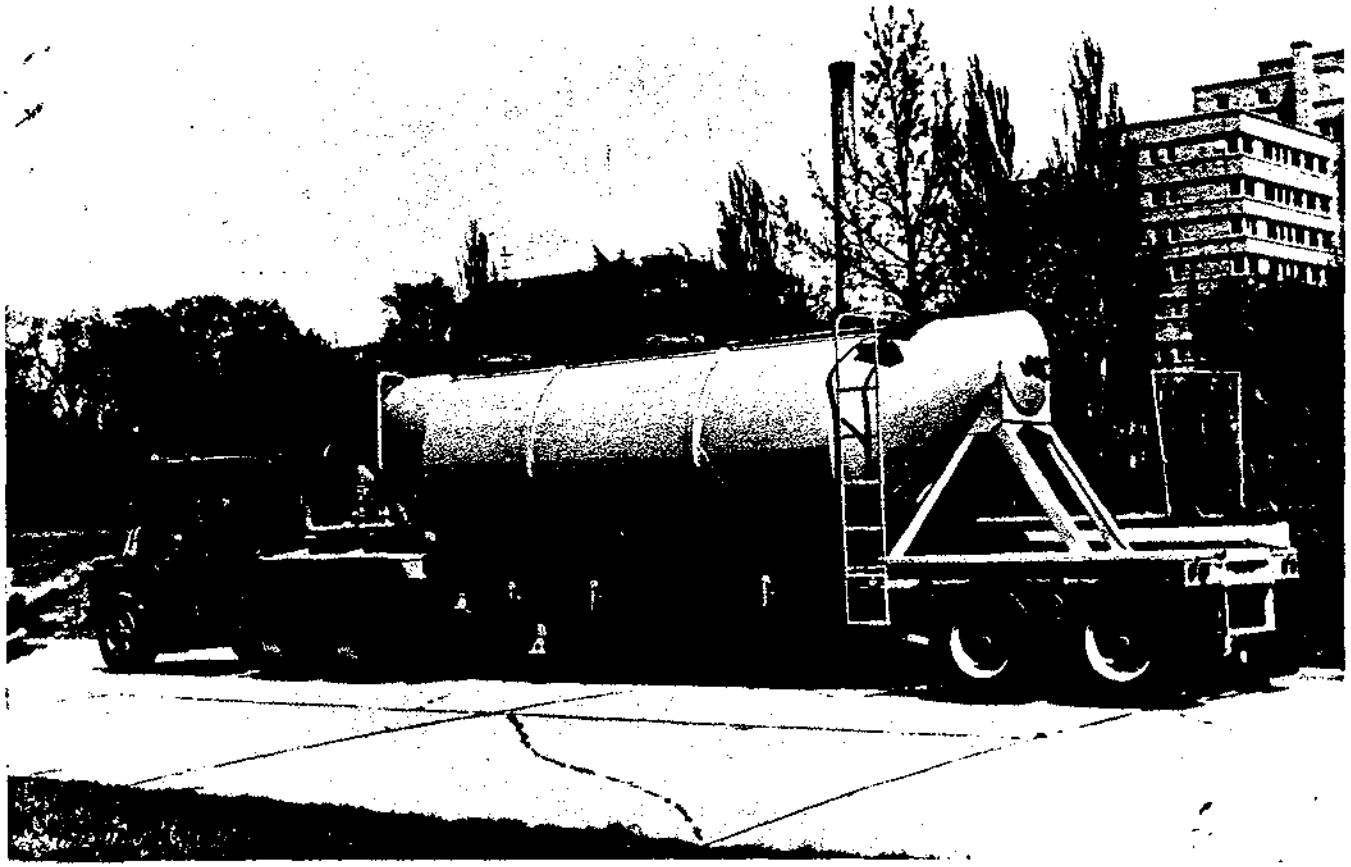


FIGURE Nº. 4.4

PNEUMATIC – TYPE BULK MATERIAL TRUCK

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

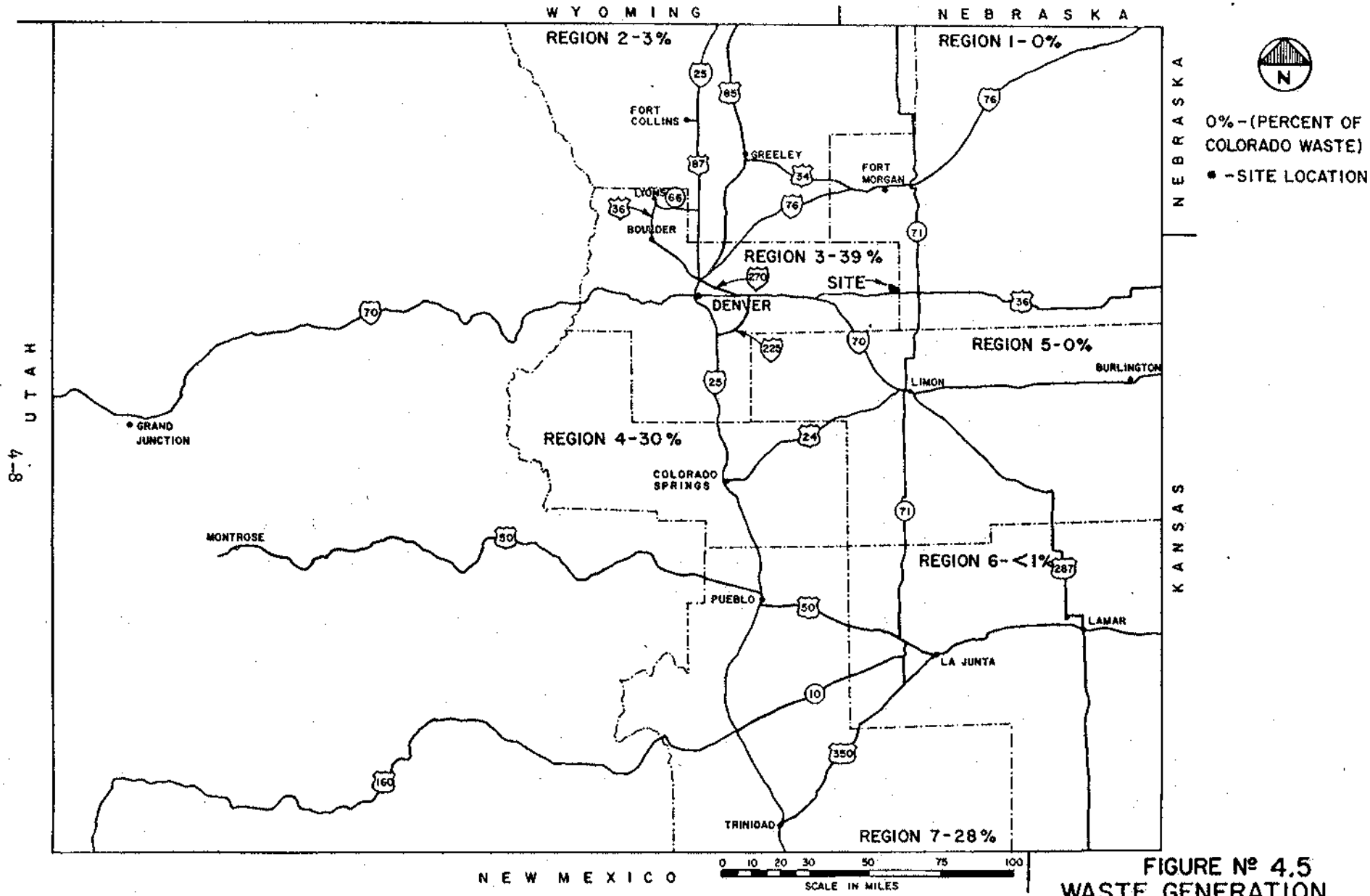
HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

for an appropriate agency or municipality to direct the transporter to take action to prevent or limit the effects of a spill. In the event of a road accident resulting in a spill, a response team will be sent from BFI to assist in clean-up. This response team is described in Section 7.4.

In addition to the above Federal regulations, Colorado regulations governing transport and shipping of hazardous materials will be complied with, where applicable. The Colorado Public Utilities Commission regulations are contained in HMS 1-12 and HMT 1-18(1,3). These are presented in Appendix I.

4.3 ACCESS ROUTES

The Colorado Department of Health and Colorado Geological Survey have determined that 99.7% of the State's hazardous waste is generated in Regions 2, 3, 4, and 7 shown in Figure 4.5(4). It is noted that the proposed source of solidification reagent at Lyons, Colorado is located within Region 3. Consequently, only the traffic from cities within these regions was considered as having a potential impact on transportation facilities. The routes regarded as most reasonable for access are also illustrated in Figure 4.5. The major traffic sources include the cities of Denver, Greeley, Lyons, Fort Collins, Boulder, Colorado Springs, and Pueblo. The major routes to be affected by increased traffic associated with the facility are U.S. Highway 36 (U.S. 36), State Highway 71 (S.H. 71), U.S. Highway 85 (U.S. 85), and Interstate Highways I-25, I-70, I-270 and I-225. Probable routes to the site are summarized in Table 4.1. These routes will be recommended to transporters for reasons of efficiency and safety.



HNTB
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ARCHITECTS ENGINEERS PLANNERS

FIGURE Nº 4.5
WASTE GENERATION
BY COLORADO REGION

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TABLE 4.1

PROBABLE TRANSPORTATION ROUTES

City	Probable Route	Distance (Miles)
Denver	I-70 to U.S. 36	75
Colorado Springs	I-25 to I-225 to I-70 to U.S. 36	145
Pueblo	I-25 to I-225 to I-70 to U.S. 36	185
Fort Collins	I-25 to I-270 to I-70 to U.S. 36	150
Greeley	U.S. 85 to I-76 to to I-270 to I-70 to U.S.36	120
Boulder	U.S. 36 to I-270 to I-70 to U.S. 36	110
Lyons	U.S. 66 to I-25 to I-270 to I-70 to U.S.36	120

All existing bridges on the routes indicated in Table 4.1 were found to conform to standard Colorado structural loadings(5). It is noted that U.S. 24 and U.S. 34 were studied as possible routes, but eliminated because of load restrictions. The State of Colorado legal weights and sizes can be found in Appendix I.

BFI will meet with each of the proposed transporters to encourage the scheduling of transport trips during off-peak hours and suggest preferred routes that by-pass the I-25/I-70 interchange, thereby limiting waste trips through the interchange to those originating in and west of Denver.

4.4 TRIP GENERATION

The traffic generated by the operation of the disposal facilities can be separated into two major categories: truck traffic and employee/miscellaneous generated traffic. Three major criteria used in all traffic volume estimates were:

- waste processing volume of 12,000,000 gallons per year;
- major processing time between 7:00 A.M. and 7:00 P.M.;
- 5-day per week operation.

The methodology and basic assumptions used to estimate the type and amount of traffic generated by the facility operation are discussed in detail in the following sections.

4.4.1 Truck Traffic

The estimated daily truck traffic generated by the facility includes waste trucks (empty and loaded) and reagent trucks (empty and loaded). For the purpose of estimating daily truck traffic generated by the facilities, the following assumptions were made:

- Truck Capacities:

  Liquid Tanks - 4,200 gallons
  Roll-off Containers - 20 cubic yards
  Drums - 80 per truck
  Reagents - 50 cubic yards

- Waste Volume Split:

  Liquid Tanks - 75%
  Roll-off Containers - 20%
  Drums - 5%

- Reagent to Waste Ratios (Volume/Volume):

  Liquids - 2.5:1
  Semi-Solids - 1:1
  Solids - direct burial

At the maximum waste processing rate of 12,000,000 gallons per year and a five-day per week operation (260 days per year), the average daily waste volume processed would be about 46,150 gallons per day. Using this daily waste volume in combination with the previous assumptions for waste truck capacity and waste volume split, the resulting waste quantity types and required trucks are as shown in Table 4.2.

TABLE 4.2

SUMMARY OF DAILY WASTE VOLUMES AND TRUCK REQUIREMENTS

Waste/Truck Type	Volume per Day			Number of Trucks Required
	Gallons	Cubic Yards	Drums	
Liquid Tanks	34,620	172	-	9
Roll-off Containers	9,230	46	-	3
Drums	2,300	11	42	1
TOTAL	46,150	229	42	13

Based on Table 4.2, the total number of trucks carrying hazardous waste is estimated to be 13 trucks per day. This would result in a total of 26 vehicle trips considering the trucks leave the site empty and return loaded.

The number of daily reagent truck trips was estimated on the basis of the waste volumes shown in Table 4.2 in combination with the previously presented reagent to waste volume ratios. For the purpose of estimation, it was assumed that the liquid waste and all of the drum waste would require a reagent to waste volume ratio of 2.5:1; and the semi-solids represented by the roll-off containers would require a reagent to waste volume ratio of 1:1. (It should be noted that assuming all the drum waste would be liquid would represent a maximum condition since semi-solid and solid waste will also be received in drums.) The resulting quantity of reagent required daily would be 503 cubic yards (457 cubic yards for liquids plus 46 cubic yards for semi-solids). At a reagent truck capacity of 50 cubic yards, the estimated number of reagent trucks would be 10. This represents a total of 20 vehicle trips per day considering the trucks arrive at the site loaded and leave empty.

4.4.2 Employee Traffic

The traffic volume generated by facility employees was based on an operating schedule of five days per week with the major processing occurring between 7:00 A.M. and 7:00 P.M. and the facility staffing requirements subsequently presented in Chapter 6. The estimated staffing requirements and hourly variations in weekday employee traffic are summarized as follows(6):

- A security staff of four (2.4 vehicle-trips each per day for 24 hours for a total of 10 vehicle-trips per day.
- A managerial staff of seven during the day (3.3 vehicle-trips each per day from 7:00 A.M. to 7:00 P.M. for a total of 23 vehicle-trips per day).
- A waste processing staff of nine during the period of maximum activity (2.4 vehicle-trips each per day, two shifts from 7:00 A.M. to 4:00 P.M. and 10:00 A.M. to 7:00 P.M. for a total of 22 vehicle-trips per day).
- A waste truck driving staff of ten for peak loadings (2.0 vehicle-trips each per day from 5:00 A.M. to varying times in the P.M. depending on destination for a total of 20 vehicle-trips per day).
- Twenty-five (25) miscellaneous one-way vehicle-trips per day was added to account for water trucks, temporary excavation crews, guests, and visitors to occur between 7:00 A.M. and 10:00 P.M.

Other assumptions made were as follows:

- Waste will be hauled by BFI and processed the day it is delivered to the site, if possible, on a weekday basis from 7:00 A.M. to 7:00 P.M.
- Reagent will be delivered by subcontract on an as needed basis and is assumed to arrive between 10:00 A.M. and 5:00 P.M.

Based on the above assumptions, the total number of employee/miscellaneous vehicle-trips per day would be 100.

4.4.3 Summary of Traffic Generation

The total volume of traffic generated at the site is a combination of waste and reagent truck traffic (46 vehicle-trips per day) and the

employee/miscellaneous traffic (100 vehicle-trips per day). The estimated hourly traffic variation at the site for a 24-hour period is presented in Table 4.3. As indicated in Table 4.3, the vast majority of the site generated traffic will occur between 6:00 A.M. and 8:00 P.M. It is anticipated that the only traffic generated outside this time frame would be due to a guard change or an early arrival of a truck driver in anticipation of an unusually long haul distance. In Table 4.3, the estimated peak hourly number of site-generated vehicle-trips is 14. The peak hourly number is comprised of at least seven employee-related trips and is projected to occur between 8:00 A.M. to 9:00 A.M. and 3:00 P.M. to 4:00 P.M. Of the 146 total daily site-generated trips, only 13 trips (i.e., 9%) involve the transportation of hazardous waste.

4.5 TRAFFIC VOLUMES AND DISTRIBUTION

Table 4.4 shows existing routes expected to be used for access to the site. Included in this table are the projected 1982 average daily traffic (ADT) without the site, traffic generated by the site, 1982 ADT with the site and the percentage of 1982 ADT that are loaded waste truck trips generated by the site(7).

Future volumes on the road systems were derived using 1980 traffic counts and growth rates established by the Colorado Department of Highways. Assumptions made for this study were that 40% of the employee/miscellaneous traffic will be from communities west of the site, 10% from the east, 40% from the north, and 10% from the south. In addition, to estimate truck traffic it was assumed that the reagent would be delivered from Lyons and that hazardous waste would be delivered from areas in relative proportion to the quantities generated in the area (see Section 4.3). The origins and number of daily waste truck trips can be summarized as follows:

TABLE 4.3

ESTIMATED WEEKDAY TRAFFIC VARIATION AT THE SITE
(VEHICLE-TRIPS)

Time	Employee Trips	Waste Trucks (Empty)	Waste Trucks (Loaded)	Reagent Trucks (Loaded)	Reagent Trucks (Empty)	Misc. Trips	Totals
Midnight	1						1
	1						1
2:00	0						0
	0						0
4:00	0						0
	1						1
6:00	4	3					7
	10	2				1	13
8:00	9	3				2	14
	4	2	2			2	10
10:00	4	1	1			2	8
	2		1	2		2	7
Noon	3	1	2	2	2	2	12
	3	1		3	2	2	11
2:00	3		2	3	3	2	13
	7		2		3	2	14
4:00	9					2	11
	2		1			2	5
6:00	3		1			2	6
	7		1			2	10
8:00	2						2
	0						0
10:00	0						0
	0						0
Midnight							
TOTAL	75	13	13	10	10	25	146

TABLE 4.4

FUTURE ROAD TRAFFIC VOLUMES

Route	1982 ADT without Site[1]	Daily Employee/Misc. Trips	Daily Total Truck Trips	1982 ADT with Site	Daily Hazardous Waste Truck Trips Generated by the Site[2]	Hazardous Waste Truck Trips, % of 1982 ADT with Site
U.S. 36 E. of Byers	780	40	42	862	11	1.3
U.S. 36 W. of Last Chance	750	60	4	814	2	<1
S.H. 71 S. of Last Chance	635	10	2	647	1	<1
S.H. 71 N. of Last Chance	810	40	2	852	1	<1
U.S. 36 E. of Last Chance	710	10	0	720	0	0
I-70 W. of Byers	6,740	40	42	6,822	11	<1
I-25 S. of Denver	20,565	0	14	20,579	7	<1

[1]Projected from actual Colorado Department of Highways 1980 traffic counts and growth factors(8).

[2]Represents only hazardous waste trucks carrying a load.

NOTE:

ADT = average daily traffic counts.

- seven hazardous waste truck trips originating from the Colorado Springs and Pueblo areas;
- four hazardous waste truck trips originating from the Denver, Boulder, Fort Morgan, Greeley areas;
- one hazardous waste truck trip originating north of Last Chance and using S.H. 71 as part of the route to the disposal site;
- one hazardous waste truck trip originating south of Last Chance and using S.H. 71 as part of the route to the disposal site.

Figure 4.6 illustrates the projected 1982 ADT volumes with and without traffic generated by the site.

Colorado Department of Highways traffic counts do not include vehicle classification information. Therefore, auto and truck vehicle counts were performed at three locations near the site to determine the number of vehicles currently using the transportation routes and the characteristics or type of vehicle. The counts were made at the Byers interchange with I-70, on U.S. 36 at the proposed disposal site, and at the south limits of Brush on Highway 71. Truck vehicles were identified as carrying hazardous material if they displayed any of the following placards: flammable, corrosive, explosives, poison gas, or radioactive. From the actual counts, the percentage of the vehicles that were heavy trucks and the percentage of the vehicles that carried hazardous materials (e.g., gasoline, etc.) were calculated. The results are summarized in Table 4.5, along with the projected 1982 average daily traffic data presented previously.

Table 4.5 shows that the highway system near the project site currently has a significant volume of heavy truck traffic and many of these vehicles carry cargo classified as hazardous material. For example, the count on U.S. 36 west of Last Chance indicated that 29% of the 1982 ADT

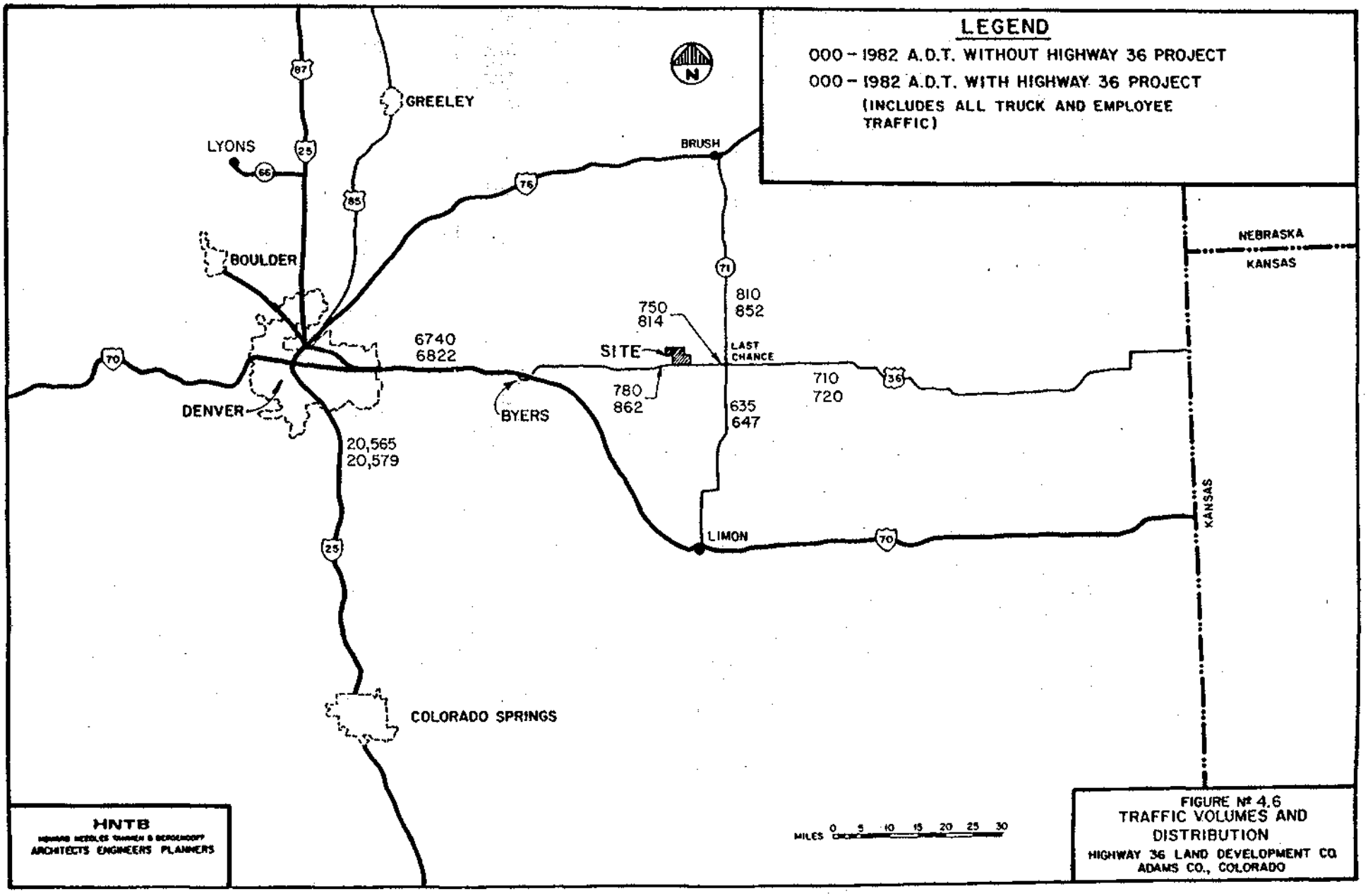


FIGURE Nº 4.6
TRAFFIC VOLUMES AND DISTRIBUTION
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

currently is classified as heavy trucks. This is approximately 220 trucks per day. Of this amount, 4% or approximately 32 trucks per day were placarded as carrying hazardous material. With the project, the percentage of vehicles carrying hazardous materials will not change. The combined site-generated hazardous waste traffic and existing hazardous material traffic will still constitute 4% of the estimated total traffic volume. Similar conditions exist on U.S. 71 south of Brush and I-70 at Byers, with approximately 15 and 148 placarded vehicles per day, respectively. As can be seen in Table 4.5, the only route where the percentage of heavy truck traffic and hazardous material traffic is anticipated to increase is U.S. 36 east of Byers. The heavy truck traffic is expected to increase by 3% of the total from 22% to 25%, and the hazardous material traffic is expected to increase by 1% of the total from 3% to 4%.

TABLE 4.5

EXISTING VEHICLE CHARACTERISTICS (1982) WITHOUT THE SITE

			% of Total Traffic			
	Total Traffic (ADT)		Heavy Trucks		Vehicles That Carry Hazardous Material	
Location	Without Site	With Site	Without Site	With Site	Without Site	With Site
U.S. 36						
East of Byers	780	862	22%	25%	3%	4%
West of Last Chance	750	814	29%	27%	4%	4%
U.S. 71						
North of Last Chance	810	852	12%	12%	2%	2%
I-70						
West of Byers	6,740	6,822	33%	33%	2%	2%

4.6 ANALYSIS AND REQUIREMENTS

4.6.1 Level of Service

The anticipated impact of the facility on the adjacent and area road system is measured by changes in level of service attributable to additional vehicular volumes generated by the site. Level of service is a qualitative measure used to describe general operating conditions on a specific roadway segment(9). Factors included in evaluating level of service are speed, vehicle types, traffic volumes, roadway conditions, and roadway geometrics. Level of service indexes range from A to F, with A being a free flow condition.

Level of service is generally determined on the basis of traffic occurring during a period of one hour over a specified section of road. The maximum rate of flow in vehicles per hour which can be accommodated on a section of roadway and still provide service A level of operation is called the service volume at level of service A. The service volume at level of service A for U.S. Highway 36 is 280 vehicles per hour. This assumes 30% trucks and passing sight distance greater than 1500 feet over at least 80% of the roadway. The peak hour volume on U.S. 36 in the site area is 102, well within the level of service A range. Therefore, no change in level of service on these roads is expected to result from site-generated traffic. Other roadways along routes to the site have large enough volumes of traffic to make the increases due to site-generated traffic insignificant as indicated previously by Table 4.4. Therefore, the traffic impacts related to the site do not require significant mitigating measures.

4.6.2 Traffic Safety Analysis

The average accident rate in Colorado for all Federal-Aid rural highways is 2.5 accidents per million vehicle miles of travel. Highways 36 and 71 fall in this highway classification and yet have significantly lower accident rates as shown below.

Highway 36 - Byers to Last Chance

	1979	1980	1981	Average
No. of Accidents	5	10	8	7.7
Accident Rate	0.5	1.0	0.8	0.8

Highway 71 - Brush to Last Chance

	1979	1980	1981	Average
No. of Accidents	15	13	19	15.1
Accident Rate	1.1	0.9	1.4	1.1

Both average accident rates are considerably less than the state's average of 2.5 indicating that these are safe highways. Since the increase in traffic due to the site is slight and will not reduce the level of service, the accident rates per million vehicle miles of travel are not expected to change. Therefore, the safety of the highways is not expected to change.

4.6.3 Access Road Analysis

It is recommended that access to the active site be provided by a road connecting to U.S. 36. Prior to construction of this access road, vehicles will utilize the existing roadways, as follows. The Phase I route would follow the existing road on the Adams/ Washington county line north from U.S. 36 approximately one mile, then west into the site area along the existing access road.

The Phase II route from U.S. 36 to the southern site boundary is expected to be operational in 1983. Located approximately one mile west of the Adams/Washington county line, this route parallels an existing power line on the site. This main access road would be asphalt pavement on a granular base, or equivalent, capable of handling the intended traffic.

The location of the site access connection to U.S. 36 provides adequate stopping sight distance for traffic on the highway. Approach roadway features on Highway 36 leading to the southern access road for Phase II will be provided consistent with Colorado Department of Highway requirements.

4.7 SUMMARY AND CONCLUSIONS

The preceeding transportation analysis indicated that the operation of the hazardous waste disposal facilities would have only a very minor impact on existing traffic volumes and will have no measurable impact on highway safety. The major factors supporting these conclusions are:

- The total number of vehicle-trips generated by the site is estimated to be 146 vehicle-trips per weekday and is relatively small compared to the existing traffic volume (see Table 4.4).

- The most affected route is U.S. 36 east of Byers. It is estimated that the traffic volume on this route could increase by a total of 10% when the facility is in operation. The 10% increase is comprised of 40 employee/miscellaneous trips and 42 truck vehicle-trips, 11 of which carry hazardous wastes. The 11 vehicle-trips which involve transporting hazardous waste represent only 1.3% of the total traffic volume.

- A 1982 survey (Table 4.5) indicated that 3% of the vehicles (23 vehicles per day) presently using U.S. 36 east of Byers were transporting hazardous materials.

- For the other proposed routes, the percentage of site-generated hazardous waste vehicles is less than 1% of the projected total traffic volume.

- The level of service assigned to a transportation route is a function of several factors which determine highway safety. If

changes in these factors, i.e., traffic volume, do not change the level of service classification, then highway safety does not change.

- The traffic generated by the facility will not affect the level of service for U.S. 36 and, therefore, should not have any impact on highway safety.

- BFI uses specialized vehicles for transporting hazardous wastes and monitors these vehicles to insure that all safety devices are maintained and that all safety regulations are enforced.

- Access to the site will not impact highway safety, since access will be designed to provide adequate stopping distance and will be constructed in accordance with Colorado Department of Highway requirements.

- In accordance with the reduced waste processing rate, transportation impacts have been reduced by approximately 75% compared to the original facility planning report.

4.8 REFERENCES

1. Public Utilities Commission of the State of Colorado, Department of Regulatory Agencies, Rules and Regulations Governing the Transportation of Hazardous Materials within Colorado.

2. "Environmental Protection Agency - Hazardous Waste and Consolidated Permit Regulations," Federal Register, 45 (98), Book 2 (May 19, 1980).

3. Public Utilities Commission of the State of Colorado, Department of Regulatory Agencies, Rules and Regulations Governing the Shipping of Hazardous Materials within Colorado.

4. Hynes, J. L., Sutton, C. J., Hazardous Wastes in Colorado, A Preliminary Evaluation of Generation and Geologic Criteria for Disposal, Colorado Department of Health and Colorado Geologic Survey, State of Colorado (1980).

5. Personnel Communication, Bridge Inspection Engineer, Colorado Department of Highways.

6. Buttke, C. H., et al., Trip Generation, Institute of Transportation Engineers, Arlington, Virginia (1979).

7. 1978 Traffic Volume Map - Colorado State Highway System, Division of Planning, State Department of Highways - State of Colorado.

8. Colorado Department of Highways, Division of Transportation Planning, Traffic Counts and Growth Factors.

9. Kemp, B. K., et. al., Highway Capacity Manual, Highway Research Board, Washington, D.C. (1965).

CHAPTER 5

EXISTING ON-SITE AND OFF-SITE CONDITIONS

5.1 INTRODUCTION

The purpose of this chapter is to provide a detailed summary of existing regional and site-specific conditions. This information provided essential input to the design and operational plan, to be discussed in Chapters 6 and 7. It also served as a basis from which potential environmental impacts could be assessed, as discussed in Chapter 8. The conditions characterized in this chapter include the following:

- o boundary survey;
- o geology and hydrogeology;
- o topography and surface drainage;
- o baseline water quality;
- o air quality and noise;
- o environmental inventory;
  - climate;
  - natural ecosystems;
  - land use and population;
  - economic activities;
  - heritage and cultural resources.

5.2 METHODS OF CHARACTERIZATION

Several methods of characterization were utilized in order to accurately describe the regional and site-specific base line conditions. These included:

- o legal surveys of property;
- o aerial reconnaissance;
- o site borings and soils testing;
- o field reconnaissance;
- o water sample collection and analysis;
- o collection, review, and analysis of existing information;
- o computer modeling;
- o biological reconnaissance.

5.3 BOUNDARY SURVEY

5.3.1 Legal Description

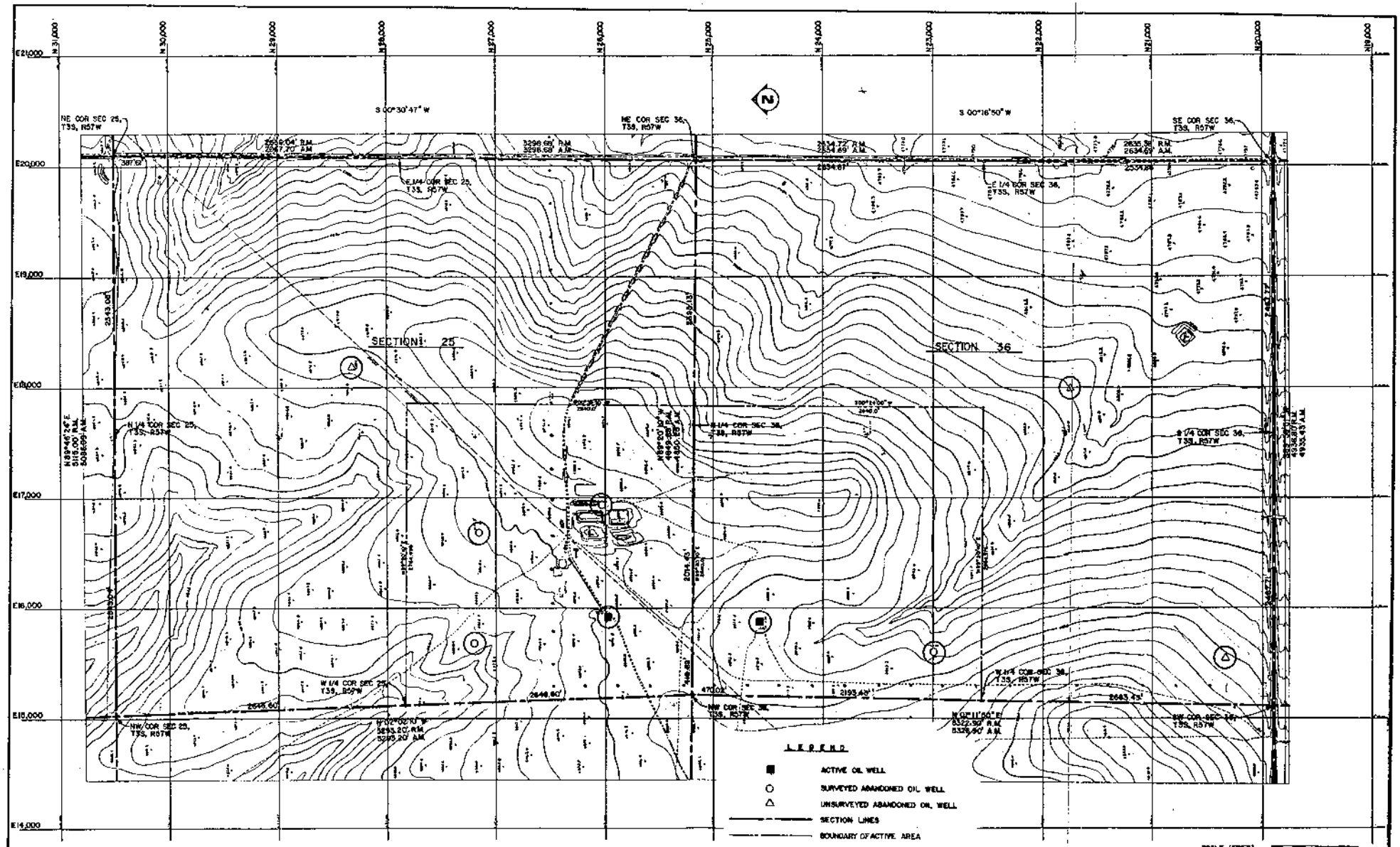
As shown in Figure 5.3.1, the legal description of the two sections, within which the active site is located, reads as follows:

> All of Sections 25 and 36, Township 3 South, Range 57 west of the sixth prime meridian, Adams County, Colorado; except an apparent utility easement across Sections 25 and 36 and except an easement and right-of-way for the purpose of constructing, reconstructing, operating, and maintaining a 6 inch oil pipeline, granted to Arapahoe Pipeline Company by the State of Colorado, acting by and through the State Board of Land Commissioners, affecting Sections 25 and 36, excepting right-of-way for ditches or canals, reserved in United States patents recorded in Book 106, page 201, affecting the north half of Section 25; also Book 99, page 201, affecting the south half of Section 25; and excepting the east 30.00 feet of Section 25; also excepting the east 30.00 feet of Section 36 to be dedicated to Adams County for road, and except the south 100.00 feet of Section 36.

A certified copy of the boundary survey is given as Exhibit 5.3.1.

Section 25 contains approximately 603.93 acres; Section 36 contains approximately 580.18 acres. Acreages include an easement and rights-of-way for the pipeline recorded in Book 1356, page 288, and an apparent utility (electrical power line). Figure 5.3.2 is an aerial photograph of Sections 25 and 36 taken in December of 1980.

The portion of the two sections to be used for the processing and disposal facility complex (the site) is indicated on Figure 5.3.1. It contains approximately 325 acres. All recorded abandoned oil wells within this area were physically located and surveyed. These are shown in Figure 5.3.1 along with the historically recorded locations of other abandoned oil wells on the remainder of the two sections. The oil well shown approximately at coordinates N 24,600 and E 15,900 was activated in late 1981.



SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

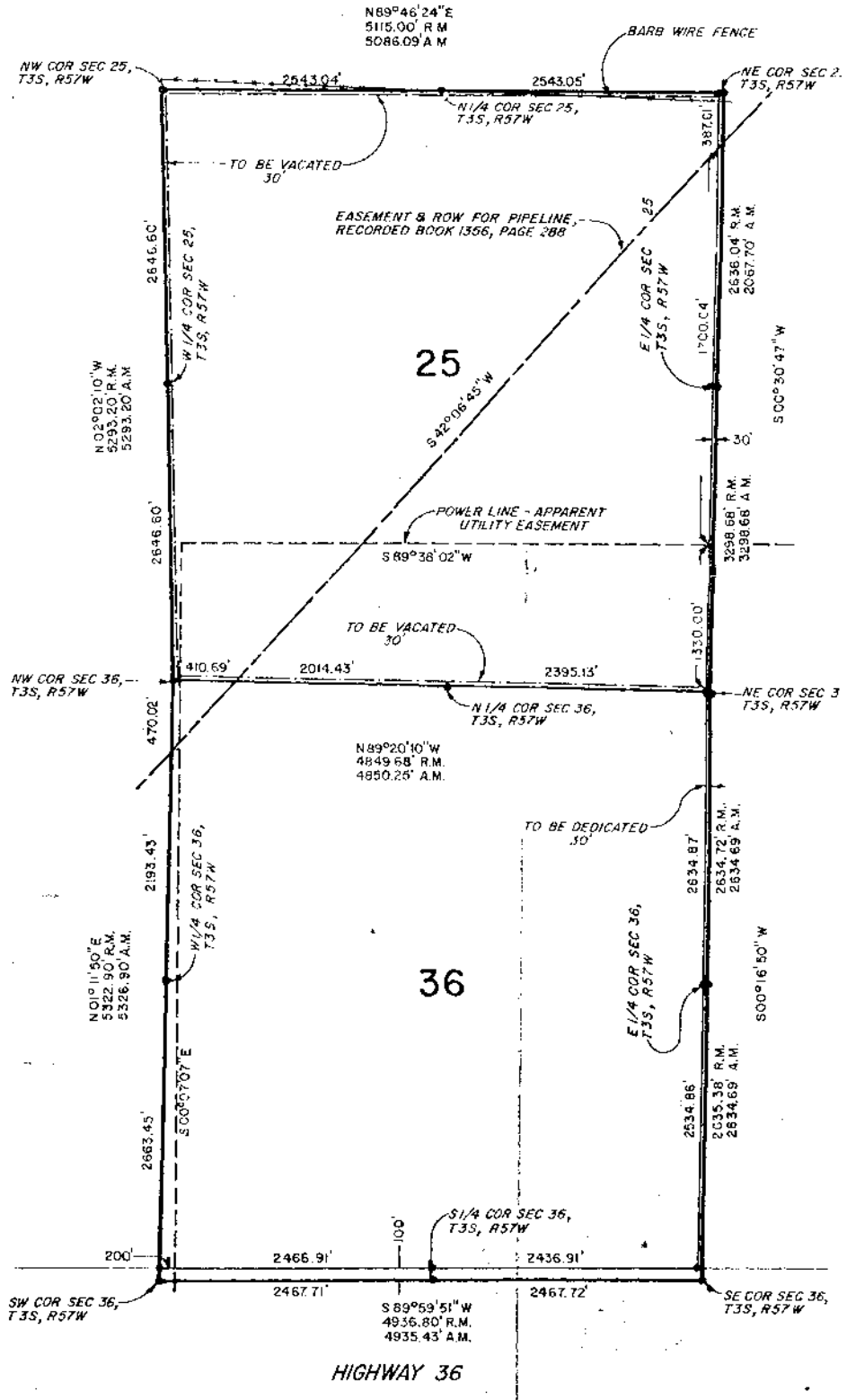
JOB NO.
DATE 15 MAR 81

BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

BOUNDARY SURVEY OF SECTIONS 25 & 36 AND ACTIVE AREA

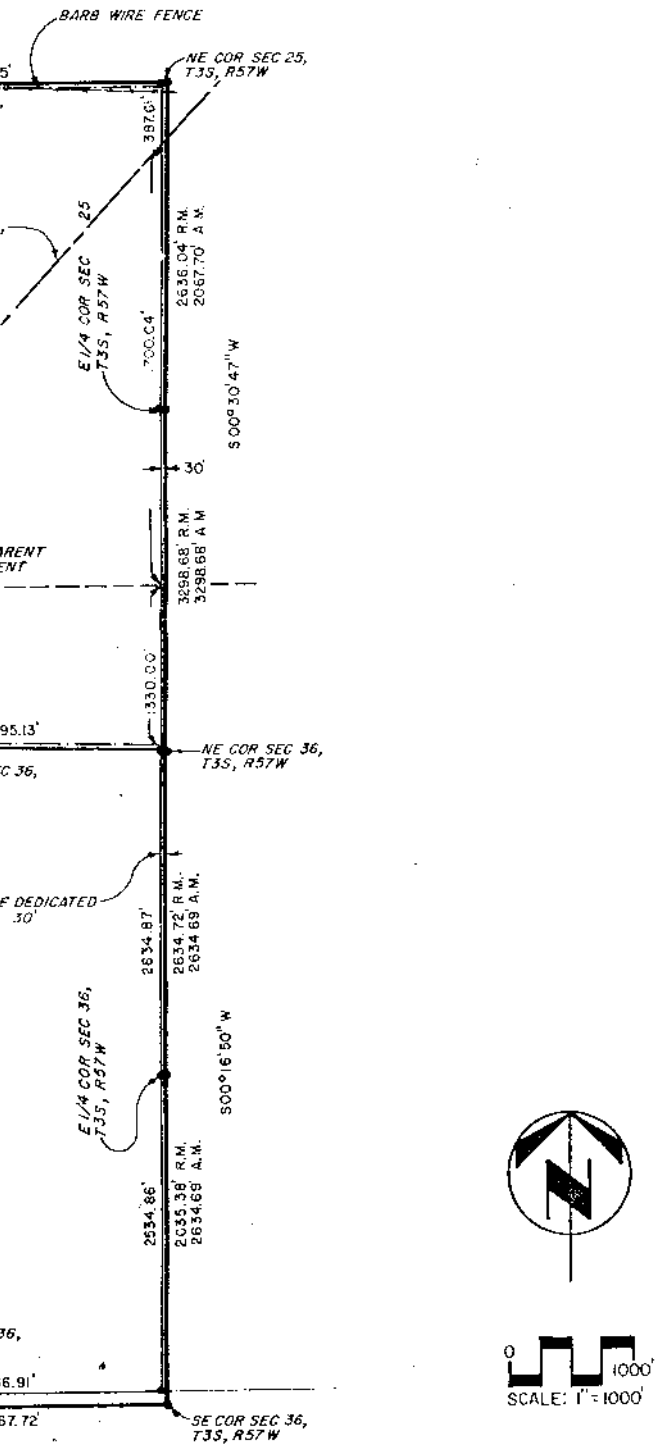
SHEET NO.
FIG 5.3.1
OF

HIGHWAY 36 LAN
BOL
SECTIONS 25 & 36, TOWNS
ADA



36 LAND DEVELOPMENT CORPORATION
BOUNDARY SURVEY

5 & 36, TOWNSHIP 3 SOUTH, RANGE 57 WEST OF THE 6TH P.M., ADAMS COUNTY, COLORADO



LEGAL DESCRIPTION:

ALL OF SECTIONS 25 & 36, T3S, I
P.M., ADAMS COUNTY, COLORADO; E
UTILITY EASEMENT ACROSS SECTIC
EXCEPT AN EASEMENT AND RIGHT
PURPOSE OF CONSTRUCTING, RECC
AND MAINTAINING A 6 INCH OIL PI
TO ARAPAHOE PIPELINE COMPANY
COLORADO, ACTING BY AND THROU
OF LAND COMMISSIONERS, AFFECTI
EXCEPTING RIGHT-OF-WAY FOR DI
RESERVED IN UNITED STATES PATEN
BOOK 106, PAGE 201, AFFECTING TH
SECTION 25; ALSO BOOK 99, PAGE
SOUTH 1/2 OF SECTION 25; AND E
30.00' OF SECTION 25; ALSO EXCE
30.00' OF SECTION 36 TO BE DEDI
COUNTY FOR ROAD, AND EXCEPT T
OF SECTION 36.

SURVEYOR'S CERTIFICATE

I, CHRISTOPHER D. BASGALL, A REG
LAND SURVEYOR, DO HEREBY CERT
THE SURVEY BY THIS MAP, THAT T
REPRESENTS SAID SURVEY AND TH
EXIST AS SHOWN HEREON.

Chris
CHRI
L.S. 1

NOTICE:

ACCORDING TO COLORADO LAW YOU
LEGAL ACTION BASED UPON ANY D
WITHIN SIX YEARS AFTER YOU DIS
IN NO EVENT, MAY ANY ACTION BA
IN THIS SURVEY BE COMMENCED M
FROM THE DATE OF CERTIFICATION

NOTE:

SECTION 25 CONTAINS 603.93 ACR
SECTION 36 CONTAINS 580.18 ACR
ACREAGES INCLUDES EASEMENT &
RECORDED BK.1356, PG. 288. ALSO
INCLUDED.

• SET PIN & CAP

COMI
DATE
DRAF

_OPMENT CORPORATION
SURVEY

, RANGE 57 WEST OF THE 6TH P.M.,
COLORADO

LEGAL DESCRIPTION:
ALL OF SECTIONS 25 & 36, T3S, R57W OF THE 6TH P.M., ADAMS COUNTY, COLORADO; EXCEPT AN APPARENT UTILITY EASEMENT ACROSS SECTIONS 25 & 36 AND EXCEPT AN EASEMENT AND RIGHT-OF-WAY FOR THE PURPOSE OF CONSTRUCTING, RECONSTRUCTING, OPERATING, AND MAINTAINING A 6 INCH OIL PIPELINE, GRANTED TO ARAPAHOE PIPELINE COMPANY BY THE STATE OF COLORADO, ACTING BY AND THROUGH THE STATE BOARD OF LAND COMMISSIONERS, AFFECTING SECTIONS 25 & 36, EXCEPTING RIGHT-OF-WAY FOR DITCHES OR CANALS, RESERVED IN UNITED STATES PATENTS RECORDED IN BOOK 106, PAGE 201, AFFECTING THE NORTH 1/2 OF SECTION 25; ALSO BOOK 99, PAGE 201, AFFECTING THE SOUTH 1/2 OF SECTION 25; AND EXCEPTING THE EAST 30.00' OF SECTION 25; ALSO EXCEPTING THE EAST 30.00' OF SECTION 36 TO BE DEDICATED TO ADAMS COUNTY FOR ROAD, AND EXCEPT THE SOUTH 100.00' OF SECTION 36.

SURVEYOR'S CERTIFICATE
I, CHRISTOPHER D. BASGALL, A REGISTERED COLORADO LAND SURVEYOR, DO HEREBY CERTIFY THAT I HAVE MADE THE SURVEY BY THIS MAP, THAT THIS MAP ACCURATELY REPRESENTS SAID SURVEY AND THAT ALL MONUMENTS EXIST AS SHOWN HEREON.

Christopher D. Basgall
CHRISTOPHER D. BASGALL
L.S. 16823

NOTICE:
ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN SIX YEARS AFTER YOU DISCOVER SUCH DEFECT, IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF CERTIFICATION SHOWN HEREON.

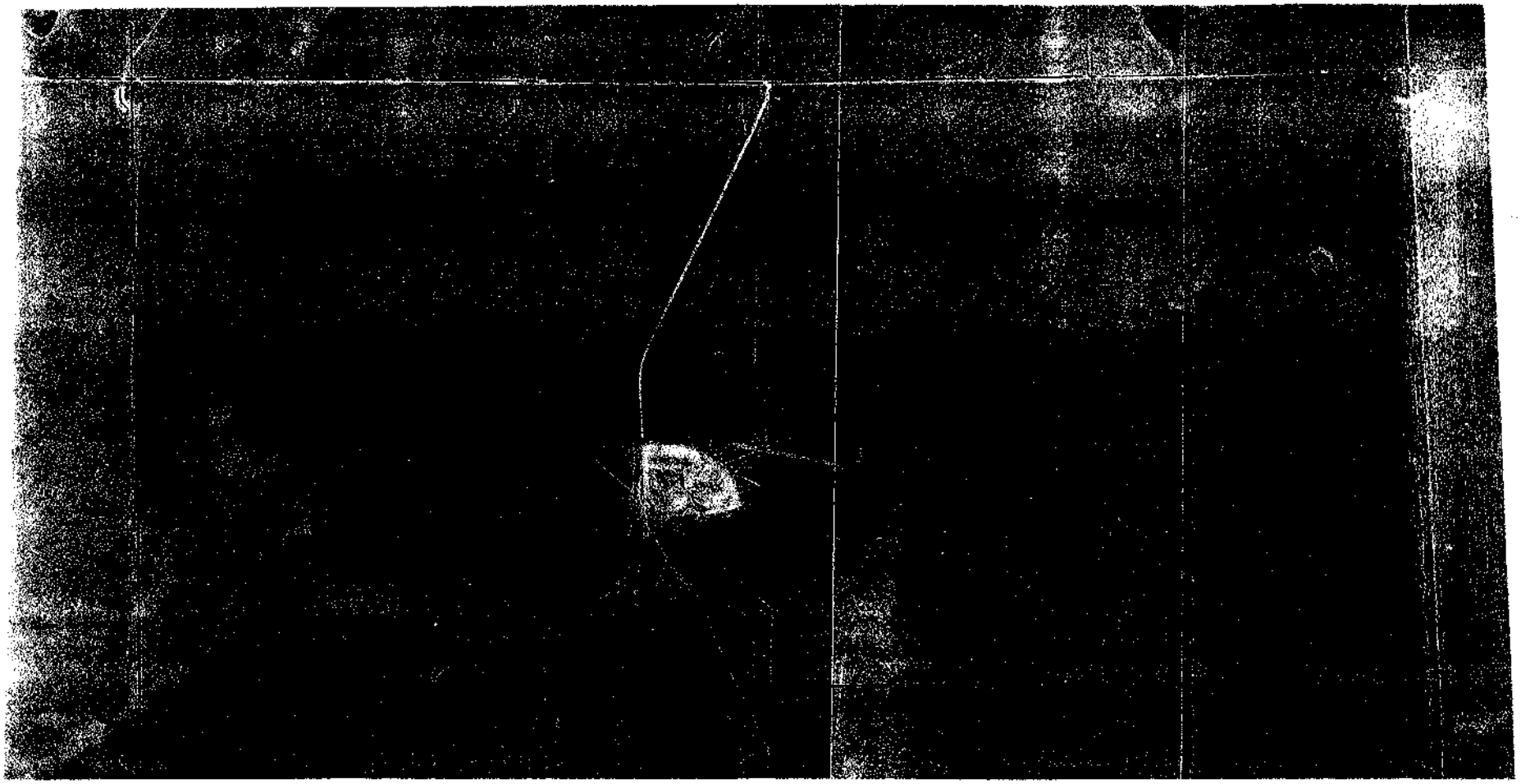
NOTE:
SECTION 25 CONTAINS 603.93 ACRES, MORE OR LESS; SECTION 36 CONTAINS 580.18 ACRES, MORE OR LESS. ACREAGES INCLUDES EASEMENT & R.O.W. FOR PIPELINE RECORDED BK. 1356, PG. 288. ALSO, APPARENT UTILITY INCLUDED.

• SET PIN & CAP.

1000'
: 1" = 1000'

EXHIBIT 5.3.1

QUEST CONSULTING	
COMMERCE CITY, COLORADO	288-0267
DATE: 3/02/81	SCALE: 1" = 1000'
DRAFTING: ABN	80-1



(SCALE IN FEET)

0 400 800 1600

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ ENGR
PROJ MGR
BY
DATE

HOWARD WETOLES TAMMEN & BERGENDOFF HNTB

ARCHITECTS ENGINEERS PLANNERS

JOB NO

DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES

HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

AERIAL PHOTOGRAPH OF SECTIONS 25 & 36

SHEET NO FIG 5.3.2

5.3.2 History of Ownership

The history of ownership of Sections 25 and 36 since Adams County was formed in 1902 is provided below:

- Section 36
  - Acquired by patent from the State of Colorado by Gene and Shirley Linnebur in 1979.
  - Sold to Highway 36 Land Development Company in 1980.
- Section 25
  - S 1/2 owned by John and Ethel Fleming when the county was formed in 1902.
  - N 1/2 acquired by patent from U.S. Government in 1920 by Lucy Pierce.
  - S 1/2 acquired by George and Mary Patterson from Fleming in 1920.
  - N 1/2 sold to Viola Ledgerwood in 1920.
  - S 1/2 acquired by Colorado Farm Company from Patterson in 1922.
  - N 1/2 sold to Wanda Lieske in 1929 from Ledgerwood.
  - S 1/2 sold to Ina Dudley from Colorado Farm Company in 1930.
  - S 1/2 sold to William Jolly in 1941 from Dudley.
  - N 1/2 sold to John Jolly from Lieske in 1943.
  - N 1/2 conveyed to William Jolly from John Jolly in 1947.
  - Section 25 conveyed to Wanda Jolly upon the death of William Jolly in 1964.
  - Section 25 sold by Wanda Jolly in 1969 to Linnebur.
  - Sold by Linnebur to Highway 36 Land Development Company in 1980.

5.3.3 Mining Activities

Based upon review of the title materials provided by the Transamerica Title Insurance Company, fee simple title to the oil and gas estate in Section 36 is presently vested in the State of Colorado. The oil and gas estate in Section 25 is owned by the parties in the proportions listed in Table 5.3.1(1).

TABLE 5.3.1

OWNERSHIP OF GAS AND OIL ESTATE IN SECTION 25(1)

Highway 36 Land Development Company	240/640
Franklin W. Baumgartner	151/640
The Carter Oil Company	149/640
William R. Thurston	20.5/640
Walter K. Arbuckle	17.5/640
Philip C. Beals	14.5/640
Connolly J. Reagan and Jacqueline A. Webster	8.75/640
Delbert W. Miller and Helen M. Miller	8.75/640
Joe M. Halvorsen	7/640
George H. Fentress	5/640
Hortense K. Loken	5/640
William S. Davis	5/640
W. W. Ferris and Dorothy M. Hughes	3/640
Elliott Oil Corporation	1.5/640
Dennis V. Sundheim and Renee L. Sundheim	1.5/640
Herbert M. Coulson	1/640
Clifford K. Beabout and Isabelle Beabout	1/640

The active oil wells (shown in Figure 5.3.1) will not be sealed when disposal operations commence. Oil wells (abandoned or active) do not represent a threat to the quality of underlying aquifers because there are no aquifers underlying the site that could be jeopardized (see Section 5.6).

The active oil well feeds into an oil pipeline which traverses the site. The pipeline is owned by Arapahoe Pipeline Company. According to information provided by the pipeline owner, the line is a four or six inch

steel crude oil line, approximately 30 inches deep, which presently serves a lease on Section 25. Pressures in the line vary depending upon the number of wells feeding into the line and are generally between 150 and 250 pounds per square inch. If Arapahoe Pipeline Company cannot verify the pipeline size, BFI will measure the pipe in the field prior to operation.

Information received from the Arapahoe Pipeline Company indicates that shut-off valves on the line are probably located 20 miles apart. Exact location information was not provided. BFI will continue to investigate this matter so that specific information on valve locations is known prior to start-up of operations. The site layout as shown in Chapter 6 provides for a buffer zone that will keep facilities safely away from the pipeline.

All of the abandoned oil wells were sealed (plugged) under the jurisdiction of the Colorado Oil & Gas Commission upon abandonment. BFI does not intend to disturb such abandoned and sealed oil wells. Should an abandoned oil well be accidentally encountered in the excavation process, the Colorado Oil & Gas Commission will be notified, and standard Oil & Gas Commission procedures will be followed to seal such well.

5.3.4 References

1. Schissler, Gerald J., letter to Robert Johnson regarding Highway 36 Land Development Company, Holland and Hart Attorneys-at-Law, Denver, Colorado (Sept. 18, 1981).

5.4 GEOLOGY AND HYDROGEOLOGY

5.4.1 Introduction

Geologic and hydrogeologic investigations of the site and the surrounding region were performed by F. M. Fox & Associates, Inc., of Denver, Colorado. The purpose of these studies was to assess and determine the site's geological and hydrogeological suitability for a chemical waste treatment, solidification, and disposal facility.

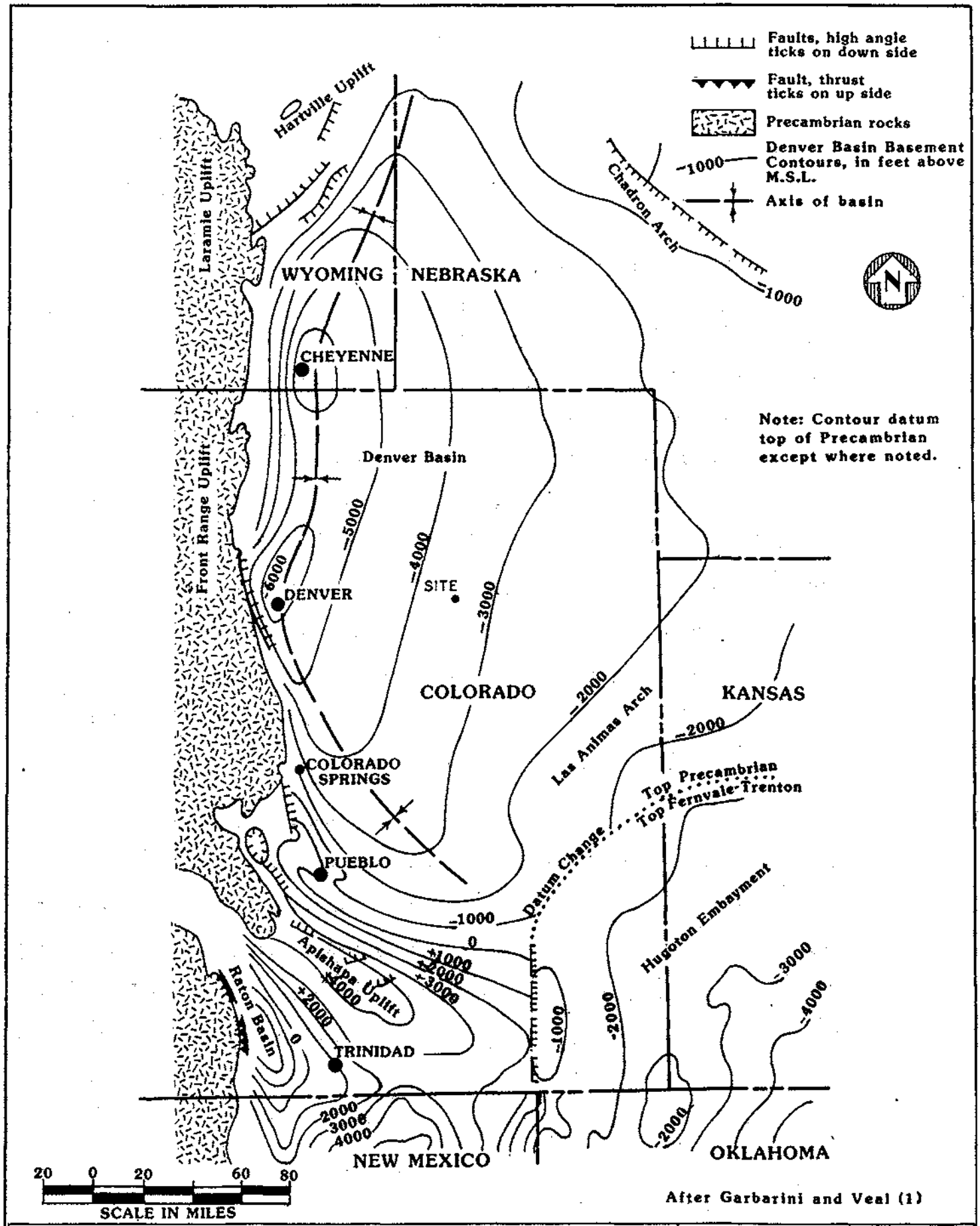
A preliminary report was prepared by F. M. Fox & Associates and submitted to BFI as an unsigned, preliminary draft. The purpose of this draft was primarily for internal project assessment. The pertinent sections of the draft submitted to the State reviewers were prepared by personnel of F. M. Fox & Associates, Inc., and is essentially the same preliminary report. The pertinent sections of this draft report were used in the preparation of Section 5.4 of this facility plan.

5.4.2 Geologic Conditions

5.4.2.1 Regional

The Denver Basin in northeastern Colorado, east of the Front Range and north of Colorado Springs, was evaluated in this regional analysis. The Denver basin is in the Great Plains physiographic province, a region primarily of rolling grasslands. These plains slope generally eastward across the Denver basin. Elevations range from 7,000 feet near the mountains to 4,000 feet along the Kansas border.

A generalized tectonic map of the Denver basin and surrounding area is presented in Figure 5.4.1(1). As indicated by the contour lines, the Precambrian basement east of the mountains is at a depth of 2,000 to 6,000 feet below mean sea level. Furthermore, these contours illustrate

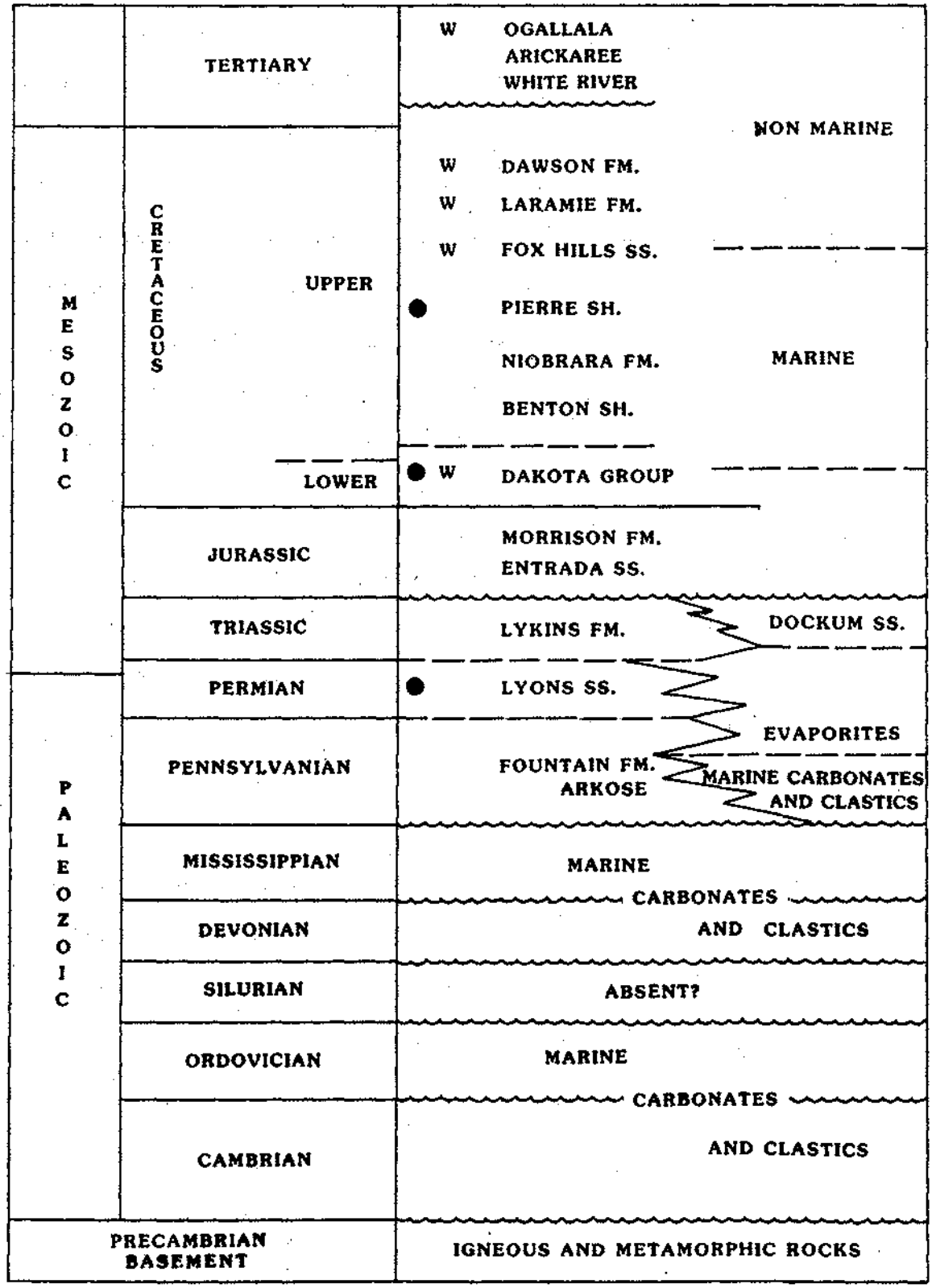


GENERALIZED TECTONIC MAP OF THE DENVER BASIN	Job No:	1-2543-3233
FOX Consulting Engineers and Geologists	Date:	12/11/80
	Figure	5.4.1

that the Denver basin is a broad asymetrical structure with the axis very close to the western margin of the basin. The eastern flank dips gently west at about 30 to 50 feet per mile, and the western flank dips very steeply to the east, with beds locally overturned(1). Very few faults have been found, except along the boundary of the Front Range.

Few wells have been drilled to basement in the Denver basin. Where observed, the basement material consists of Precambrian igneous and metamorphic rocks, primarily gneiss and granite. Overlying sedimentary rocks range in age from Cambrian to Tertiary, as illustrated in the regional composite stratigraphic section presented in Figure 5.4.2(1). East of the basin axis, only Cretaceous age and younger rocks are exposed. Surficial deposits of Quaternary dune sand, silt, and Peoria loess blanket much of the surface. Figure 5.4.3 is a generalized regional geologic map of the basin area(2), and Figure 5.4.4 is a generalized regional east-west cross-section. The significance of these figures will be discussed in Section 5.4.4.

Coal, oil, and gas have been produced from the Denver basin. Coal has been mined from seams in the Laramie Formation just east of the Front Range. Oil and gas production has come from the Dakota "D" and "J" sandstones, the Niobrara Formation chalk, the Hygiene Sequence sandstones of the Pierre Shale, and the Lyons Sandstone. Within the Pierre Shale are the Richard, Larimer, Rocky Ridge, Terry, and Hygiene Sandstones, collectively called the Hygiene Sequence. These units thin eastward from the Front Range. The oil and gas accumulations are localized in stratigraphic traps of lenticular sandstone bodies pinching laterally into shale or sandy shale.



W Aquifer

● Designates major oil objectives

After Garbarini and Veal (1)

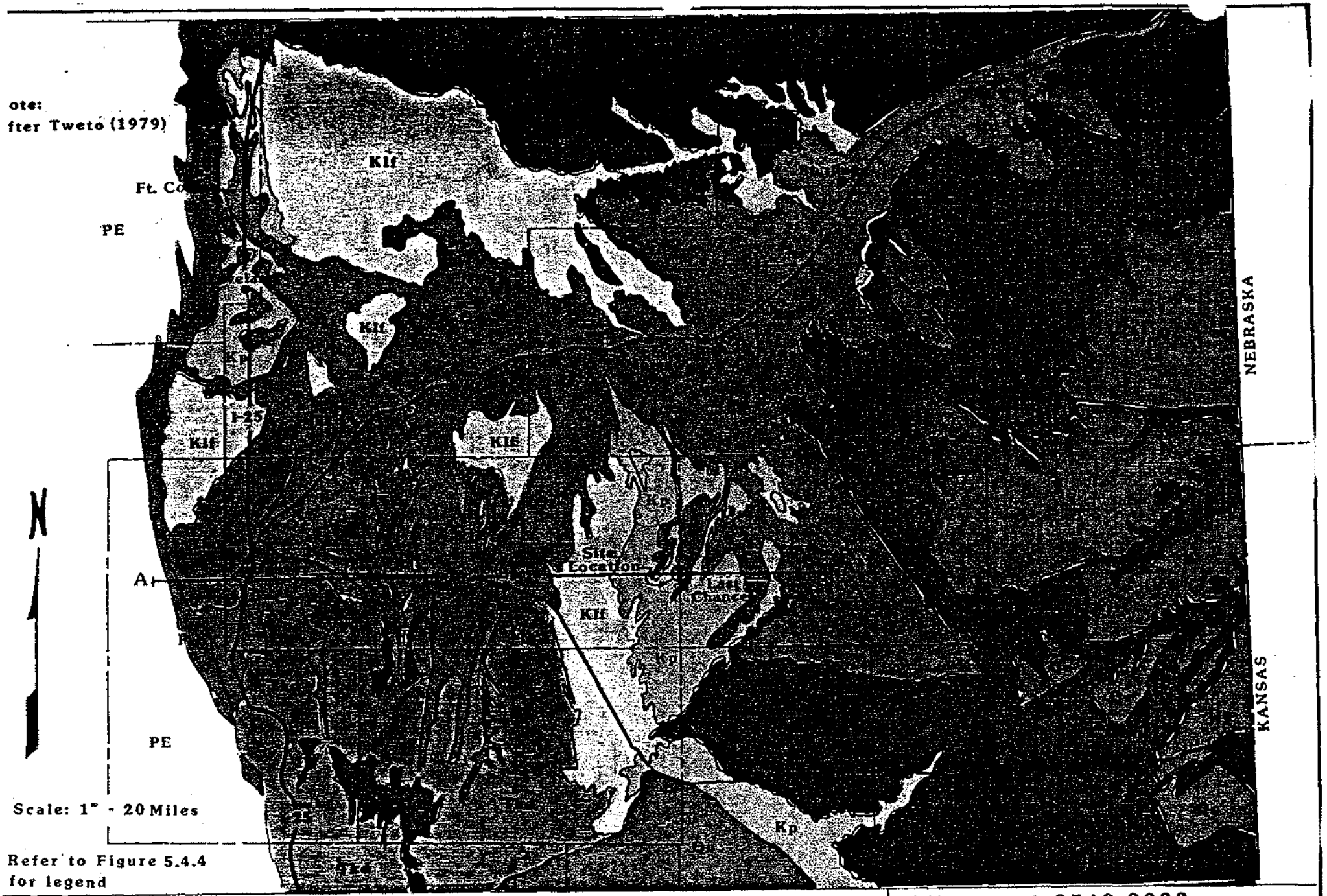
COMPOSITE STRATIGRAPHIC SECTION OF DENVER BASIN	Job No: 1-2543-3233
FOX Consulting Engineers and Geologists	Date: 12/11/80
	Figure 5.4.2

5.4.2.2 Site Specific

Bedrock below the site is the Pierre Shale. The Colorado Department of Health has evaluated geologic formations in the State for potential use as hazardous waste disposal sites(3). Their evaluation indicated that the Pierre Shale has the highest probability of developing a safe storage facility. Other formations in the Denver basin, i.e., the Denver Formation, Dawson Arkose, Laramie Formation, Niobrara Formation, and Benton Group were evaluated as having marginal probability for safe storage. These conclusions are summarized in Table 5.4.1. Figures 5.4.3 and 5.4.4 illustrate that the site is located within this favorable formation.

The Pierre Shale is a gray to black, silty, fossiliferous, marine shale. Oil well information indicates the sandstones of the Hygiene Sequence of the Pierre Shale pinch out west of the site(1,4,5). If the sequence were below the site, it would be expected at an approximate depth of 1,000 feet. No evidence of this sequence was found in the available geophysical logs from wells at the site. The total thickness of the Pierre Shale at the site is approximately 4,300 feet, as illustrated in the generalized site stratigraphic section presented in Figure 5.4.5(5) and the general cross section in Figure 5.4.6(5). In-situ permeability test results near the surface of the unweathered Pierre Shale indicate that the shale is impervious (refer to Section 5.4.3).

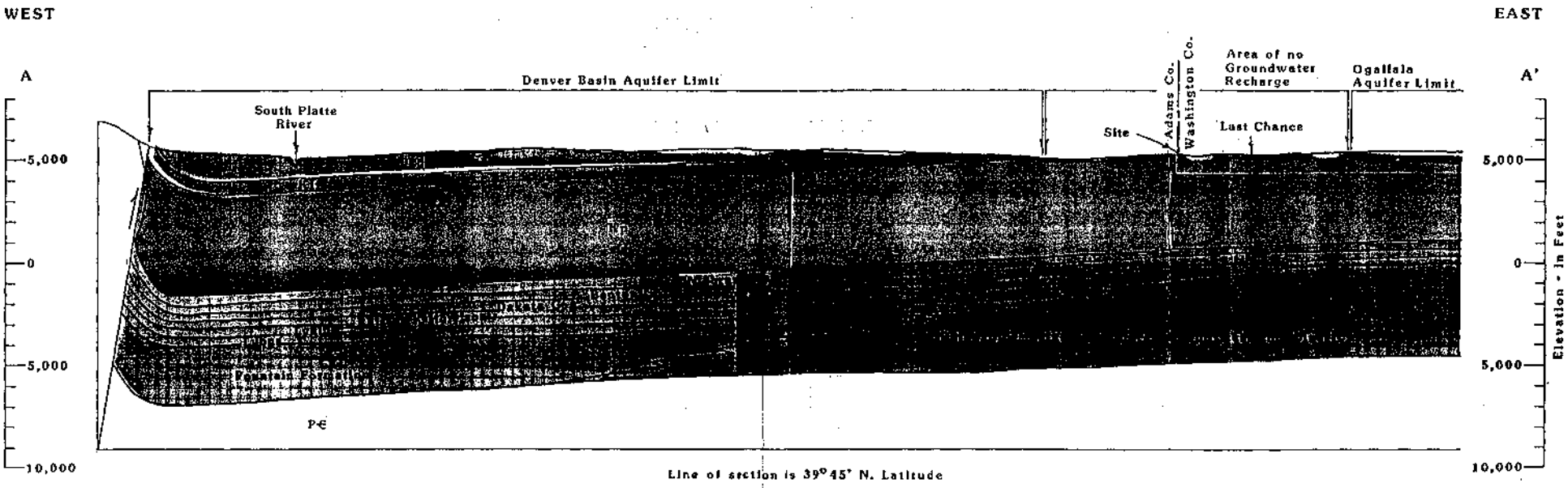
The scale of the stratigraphic section, Figure 5.4.6, necessitated a certain amount of simplification. However, the electric logs from wells in the area show a fairly uniform shale throughout the Pierre section. Samples from the Pierre collected to depths of 500 feet during the investigation of this site did not contain sandstone, siltstone, or sandy



GENERALIZED REGIONAL GEOLOGIC MAP

FOX Consulting Engineers and Geologists

Job No:	1-2543-3233
Date:	1/15/81
Figure	5.4.3



LEGEND

Qe	Quaternary loess, eolian sand, and alluvium
	Tertiary Ogallala and White River Formations
Tkd	Tertiary / Cretaceous Denver Formation and Dawson Arkose
Klf	Cretaceous Laramie and Fox Hills Formations
Kp	Cretaceous Pierre Shale
P-K	Pennsylvanian through Cretaceous rocks, undifferentiated
P€	Precambrian rocks

0 5 10 15 20
Horizontal Scale
(in miles)

GENERALIZED REGIONAL CROSS SECTION

FOX Consulting Engineers and Geologists

Job No. 1-2543-3233 | Date 1/15/81 | Figure 5-4-4

TABLE 5.4.1

GEOLOGIC SUITABILITY RANKING FOR WASTE DISPOSAL

Formations with highest probability of developing a safe storage facility for hazardous waste:

Formation

Pierre Shale - eastern Colorado (includes upper and lower sections)*

Mancos Shale - northwestern, southwestern Colorado

Lewis Formation - northwestern, west central Colorado

San Jose Formation - southwestern Colorado

Formations with marginal probability of developing a safe storage facility for hazardous waste:

Formation

Pierre Formation - middle section, eastern Colorado

Dawson Arkose - eastern Colorado

Laramie Formation - east central Colorado

Niobrara Formation - southeastern Colorado

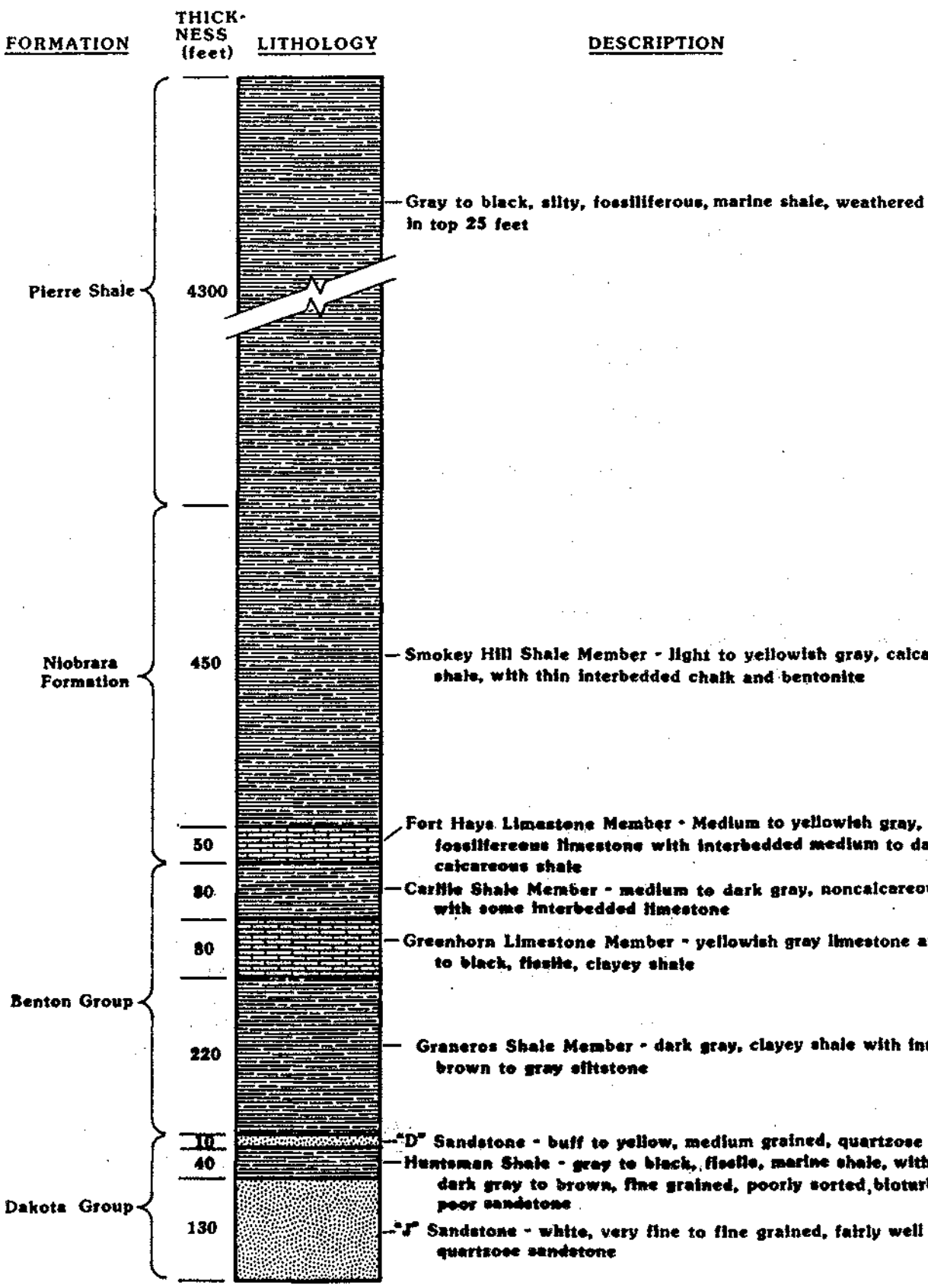
Benton Shale - southeastern Colorado

Wasatch Formation - northwestern Colorado

Lance Formation - northwestern Colorado

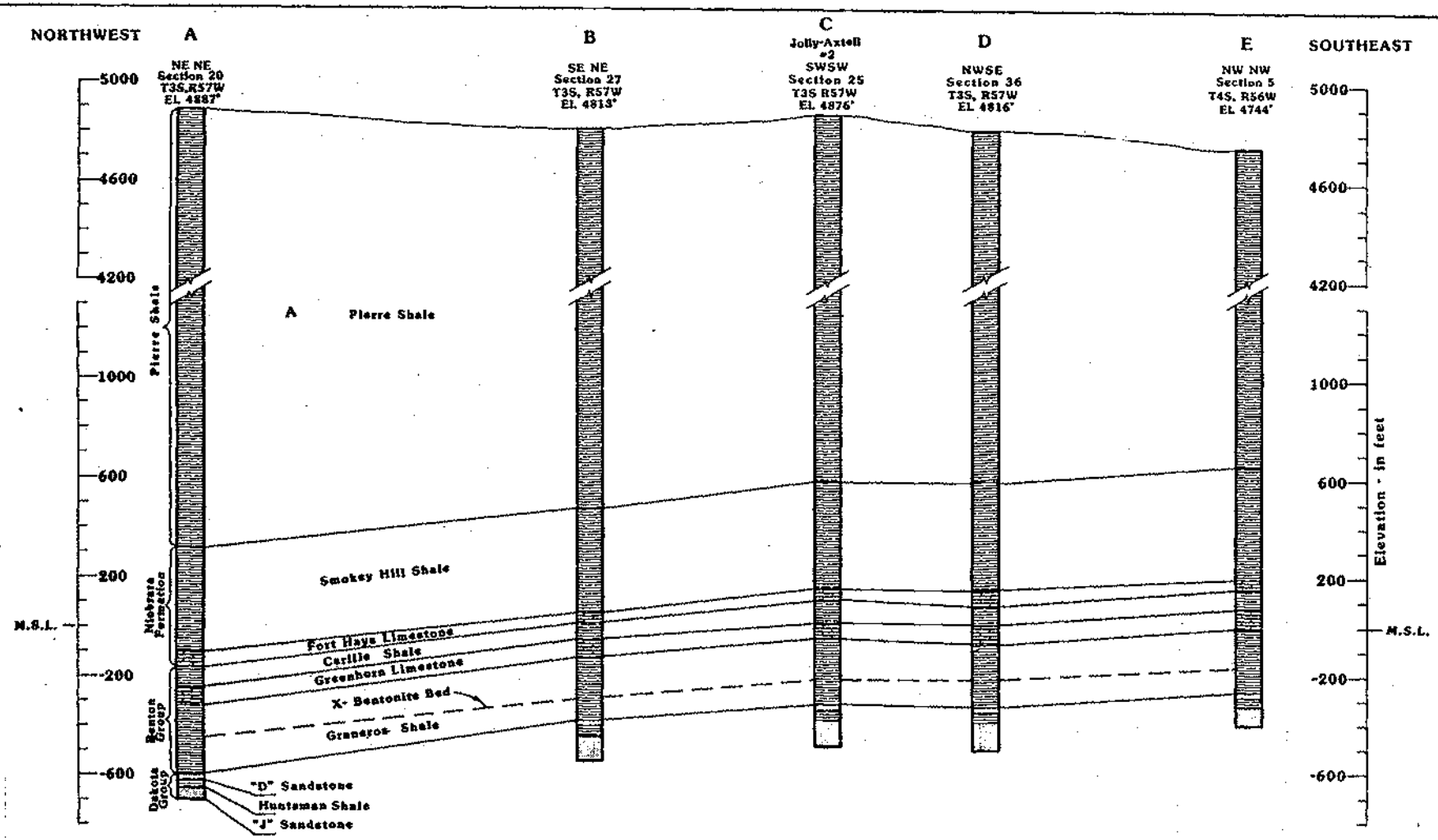
(From Colorado Department of Health(3)).

*The site is located on top of this upper section of the Pierre Shale.



Note: Data generalized from the review of approximately fifty electric logs and a review of pertinent U.S.G.S. literature.

GENERALIZED SITE STRATIGRAPHIC SECTION	Job No: 1-2543-3233
FOX Consulting Engineers and Geologists	Date: 12/8/80
	Figure 5.4.5


NORTHWEST
A
NE NE
Section 20
T3S,R57W
EL 4887'
B
SE NE
Section 27
T3S, R57W
EL 4813'
C
Jolly-Axtell
#2
SWSW
Section 25
T3S R57W
EL 4876'
D
NWSE
Section 36
T3S, R57W
EL 4816'
E
NW NW
Section 5
T4S, R56W
EL 4744'
SOUTHEAST
5000
4600
4200
1000
600
200
N.S.L.
-200
-600
Pierre Shale
Niobrara Formation
Benton Group
Dakota Group
A Pierre Shale
Smokey Hill Shale
Fort Hays Limestone
Carlile Shale
Greenhorn Limestone
X- Bentonite Bed
Graneros Shale
"D" Sandstone
Huntsman Shale
"J" Sandstone
Elevation - in feet
M.S.L.
Horizontal Scale: 1" - 3000'
Note: Information derived from electric logs
LEGEND
Shale
Limestone
Sandstone
21
22
23
27
26
25
34
35
36
Scale: 1" - 10,000'
GENERAL SITE CROSS SECTION
FOX
Consulting Engineers and Geologists
Job No: 1-2543-3233
Date: 1/16/81
Figure 5.4.6

siltstone (CC1 through CC7, see Section 5.4.3.1). None of these rock types occurred in any of the cores, which went to 250 feet. A few of the electric logs showed slight increases in permeability within zones less than 20 feet thick at depths between 2,700 and 3,000 feet. Density logs of the Pierre Shale were not available to BFI and were probably not run on these zones for the oil and gas exploration. These zones were not included on the logs because they account for less than 1% of the total Pierre Shale section at the site and would be very difficult to portray at the scale of presentation. These zones may relate to the sandstones of the Terry-Hygiene Sequence which, although non-existant at the site, may have contributed clastics eastward into the Cretaceous Pierre Seaway Basin to yield a slight increase in sand content and related permeability within the shale. This means there may be from one to three zones of slightly sandy shale with slightly higher than normal permeability at depths between 2,700 and 3,000 feet, which is not significant enough to indicate on the logs in Figure 5.4.6.

Mr. John Romero, Supervising Engineer of the Groundwater Analysis Branch of the Colorado Division of Water Resources, has inspected the core from the continuous core holes. His findings and strip logs for those cores were sent to F. M. Fox & Associates, Inc., in a letter dated August 31, 1981. The purpose of this core examination was to locate stratigraphically the Fox Hills Transition Sandstone beneath the site. He found what he called "zones of interest" in wells CC2, CC3, and CC4. These "zones of interest" are at depths between 132 to 244 feet below the surface of the site. The description on his strip logs for these zones indicate primarily a tight, hard dry shale with local increases in silt and some "minute siltstone partings, mostly interstitial". Based on

these strip logs and BFI's reexamination of the core, it is BFI's opinion that revision of the stratigraphic section as portrayed on Figure 5.4.6 is not warranted.

The Pierre Shale is underlain by the Niobrara Formation. This formation is light to yellowish gray, calcareous shale, with thin interbedded limestone and bentonite. The Niobrara Formation is approximately 500 feet thick and contains two members, the Smokey Hill Shale and the Fort Hays Limestone. The Fort Hays Limestone is a shaley chalk in the lower 50 feet of the formation. This member has been drilled for gas in parts of northeastern Colorado(6).

The Benton Group underlies the Niobrara Formation. The Group is composed of the Carlile Shale, the Greenhorn Limestone, and the Graneros Shale. The Carlile Shale is approximately 80 feet of medium to dark gray, non-calcareous siltstone, with some interbedded limestone. The Greenhorn Limestone is yellowish gray limestone with light gray to black, fissile clayey, shale, approximately 80 feet thick. The bottom 220 feet of the Benton Group is the Graneros Shale, a dark gray, clayey shale with interbedded brown to gray siltstone.

The Dakota Group underlies the Benton Group. Below the site the upper "D" Sandstone of the Dakota Group is approximately 10 feet thick and consists of buff to yellow, medium grained quartzose sandstone. Approximately 40 feet of Huntsman Shale separates the "D" and "J" Sandstone.

Oil wells have been drilled in the area to the "D" and "J" Sandstones of the Dakota Group. The Niobrara chalk has produced natural gas, but the chalk is not known to contain natural gas at the site. No other economic minerals are known to exist beneath the site.

No evidence of faulting was observed at or near the site. The site is an area of low seismicity. Algermissen and Perkins(7) have mapped the region as having maximum probable acceleration of less than 4% of gravity (Modified Mercalli Intensity IV). This is sufficiently low that seismic shaking of structures should be of less importance than wind shaking.

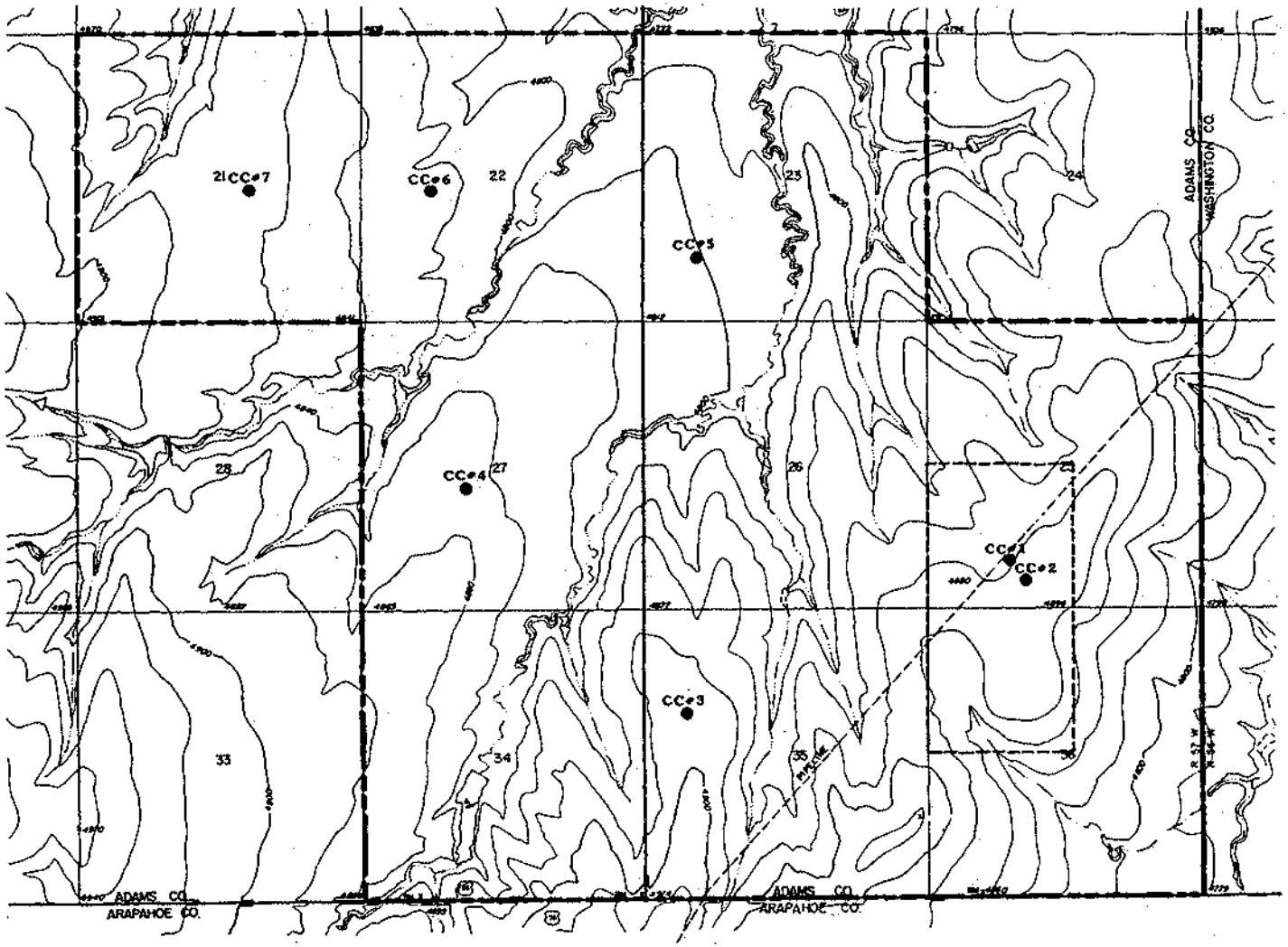
5.4.3 Subsoil Conditions

The area referred to as the general site is shown on Figure 5.4.7. It is the entire area within Sections 21, 22, 23, 25, 26, 27, 34, 35, and 36, Township 3 South, Range 57 West, in Adams County, Colorado. Data from seven borings (CC1 through CC7) were collected from this area to provide an indication of general subsoil conditions. Upon completion of the general site characterization effort, a more concentrated subsoil investigation was conducted in Sections 25 and 36 (refer to Figure 5.4.8). All of the subsoil data collected for these evaluations were obtained from field and laboratory investigations. The field methodology employed is described below.

5.4.3.1 Field Methods

5.4.3.1.1 Test Boring Program

The test boring program originally consisted of the 46 borings illustrated in Figures 5.4.7 and 5.4.8. In response to a request by the Colorado State Department of Health, six additional soil borings (H series) were drilled at the site on August 20, 1981 to characterize the area where disposal cells would be located(9). The exploratory borings and the field permeability test holes were left open for periods of 24 hours to 11 days after drilling to monitor for groundwater. The test boring designations are assigned as below.



LEGEND

CC#1 ● Site Specific Core Holes CC#1 and CC#2

CC#3 ● General Site Core Holes CC#3 - CC#7

SCALE (FEET)

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE (8 MAR 85)

BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF CORE BORINGS

SHEET NO.
FIG 5.4.7

The format used for presentation of boring logs is standard for soil borings. Although cross-sectional plotting may have made it easier to visualize unit relationships, it also introduces subjective interpretation between test borings. Furthermore, cross-sectional type plotting would have increased the size of the presentation, which would be unduly awkward. Such a presentation would have required duplication of every test hole log to provide complete north-south and east-west cross-sectional coverage. Therefore, the standard method of presentation was chosen as the most efficient method of presenting the data for the purpose of the report.

Borings CC1 through CC7

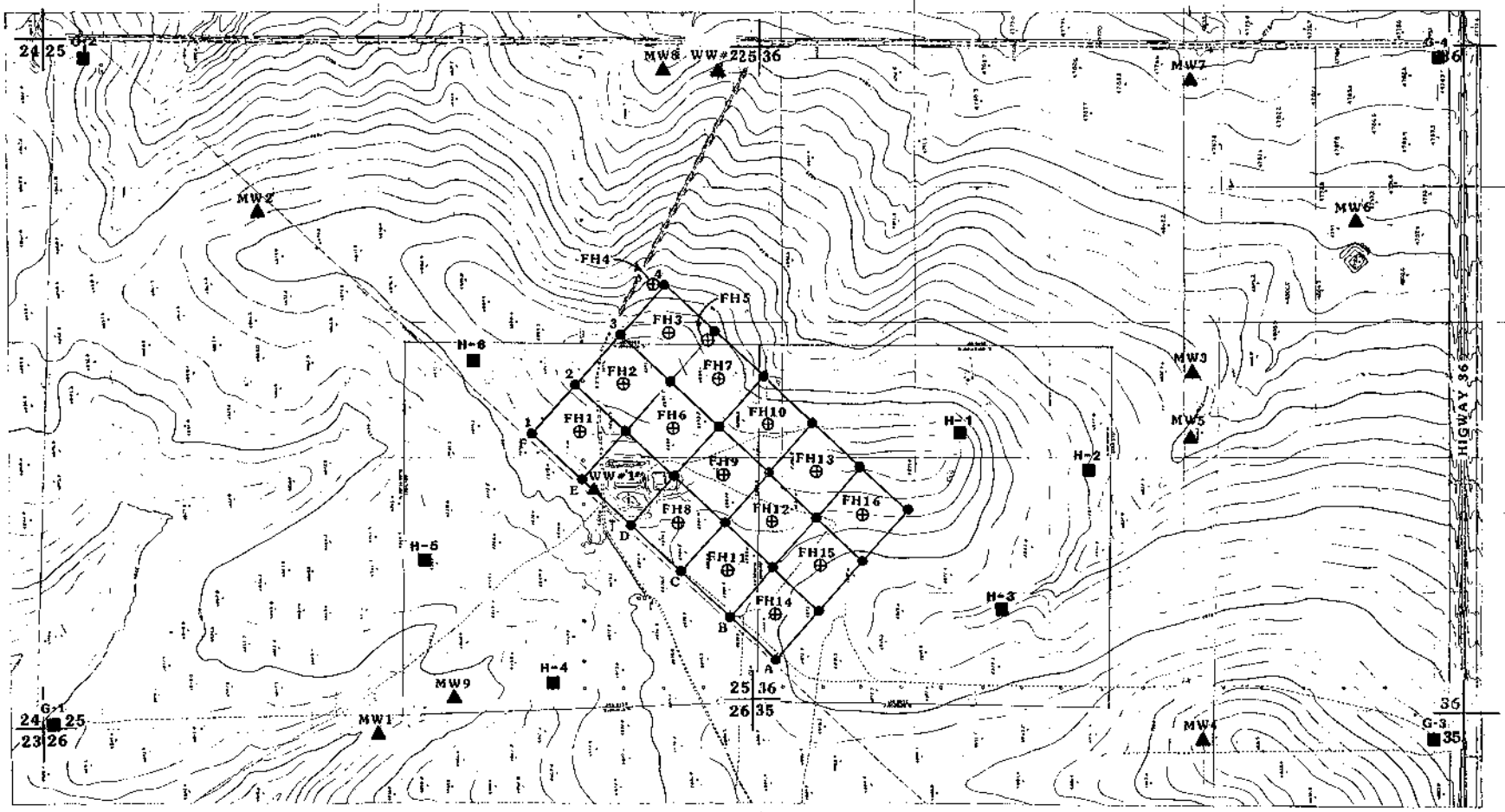
Borings CC1 through CC7 were drilled to provide subsoil information for the area described above as the general site. With the exception of boring CC1, these holes were drilled to a depth of approximately 30 feet with 6-inch diameter hollow stem augers and then continuously cored to their total depth. Boring CC1 was drilled with a combination of rotary and coring techniques. Each of these borings is now completely sealed with a very thick bentonite slurry mixture. The logs of these borings are presented in Appendix G.

Borings A1 through H6

Borings A1 through G4 were drilled at the nodes of a grid (see Figure 5.4.8) to generate detailed subsurface information in Sections 25 and 36 and more specifically the initial construction area. Borings H1 through H6 were drilled to characterize the shallow subsurface conditions in the disposal cell area outside the previously drilled grid (A1 through G4). These borings were drilled with 4-inch diameter continuous flight solid augers. Soil and/or bedrock sampling was conducted with a 2-inch diameter modified California Barrel Sampler. Upon completion of drilling, each of these borings was sealed with a mixture containing 25% sand and 75% dry bentonite. Logs for these borings are shown in Figures 5.4.9, 5.4.10, and 5.4.11.

Borings MW1 through MW9

Borings MW1 through MW9 were drilled at locations which could later serve as monitoring wells to be used to characterize existing water quality and for groundwater monitoring during the operation and post-closure period. These borings were drilled with 6-inch diameter hollow stem continuous flight augers. Soils and/or bedrock samples were collected with a 2-inch modified California Barrel Sampler. Upon completion of drilling, each of



⊕ Standpipe Permeability Location (FH Holes), 2 Tests at each location, except FH4 & FH5

● Grid Test Holes A1 through F4

▲ Monitor Well Location

■ G, H Test Hole Location, part of Grid Test Hole Program

(SCALE IN FEET) 0 400 800 1600

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED
	REVISED 10-21-81								

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

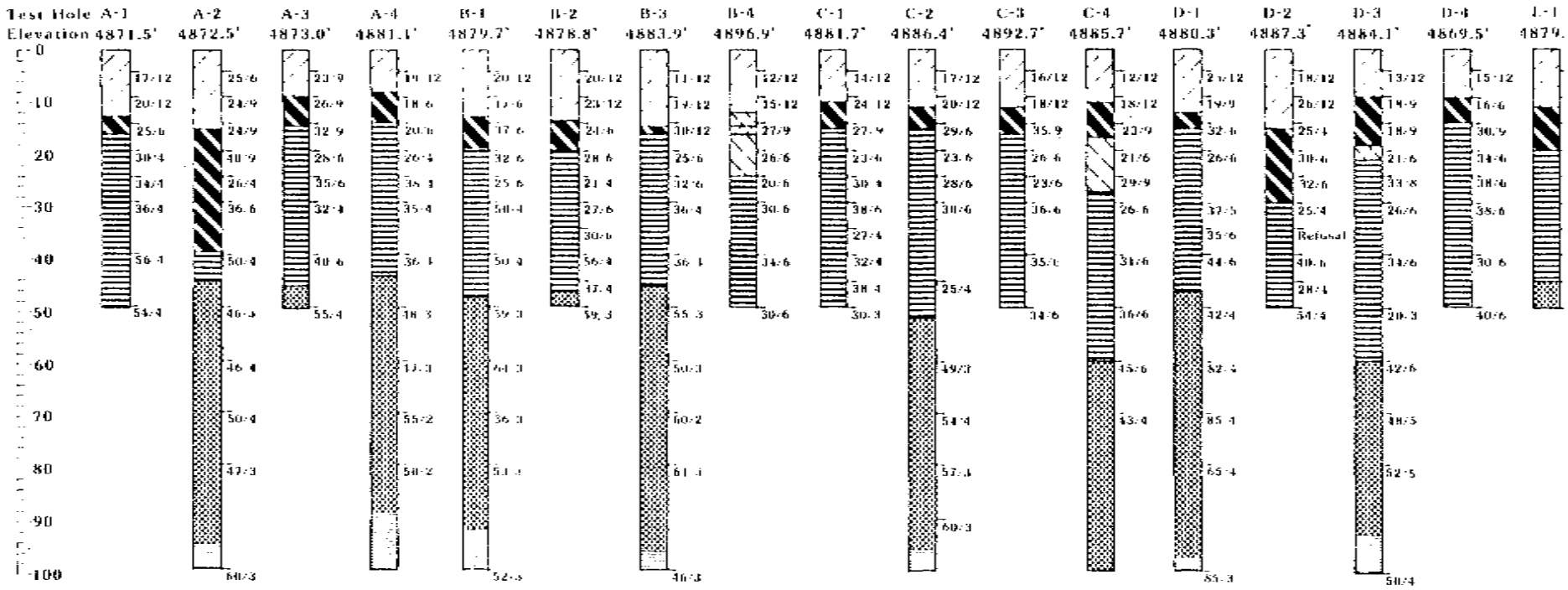
HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

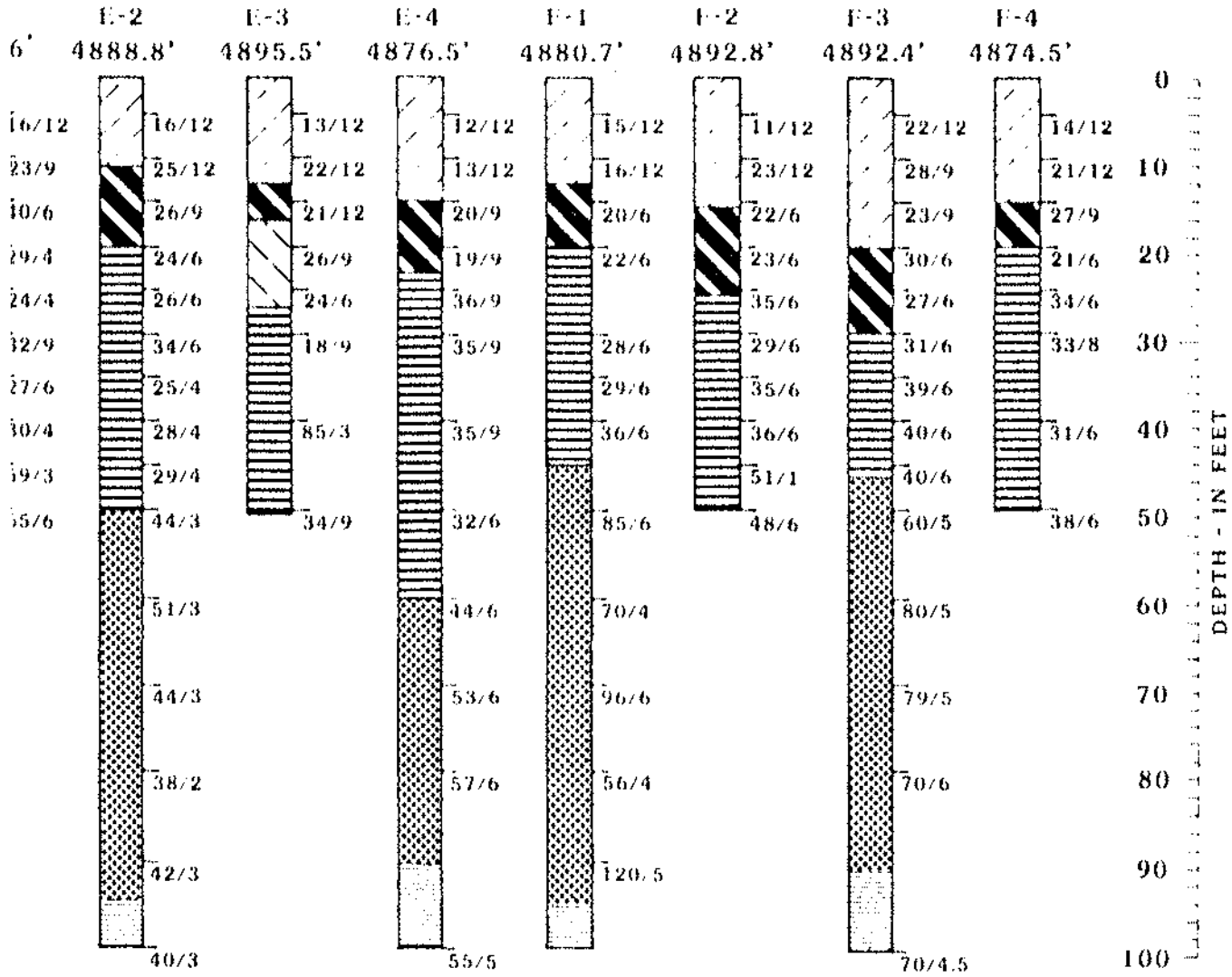
BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

TEST HOLES AND MONITORING WELLS LOCATION PLAN

SHEET NO. Figure 5.4.8 OF



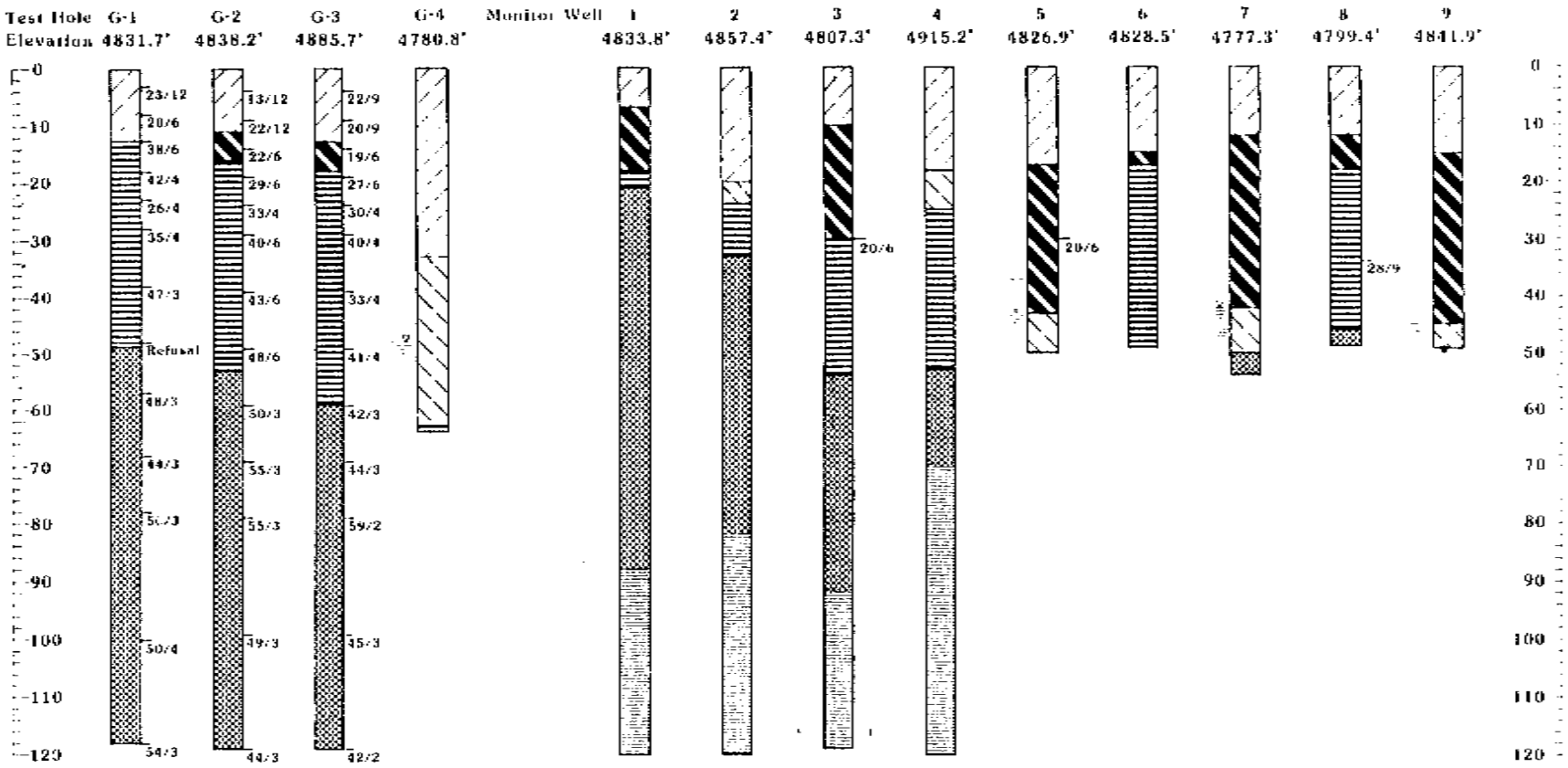
Refer to Figure 5.4.10 for Legend and Notes

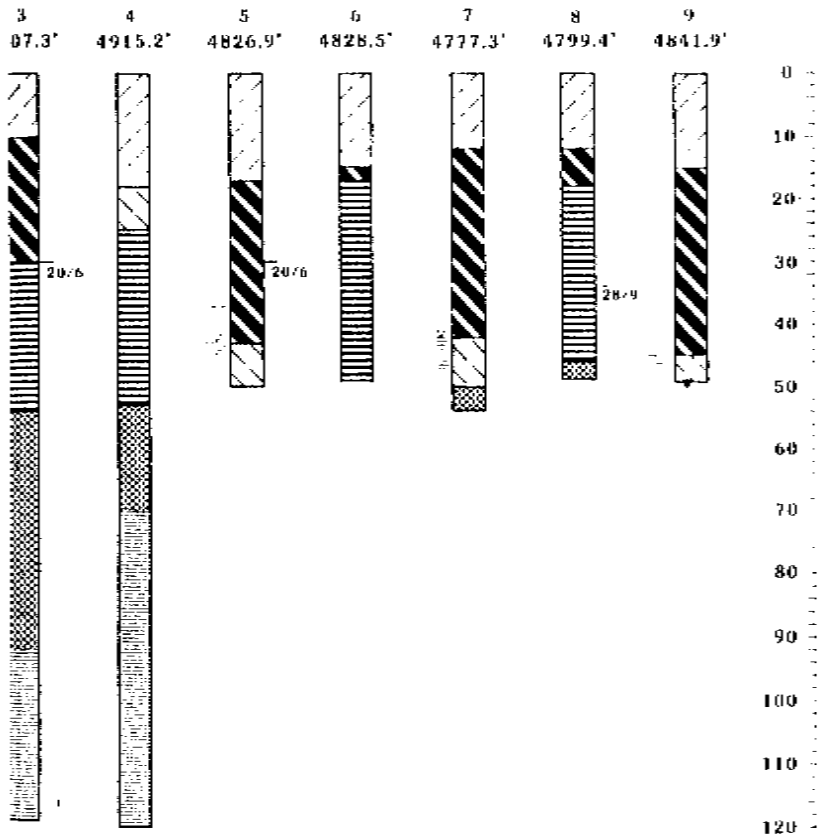


LOGS OF TEST HOLES

FOX Consulting Engineers and Geologists

Job No. 1-2543-3233 | Date: 1/8/81 | Figure 5.4.9


Test Hole G-1 G-2 G-3 G-4 Monitor Well 1 2 3 4 5 6 7 8 9
Elevation 4831.7' 4838.2' 4885.7' 4780.8' 4833.8' 4857.4' 4807.3' 4915.2' 4826.9' 4828.5' 4777.3' 4799.4' 4841.9'
0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120
23/12 20/6 38/6 42/4 26/4 35/4 47/3 Refusal 48/3 44/3 50/3 50/4 54/3
13/12 22/12 22/6 29/6 33/4 40/6 43/6 48/6 50/3 55/3 55/3 49/3 44/3
22/9 20/9 19/6 27/6 30/4 40/4 33/4 41/4 42/3 44/3 59/2 45/3 42/2
20/6
20/6
28/9
0 10 20 30 40 50 60 70 80 90 100 110 120
DEPTH - IN FEET
Group 1 Material
Group 2 Material
Refusal



LEGEND

Group I Material

CLAY, very silty (more) clay with [illegible], slightly sandy, calcareous in part, stiff to hard (with [illegible]), slightly moist [illegible], [illegible] brown to gray brown to brown ([illegible])

CLAY, with weathered claystone, slightly silty, slightly sandy to sandy, calcareous in part, some iron staining and sulfates noted, very stiff to hard, medium moist to moist, low to high plasticity, gray brown to yellow brown ([illegible])

SAND, clayey to silty, fine to coarse grained with some gravel, clay lenses also noted, medium dense to dense, medium moist to wet, light brown to red brown (SC-SP)

Group II Material

SHALE (weathered Pierre Shale), slightly sandy and silty in part, fractured and sulfates noted, [illegible] fractures, medium hard to very hard, slightly moist to very moist, brown to gray brown to yellow brown

SHALE (weathered Pierre Shale), slightly silty in part, slightly fractured to semi-blocky (with [illegible]), [illegible] fractures, hard to very hard, medium moist to very moist, gray to dark gray

SHALE, (unweathered Pierre Shale) [illegible] Material

NOTES:

1. Test holes were drilled from [illegible]

2. [illegible] location of standard penetration test, indicates that [illegible] blows with a 140 pound hammer, falling [illegible] inches, were required to drive [illegible] inches.

3. Elevations surveyed by Quest Engineering.

Indicates water table at time of drilling.

Indicates free water table as measured [illegible]

Refusal: Indicates refusal encountered while [illegible]

LOGS OF TEST HOLES

FOX Consulting Engineers and Geologists

Job No. 1-2543-3233 Date 1/8/81 Figure 5.4.10

these borings was cased with 3-inch diameter slotted, polyvinyl chloride (PVC) pipe with threaded couples, and sandpacked with filter sand. The logs for these borings, as well as those for borings A1 through G4, are presented in Figures 5.4.9 and 5.4.10. MW7 was not sampled during the first phase of the groundwater sampling because the well was essentially dry at the time of sampling.

Borings WW1 and WW2

Borings WW1 and WW2 were drilled to collect deep (500 feet) geological and geohydrological information about the site. These borings were drilled and completed as 500 foot deep water wells. The upper 100 feet of each well is cased with 8-5/8 inch steel casing cemented to the surface. Each well is cased for its full length with 4-inch diameter PVC pipe. The pipe is slotted and sandpacked below 100 feet. The logs for these borings are presented in Appendix G.

All the borings, with the exception of WW1 and WW2, were drilled with a CME 55 or CME 75 drilling rig. Borings WW1 and WW2 were drilled with a Speed Star water well drilling rig.

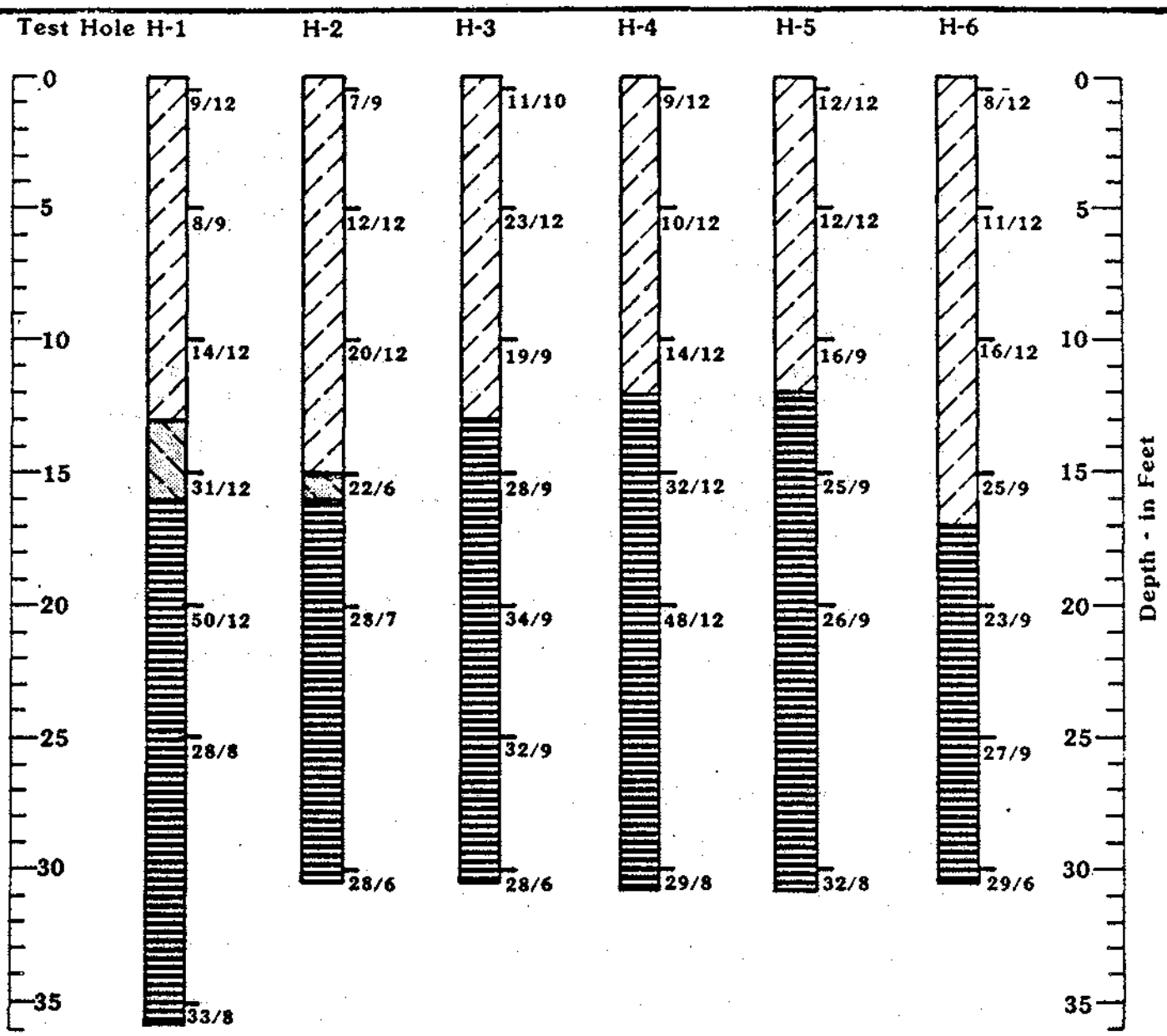
5.4.3.1.2 Seismic Refraction Investigation

A seismic refraction investigation was conducted on portions of the drilling grid to generate velocity profiles between boreholes. The investigation was conducted with a 12-channel Geometrics seismograph. Standard refraction seismic techniques were used. The resultant seismic profiles are presented in Figure 5.4.12.

5.4.3.1.3 In-situ Permeability Testing

Two types of in-situ permeability tests were conducted for this project: constant head stand pipe permeability tests, and packer type injection permeability tests. All permeability tests were conducted with Denver tap water.

Due to the extreme depth of the water table at the site and the requirement for permeability data near the surface, the tests were conducted above the water table in unsaturated material.



LEGEND

CLAY, very silty (more clay with depth), slightly sandy, calcareous in part, stiff to hard (with depth), slightly moist to moist, light brown to gray brown to brown (CL to CL-ML)

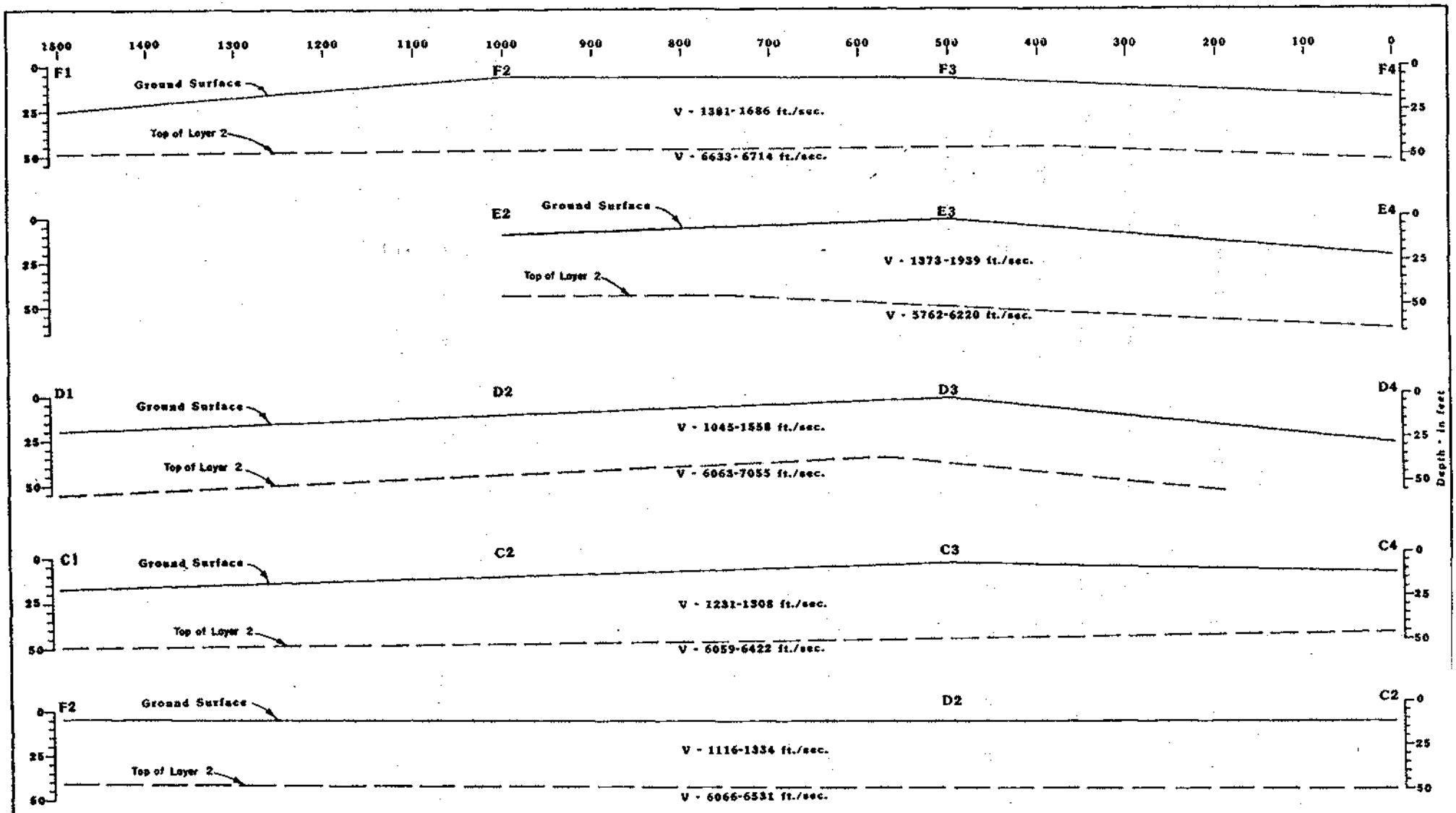
SAND, clayey to silty, fine to coarse grained with some gravel, clay lenses also noted, medium dense to dense, medium moist to wet, light brown to red brown (SC-SM)

CLAYSTONE (weathered PIERRE SHALE), slightly sandy and silty in part, fracturing and sulfates noted, iron stained along fractures, medium hard to very hard, slightly moist to very moist, brown to gray brown to yellow brown

NOTES

1. Test holes were drilled on August 20, 1981.
2. 9/12 location of Standard Penetration Test; indicates that 9 blows with a 140 pound hammer, falling 30 inches, were required to drive a 2 inch diameter sampler 12 inches.
3. No free water encountered at the time of drilling, nor when checked four (4) days later.

LOGS OF TEST HOLES 5-28	Job No:	1-2543-3233
FOX Consulting Engineers and Geologists	Date:	9/9/81
	Figure	5.4.11



Note: Refer to Figure 5.4.8 for locations

SITE SPECIFIC SEISMIC PROFILES

FOX Consulting Engineers and Geologists

Job No: 1-2543-3233 | Date: 1/15/81 | Figure 5.4.12

The constant head stand pipe permeability tests were conducted by drilling a 6-inch diameter drill hole to the test depth desired. Six-inch diameter solid PVC casing was then installed in the boring. After the casing was installed, water was added to the casing until full and allowed to stand for a minimum of 24 hours. This procedure was used to allow the test zone below the bottom of the casing to develop a nearly saturated condition. Upon completion of the test zone saturation period, a constant head permeability test was conducted in the stand pipe. The locations of these tests were indicated in Figure 5.4.8. Test results are summarized in Table 5.4.2.

The standpipe permeability test holes were not logged for their entire extent. The material on which the standpipe was set was noted and recorded in the field for each test hole. Borings FH-1B, FH-2A, FH-4A, FH-6A, and FH-7B were completed in the slightly silty clay (CL-CH); FH-15 and FH-16 in the very silty clay (CL-ML); and the remainder completed in weathered Pierre Shale.

The packer type injection tests were conducted in bore holes. These were performed by isolating a section of the bore hole with inflatable rubber packers and injecting water between them at a constant pressure head. The tests were conducted for a period of approximately 30 minutes. The length of the bore hole test section was generally on the order of tens of feet.

The well bore surface was very clean in the borehole sections drilled by rotary tri-cone or diamond core methods where clear water was used as the drilling fluid. The Packer (horizontal) permeability tests were conducted in sections that had been drilled by this method. The standpipe

TABLE 5.4.2

FIELD PERMEABILITY TEST RESULTS

Hole No.	Depth (feet)	Unified Classification and Group No.	Standpipe Test Vertical Permeability (cm./sec.)
FH-1A	19	(CL-CH) - Group I	1.0×10^{-7}
FH-1B	29	CLAYSTONE - Group II	5.0×10^{-8}
FH-2A	19	(CL-CH) - Group I	2.3×10^{-7}
FH-2B	29	CLAYSTONE - Group II	6.4×10^{-8}
FH-3A	19	(CL-CH) - Group I	4.2×10^{-8}
FH-3B	29	CLAYSTONE - Group II	1.6×10^{-7}
FH-4	4	(CL to CL-ML) - Group I	2.3×10^{-7}
FH-5	4	(CL to CL-ML) - Group I	3.9×10^{-7}
FH-6A	19	(CL-CH) - Group I	2.3×10^{-8}
FH-6B	29	CLAYSTONE - Group II	5.1×10^{-8}
FH-7A	19	(CL-CH) - Group I	1.2×10^{-7}
FH-7B	29	CLAYSTONE - Group II	3.3×10^{-8}
FH-8A	19	CLAYSTONE - Group II	6.9×10^{-8}
FH-8B	29	CLAYSTONE - Group II	6.2×10^{-8}
FH-9A	19	CLAYSTONE - Group II	1.1×10^{-7}
FH-9B	30	CLAYSTONE - Group II	8.3×10^{-8}
FH-10A	19	CLAYSTONE - Group II	1.4×10^{-7}
FH-10B	29	CLAYSTONE - Group II	1.1×10^{-7}
FH-11A	19	CLAYSTONE - Group II	4.8×10^{-8}
FH-11B	29	CLAYSTONE - Group II	3.2×10^{-8}
FH-12A	19	CLAYSTONE - Group II	3.5×10^{-8}
FH-12B	29	CLAYSTONE - Group II	1.3×10^{-7}
FH-13A	19	CLAYSTONE - Group II	2.0×10^{-6}
FH-13A	29	CLAYSTONE - Group II	1.7×10^{-6}
FH-14A	19	CLAYSTONE - Group II	8.9×10^{-8}
FH-14B	29	CLAYSTONE - Group II	1.1×10^{-6}
FH-15A	19	CLAYSTONE - Group II	1.0×10^{-7}
FH-15B	29	CLAYSTONE - Group II	1.8×10^{-7}
FH-16A	19	CLAYSTONE - Group II	8.0×10^{-8}
FH-16B	29	CLAYSTONE - Group II	9.6×10^{-8}

(vertical) permeability tests were conducted in bore hole sections drilled with an auger (the surficial clays and silts and very weathered bedrock). The walls of these borings could have been caked with a mud skin, but this would not have affected the standpipe permeability test results since such a test determines vertical permeability at the bottom of the borehole.

Packer type permeability tests were conducted for this project to determine the effect of secondary porosity (fracturing) on the overall mass permeability. When fracturing does exist, zone permeabilities are calculated to be higher than localized permeabilities measured by other methods. The packer test results generally indicate that this is the case in the weathered shale. Below the weathered shale, the shale is essentially impervious. Packer permeability test sections are indicated on the boring logs, and a summary of the packer permeability test results is presented in Tables 5.4.3 and 5.4.4.

Permeabilities determined from packer tests are typically higher than those determined from constant head permeability tests of the type conducted for this project. There are two reasons for this. First, the packer permeability test is a short duration test, conducted for a period of approximately 30 minutes. Constant head permeability tests for this project were conducted for a period of days. Because of longer test duration, a more realistic saturated flow permeability number is obtained from the constant head permeability type tests. Second, the scale effect, that is the size of the actual test section, is considerably different for the constant head permeability and packer permeability tests. The packer permeability tests are generally run on sections on

TABLE 5.4.3

FIELD PERMEABILITY TEST RESULTS

Hole No.	Depth (feet)	Unified Classification and Group No.	Packer Type Test Horizontal Permeability (cm./sec.)
CC #3	134-200	SHALE - Group III	8.6×10^{-8}
CC #4	148-200	SHALE - Group III	No Flow
CC #5	148-200	SHALE - Group III	1.4×10^{-7}
CC #6	145-202	SHALE - Group III	3.0×10^{-7}
CC #7	40-72	CLAYSTONE - Group II	2.2×10^{-7}
CC #7	145-200	SHALE - Group III	No Flow

TABLE 5.4.4

FIELD PERMEABILITY TEST RESULTS

Hole No.	Depth (feet)	Unified Classification and Group No.	Packer Type Test Horizontal Permeability (cm./sec.)
A2	85-99	CLAYSTONE - Group II	$6.6x10^{-6}$
B1	85-99	CLAYSTONE - Group II	$2.2X10^{-6}$
B2	13-19	(CL-CH) - Group I	$9.5x10^{-5}$
B3	85-99	CLAYSTONE - Group II	$5.0x10^{-6}$
C1	35-49.5	CLAYSTONE - Group II	$6.0x10^{-5}$
C2	85-99	CLAYSTONE - Group II	$5.1x10^{-6}$
C4	85-99	CLAYSTONE - Group II	$2.0x10^{-5}$
D1	15-19.5	CLAYSTONE - Group II	$4.6x10^{-5}$
D2	35-49.5	CLAYSTONE - Group II	$1.4x10^{-4}$
D3	85-99	CLAYSTONE - Group II	$1.0x10^{-5}$
E1	25-49.3	CLAYSTONE - Group II	$2.1x10^{-4}$
E2	55-99.3	CLAYSTONE - Group II	$7.6x10^{-6}$
E3	16-25.5	(SC-SM) - Group I	$5.1x10^{-4}$
E4	3-8	(CL to ML-CL) - Group I	$1.5x10^{-5}$
E4	84-99.5	CLAYSTONE - Group II	$2.5x10^{-5}$
F1	13-19.5	(CL-CH) - Group I	$2.4x10^{-4}$
F1	83-99	CLAYSTONE - Group II	$3.2x10^{-6}$
F2	8-19	(CL-CH) - Group I	$1.1x10^{-5}$
F3	85-99.5	CLAYSTONE - Group II	$8.7x10^{-6}$
G1	16-24	CLAYSTONE - Group II	$9.1x10^{-5}$
G1	90-118	CLAYSTONE - Group II	$4.0x10^{-6}$
G2	104-119	CLAYSTONE - Group II	$6.6x10^{-6}$
G3	25-39	CLAYSTONE - Group II	$2.5x10^{-5}$

the order of tens of feet in length. The constant head permeability tests, on the other hand, are conducted at the bottom of the boring, on a test section, that is equivalent to the area of the bottom of the boring. For this reason, overall mass permeability values are generally accepted to be better from packer permeability type tests. This is due to the fact that both primary and secondary porosity is a factor during the test period. In the case of the packer permeability test method at this site, secondary porosity occurs in the upper zones of the Pierre Shale in the form of fractures. In-situ permeability testing in the Group I soils was conducted in the bottom of the test borings to insure that borehole condition could not effect the test results.

5.4.3.2 Laboratory Investigation Methods

Upon completion of the field investigation, all soil and bedrock samples obtained during the drilling and sampling operations were returned to the F. M. Fox & Associates' Denver laboratory. The soil samples were then carefully opened, cataloged, and classified. Inspection of the samples followed the procedures outlined in ASTM D-2488, Standard Recommended Practice for Description of Soil (Visual-Manual Procedure). The number of specific tests, the test types, and appropriate ASTM designations were as follows:

Type of Tests	No. of Tests Conducted	ASTM Test Designation
Dry Density Determination	53	D2937
Natural Moisture Content Determination	57	D2216
Atterburg Limits	63	D423 & D424
Mechanical Analysis	51	D422
Hydrometer Analysis	13	D422
Consolidation	11	D2435
Unconfined Compressive Strength	5	D2166
Specific Gravity	11	D854
Undisturbed Constant Head Permeability	3	D2434
Remolded Constant Head Triaxial Compression Permeability	6	D2850
Cation-Exchange Capacity	3	None

The testing data obtained during the laboratory investigation are presented in Appendix G. The laboratory permeability test results were verified by the University of Colorado Soils Laboratory.

5.4.3.3 Results of Subsoil Condition Investigation

The results indicate that subsoil conditions across the processing/disposal area are very well suited for a waste facility. They are generally uniform in areal distribution but vary with depth. The subsoils across the site can generally be divided into three major groups of similar physical characteristics. These groups are indicated in Figure 5.4.13 and are described below:

Group I

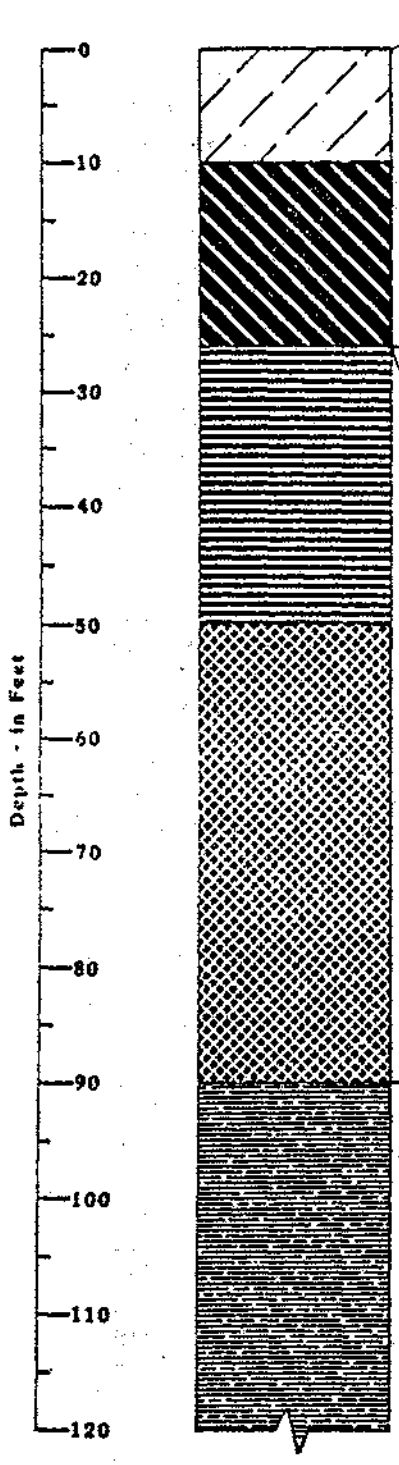
Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The uppermost soil (top six inches) is generally a very silty clayey soil, slightly sandy medium stiff to very stiff (increasingly stiff with depth), dry to slightly moist, light brown (CL-ML). The clay content, moisture content, and dry density generally increase with depth, and in most borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec. pH values range from 7.9 to 8.2. Based on the cation-exchange capacity values (See Appendix G) and the geologic environment, the clays appear to be an illite. No x-ray defraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing



Group I Material

Approx. 11 to 38 feet of slightly silty to very silty CLAY (CL to CL-ML) or silty to sandy CLAY with CLAYSTONE (CL-CH)

w = 7.6 to 22.8%
γ_d = 87 to 120 pcf
LL = 19 to 63
PI = 4 to 42
56.4% to 99.9% passing the #200 sieve
S.G. = 2.61 to 2.78
Qu = 12,440 psf (one sample tested)
K(mean) = 2 x 10^{-6} cm/sec

NOTE: Soil samples swelled up to 12.8% with 1 ksf surcharge when wetted. Some samples consolidated up to 1.2% under the same laboratory conditions.

NOTE: The above material is discontinuously underlain by a generally thin layer of silty to clayey SAND (in 22% of the test holes.)

w = 2.8 to 3.1%
γ_d = 119 pcf
LL = 22 to 30
PI = 9 to 11
18.5 to 23.5% passing the #200 sieve
Kv = 9 x 10^{-5} cm/sec (from laboratory test)
Kh = 5 x 10^{-4} cm/sec (from packer test)

Group II Material

Approx. 25 to 84 feet of CLAYSTONE, (weathered SHALE) (CL-CH), fractured with sulfates and iron staining (less fractured with depth.)

w = 8.7 to 22.8
γ_d = 91 to 124
LL = 39 to 83
PI = 15 to 53
96.6 to 99.9% passing the #200 sieve
S.G. = 2.56 to 2.80
Qu = 13,333 to 20,853 psf
Kh(mean) = 1 x 10^{-5} cm/sec (from Packer Tests)
Kv(mean) = 1 x 10^{-7} cm/sec (from Standpipe Tests)

NOTE: Soil samples swelled up to 8.8% with 1 ksf surcharge when wetted.

Group III Material

Very Hard SHALE (unweathered PIERRE SHALE) underlies the weathered SHALE at a depth of 59 to 102 feet below the ground surface.

Kh= 3 x 10^{-7} cm/sec to impervious
(No flow could be induced)
(From Packer Tests)

LEGEND

w = natural moisture content
γ_d = dry density
LL = Liquid Limit
PI = Plasticity Index
S.G. = Specific Gravity
Qu = Unconfined Compressive Strength
K = Permeability
Kh = Horizontal Permeability
Kv = Vertical permeability

TYPICAL LITHOLOGICAL LOG AND SUBSOIL CONDITIONS	Job No:	1-2543-3233
FOX Consulting Engineers and Geologists	Date:	1/8/81
	Figure	5.4.13

indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec. range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1 x 10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it can be expected to meet or exceed the requirements as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface except in test holes G1, G2, and G3 which are outside the processing/disposal area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4 x 10^{-7} cm/sec. and a low of "completely impervious" (no flow could be induced).

Correlation between the boring logs and the seismic layers was not exact, due to the nature of the seismic method and the gradation changes in lithology encountered at the site. The contact between the weathered claystone and the hard shale at the site is gradational. "Layer 2" in the seismic profiles, presented in Figure 5.4.12, may be thought of as the subweathered layer and has a velocity generally from four to five times higher than the weathered surficial materials. It is above the fresh unweathered bedrock. The fresh unweathered bedrock layer has been identified from visual inspection of the core and auger samples. The value of the seismic work is that it demonstrates the lateral consistency of the subsurface materials.

5.4.4 Groundwater Conditions

5.4.4.1 Regional

The principal aquifers of the eastern Denver basin are the Pliocene Ogallala Formation and recent unconsolidated alluvial sand and gravel in the major river drainages. In the Denver metropolitan area, the principal aquifers are the sandstones and conglomerates of the Fox Hills Sandstone, the Arapahoe and Denver Formations, and the Dawson Arkose. Sandstones of the Dakota Group are aquifers south of the Arkansas River. North of that river, the Dakota sandstones contain saline water and are major oil objectives.

Figure 5.4.3 (presented earlier) is a generalized geologic map, and Figure 5.4.4 (also presented earlier) is an east-west cross section showing stratigraphic relationships. These figures show the relationship of the disposal site to the major aquifers of the area. The aquifers used as domestic supplies in the Denver metropolitan area are recharged in the western part of the Denver basin. Because the site is located east of these exposures and west of the Ogallala exposures on the eastern flank of the basin, it is in an ideal area where runoff and infiltration do not directly recharge these major bedrock aquifers.

5.4.4.2 Site Specific

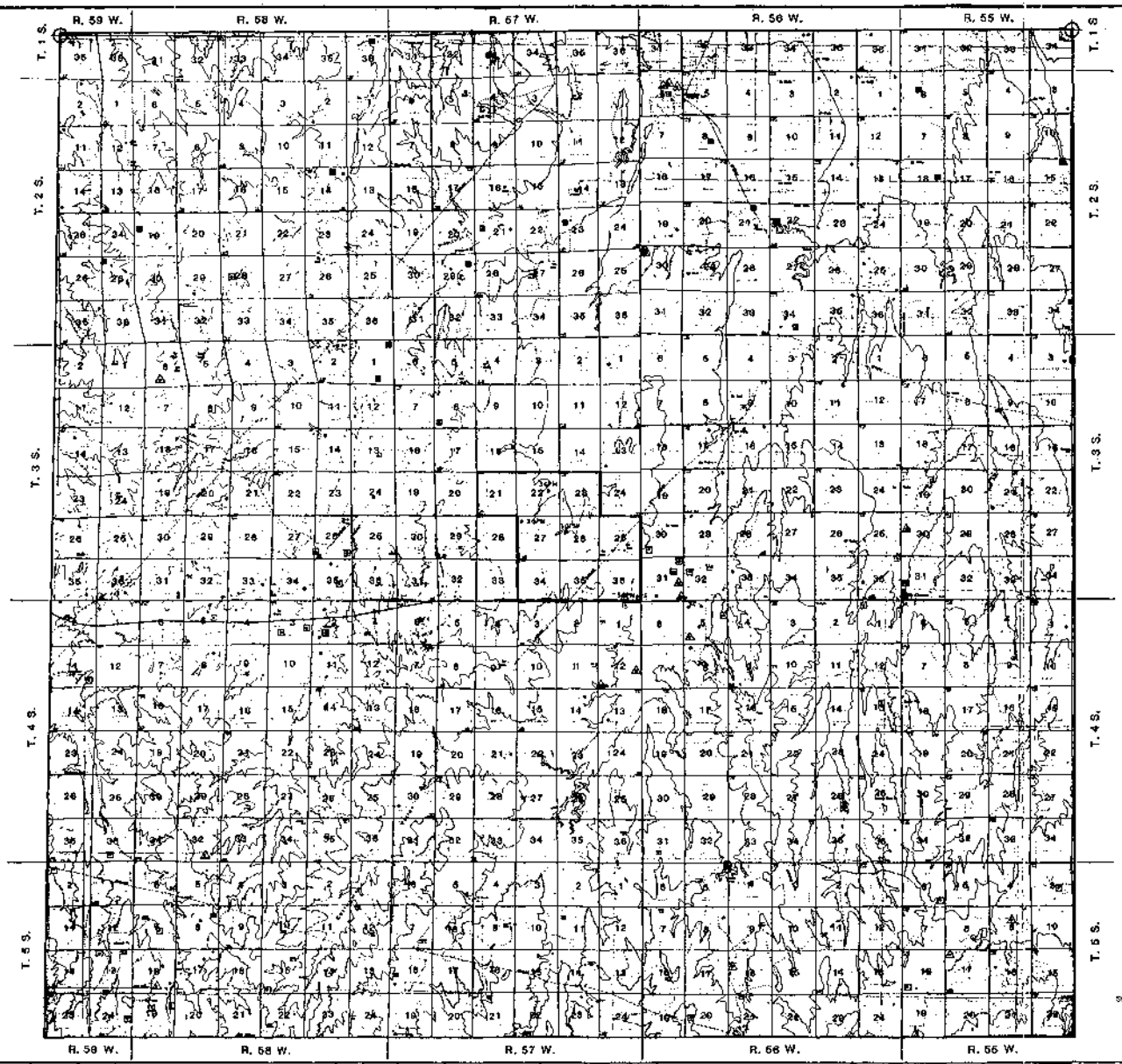
No major groundwater aquifers underlie the site, nor are any exposed at the surface; however, due to the very low permeability of the Pierre Shale, perched water tables typically occur in alluvial fill in drainage swales and are recharged in the area of the Fox Hills-Pierre transition zone.

Perched water tables were encountered during boring operations in sandy alluvial materials within surface drainages near the site. Recharge to these areas comes from vertical infiltration in the immediate drainage area. Recharge amounts are dependent upon degree of slope and the shallow material permeabilities. Groundwater of this type was encountered in four borings at depths ranging between 35.7 and 45 feet, as illustrated in Figure 5.4.10. The Colorado State Engineers Office confirmed that shallow water exists within some drainages in the area, but indicated that production rates are very low. The chemical quality of the perched water is discussed in section 5.6.

Examination of the well permit records at the Colorado State Engineers Office showed a typical maximum well yield of 5.0 gallons per minute within a one mile radius of the site. Maximum depth of production from these wells was 50 feet. The wells of the maximum yield typically supply single residences with drinking water. Figure 5.4.14 illustrates actual locations of these and other wells within a ten mile radius of the nine section parcel of land. The nearest residential well in use is over one mile from the active portion of the site.

Two wells near the site have been reported to yield 150-175 gpm. These wells are shallow alluvial wells and have been considered in the facility design. The flow rates reported are extremely high when compared to other similar wells in the area. Even if the recorded flow rates are correct, the facility design presented in Chapter 6 will protect these and other wells in the area.

Unregistered windmills and domestic wells are very difficult to document, which is why they are unregistered in the first place. Documentation of



SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR-91

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

GROUND WATER WELL LOCATION
WITHIN TEN MILE RADIUS OF SITE

SHEET NO.
FIG. 5.4.14
OF

these wells and determination of such pertinent data as yields and production depth was not performed because BFI felt it unappropriate and perhaps impossible, because of the difficulty of access to private properties, to conduct an independent survey of this nature. The safeguards designed into the site (see Chapters 6 and 7) will protect both registered and unregistered wells.

A minor amount of deep groundwater exists at the site in the Pierre Shale bedrock. Groundwater of this type was encountered in the two deep borings (WW1 and WW2) at depths of 182 and 99 feet, both corresponding to an elevation of about 4,700 feet. Pumping tests in these two deep wells indicated nearly dry conditions in the Pierre Shale. Assuming long-term recharge rates to be similar to the observed short-term (48 hours) recharge rates, the estimated production rate is approximately 0.16 gallons per minute. This rate is considerably less than that required by a single residence. These results indicate essentially dry well conditions. The Colorado State Engineers Office indicated that no water is produced in domestically useable quantities from Pierre Shale in the vicinity of the site.

5.4.5 Summary and Conclusions

A detailed geological and hydrogeological site characterization study was conducted east of Denver at the site of the Highway 36 Land Development Company chemical waste treatment/solidification and disposal facility. The results of this analysis show the site to be within the best geological and hydrogeological environment of the Denver basin for such a facility. This conclusion is based upon the following findings:

- the site is located over an extreme thickness (4,300 feet) of non-fractured impervious shale;

- the site is not located over any major aquifers;
- the site is not in an area that contributes to recharge of any major aquifer;
- the surficial materials are generally of low permeability and, when densified, are well suited for use as impervious liner materials;
- groundwater exists only in sands of adjacent surface drainages (perched) and to a very minor extent in the Pierre Shale below a mean sea level elevation of about 4,700 feet (i.e., from 130 to 200 feet below the surface of the site);
- the site is in an area of extremely low seismicity.

5.4.6 References

1. Garbarini, G. S., and Veal, H. K., "Potential of Denver Basin for Disposal of Liquid Wastes," Am. Assoc. Petroleum Geologists Mem. 10, p. 165-185 (1968).

2. Tweto, Ogden, "Geologic Map of Colorado," U.S. Geological Survey (1979).

3. Colorado Department of Health, "A Report to the Legislature Concerning Hazardous Waste Generation and Disposal in the State of Colorado" (1980).

4. Moredock and Williams, 1976.

5. Petroleum Information Corporation, Denver, Colorado.

6. Root, M. R., "Developments in Eastern and Northeastern Colorado in 1979," Am. Assoc. Petroleum Geologists Bull., 64, (9) 1484-1489 (1980).

7. Algermissen, S. T., and Perkins, D. M., "A Probabilistic Estimate of Maximum Acceleration in Rock in the Contiguous United States," U.S. Geological Survey, Open File Report 76-416 (1980).

8. Rocky Mountain Association of Geologists, Subsurface Cross Sections of Colorado: Special Publication No. 2 (1976).

9. F. M. Fox & Associates, Inc., "Additional Test Boring Results for the Proposed Highway 36 Land Development Disposal Facility, Adams County, Colorado," October 6, 1981.

5.5 TOPOGRAPHY AND SURFACE DRAINAGE

5.5.1 Topography

The study area is characterized by broadly rolling topography. Small creeks in the vicinity are in relatively wide flat areas. As can be seen in Figures 5.5.1 and 5.5.2, the project site (i.e, the two quarter-sections within Sections 25 and 36) is drained by a tributary to Beaver Creek on the east and Wetzel Creek to the west. Beaver Creek and Wetzel Creek are ephemeral in nature and are composed of highly erodible clay-loam soils. In the undeveloped portions of the drainage basins, the ground cover is predominantly native grassland.

Also illustrated in Figure 5.5.2 are the various drainage basins (areas A through F) of the project site. The project site is well drained with little rainfall run-on. Consequently, of primary concern is the quantity of runoff from the project site. The surface slope of the project site ranges from flat to about 6%.

5.5.2 Surface Runoff

A hydrological analysis was carried out to estimate the rate and quantity of rainfall runoff from the project site for a variety of rainfall conditions. Because of the simplicity of the study area, the Rational Method was used to compute the 10-year and 100-year peak surface runoff discharges from the project site. For this analysis, it was assumed that the project site would be bermed so that site run-on would be zero.

The Rational Method is based on the formula Q = CIA, where:

Q = the maximum rate of runoff in cubic feet per second (cfs)

C = rainfall runoff coefficient

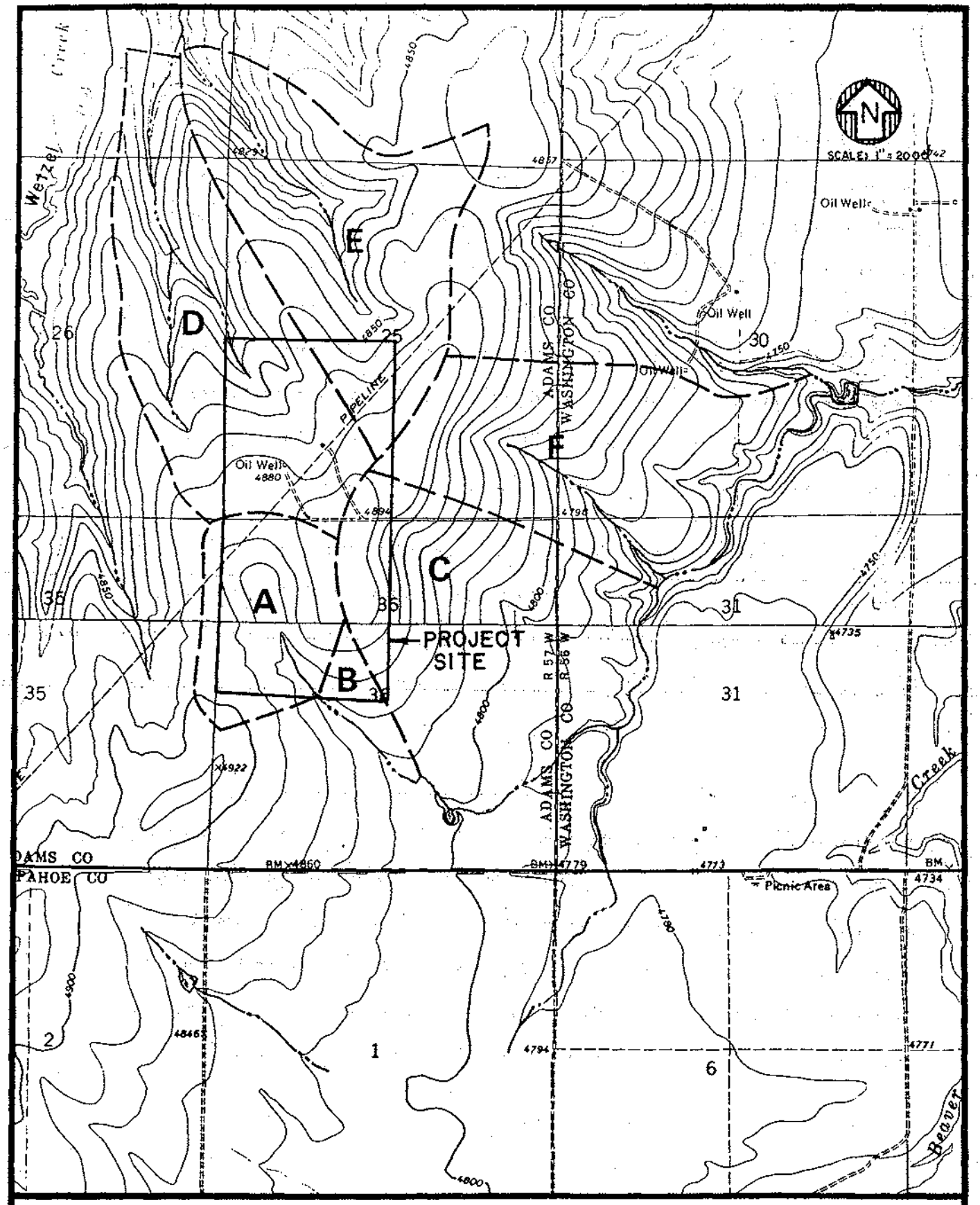


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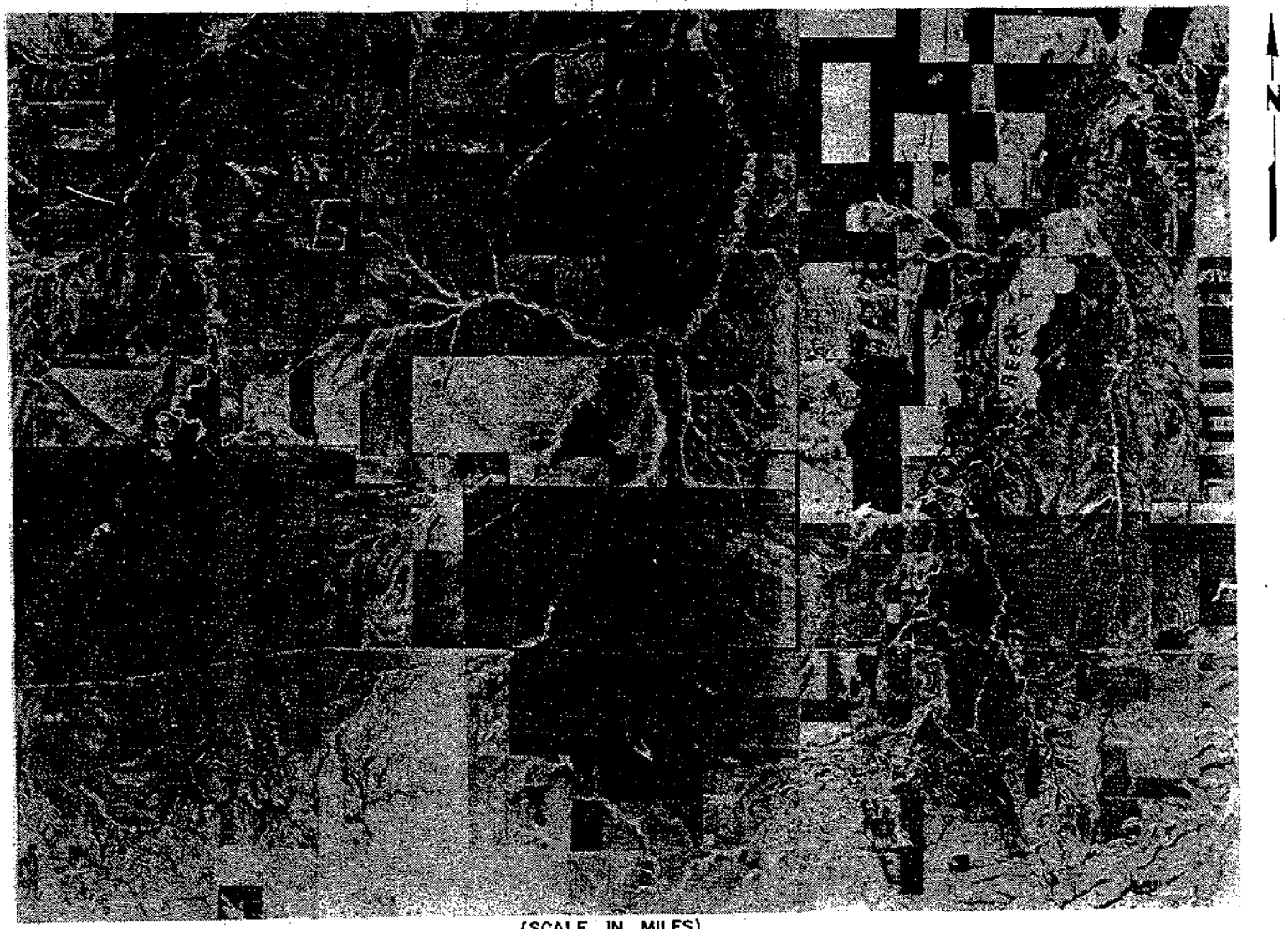
FIGURE Nº 5.5.1
STUDY AREA AND
DRAINAGE BOUNDARIES
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO



(SCALE IN MILES)

0 1 2 3

PROPERTY BOUNDRY

SITE BOUNDRY

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FIGURE № 5.5.2

AERIAL PHOTOGRAPH OF SITE AND SURROUNDING AREA

HIGHWAY 36 LAND DEVELOPMENT CO

ADAMS CO., COLORADO

I = rainfall intensity in inches per hour for a given frequency storm

A = area of project site drainage basin in acres

Values of the rainfall runoff coefficient, C, used in this study were derived from the Soil Survey of Adams County, Colorado(1) and the Drainage Criteria Manual(2). The runoff coefficients were determined to be 0.15 for a 10-year storm and 0.19 for a 100-year storm. The rainfall intensity data presented in Figures 5.5.3 and 5.5.4 were obtained from a precipitation-frequency atlas by extrapolating data for the facility's actual location(3).

As can be seen in Figure 5.5.4, the rainfall depths for a 10-year, 24-hour and a 100-year, 24-hour rainfall are approximately 2.8 inches and 4.2 inches, respectively. These depths of rainfall were used to estimate the volume of runoff from the project site. The maximum rates of rainfall runoff for the 10- and 100-year recurrance intervals were calculated by estimating the "time of concentration" T_c, for the respective drainage basins and using the corresponding intensities illustrated in Figure 5.5.3. The results of the analyses are summarized in Table 5.5.1.

Along with peak runoff discharge, runoff volume is also critical. Runoff volumes for the 10- and 100-year storms were calculated using the "Estimation of Direct Runoff from Storm Rainfall" as given in Reference 5. The assumptions used in this calculation were:

- Adena loam is predominant site soil type which has a "C" hydrologic classification.
- An average runoff curve number for three selected land uses was calculated (fallow; straight row, small grain with poor hydrologic conditions; and range with poor hydrologic conditions).
- Occurrences of rainfall events were used for the Byers, Colorado weather station (1931-1980 period of record) obtained from the Colorado State Climatology office (see Table 5.5.2).

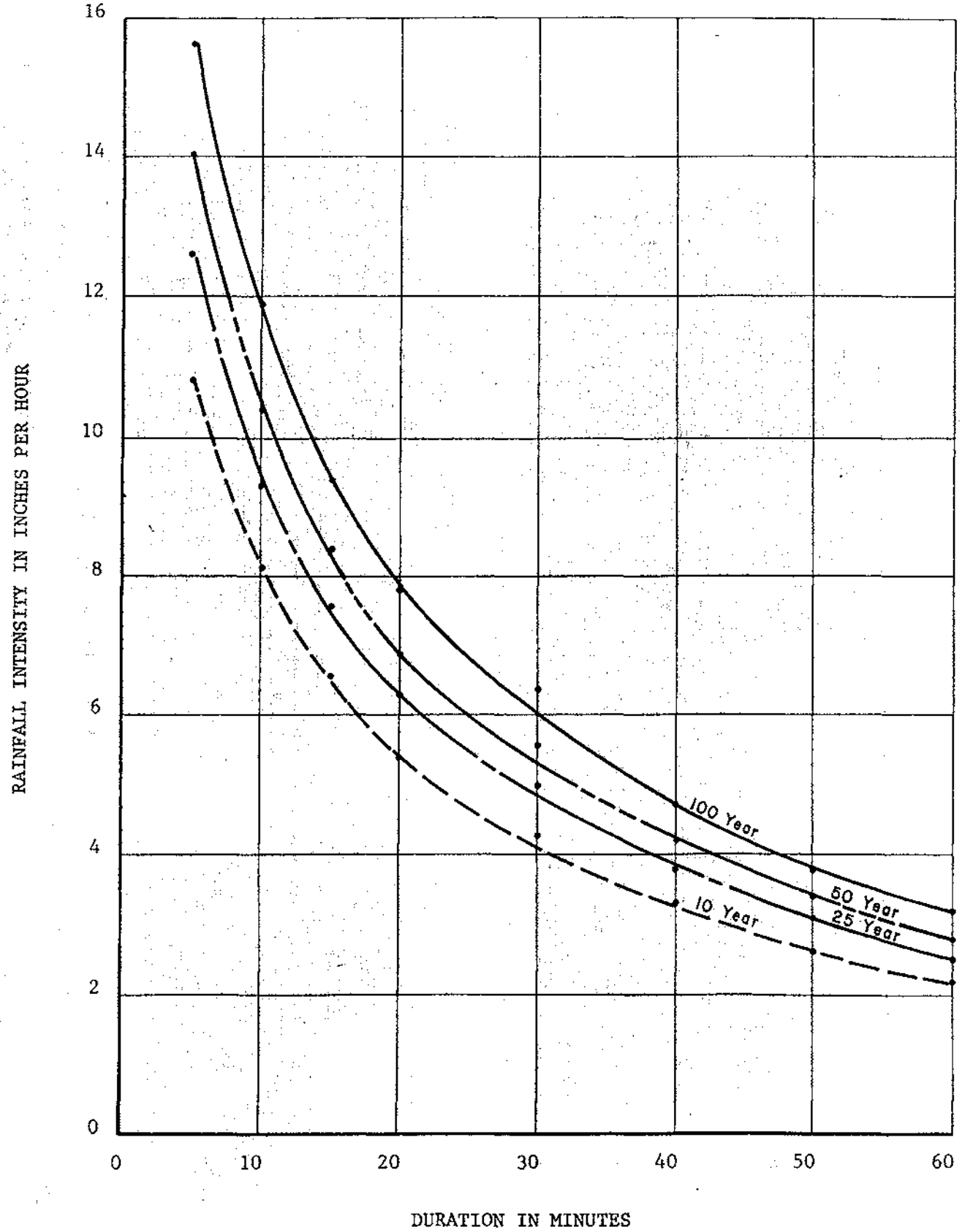

FIGURE № 5.5.3

TIME INTENSITY FREQUENCY CURVES

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

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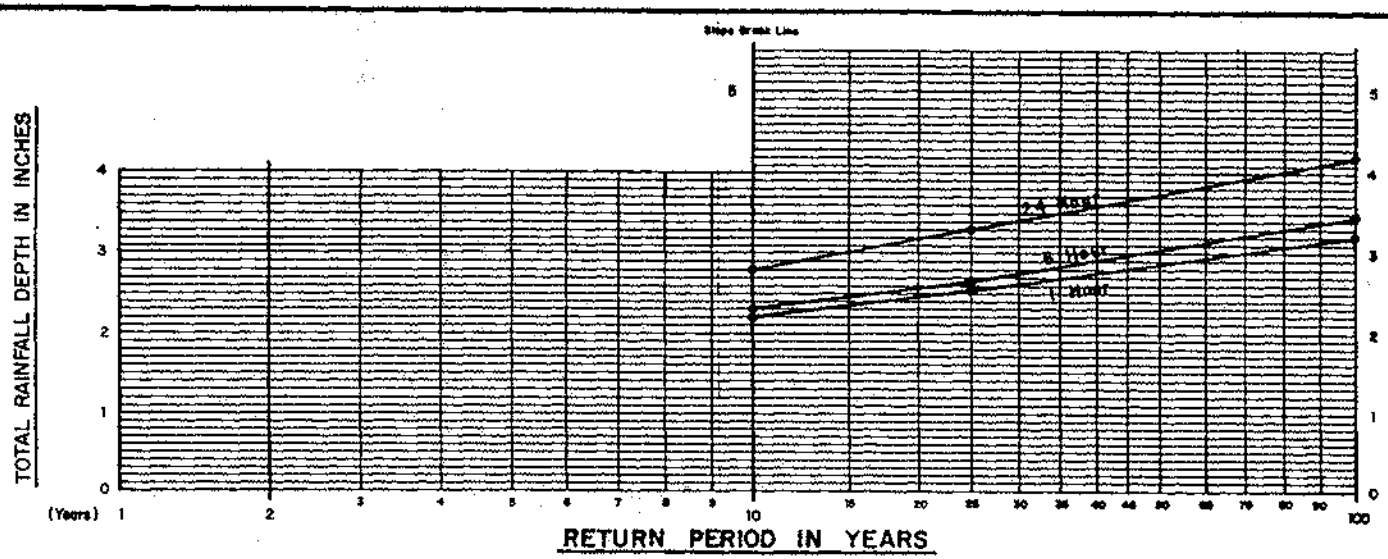

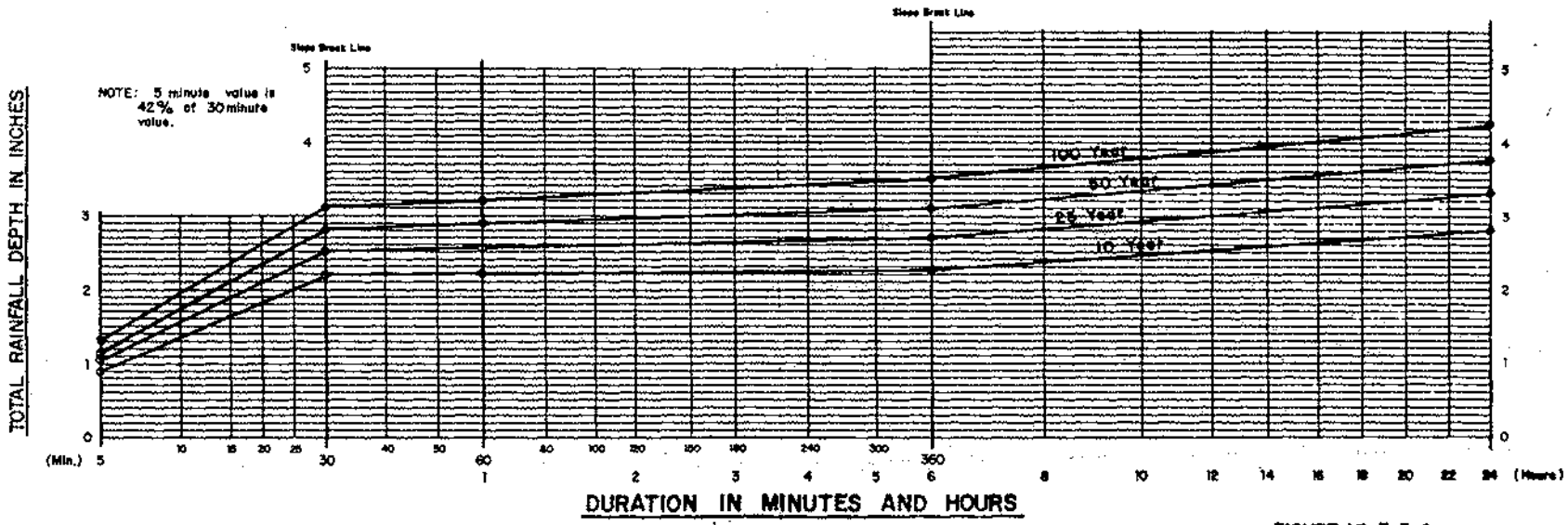

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FIGURE № 5.5.4
RAINFALL
DEPTH – DURATION – FREQUENCY GRAPHS
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TABLE 5.5.1

PEAK RATES OF RUNOFF FROM PROJECT SITE

1. 10-Year

Basin	T_c (Minutes)	C	I (In./Hr.)	A (Acres)	Peak Discharge (Q) (cfs)
A	36.0	0.15	3.6	113	61
B	10.0	0.15	8.2	13	16
C	8.3	0.15	8.8	44	58
D	36.9	0.15	3.5	125	66
E	20.7	0.15	5.3	35	28
F	5.0	0.15	10.8	2	3

2. 100-Year

Basin	T_c (Minutes)	C_f	I (In./Hr.)	A (Acres)	Peak Discharge (Q) (cfs)
A	36.0	0.19	5.2	113	112
B	10.0	0.19	11.8	13	29
C	8.3	0.19	12.8	44	107
D	36.9	0.19	5.1	125	121
E	20.7	0.19	7.7	35	51
F	5.0	0.19	15.6	2	6

Note: The acreage, A, refers to the number of acres within the project site (i.e., the two quarter-sections) for the respective drainage basins defined in Figure 5.5.1.

- Calculations for three antecedent moisture conditions were performed.
- Extreme rainfall years will result in runoff in proportion to the deviation from average annual rainfall.

The procedure resulted in runoff volumes ranging from 6.6 to 20.3 million gallons for a 10-year, 24-hour rainfall event (2.8") and 15.0 to 32.2 million gallons for a 100-year storm of the same duration (4.2").

Annual runoff from the site was also calculated using this same methodology. Knowing the number of events of a certain size with a given amount of runoff, one can calculate the volume of runoff. For example, during average moisture conditions, a 1.2" rainfall will result in 0.35 equivalent inches of runoff. By adding the runoff from all events in the same fashion, the average runoff is calculated.

Average annual runoff from the site is approximately 13 million gallons, or 11% of rainfall, over the 325-acre site for 14 inches of rainfall. During a dry year, runoff will be less than 1 million gallons (8 inches per year rainfall) and, conversely, a wet year (20 inches per year) will result in about 57 million gallons of runoff. These results are summarized in Table 5.5.3.

5.5.3 Flood Plain Analysis

The project site is located on a rise with runoff flowing to the northwest into Wetzel Creek and to the southeast into Beaver Creek. Above the confluence with Wetzel Creek, Beaver Creek flows northerly from its source through Elbert, Arapahoe, Adams, and Washington Counties. The Wetzel Creek drainage area is approximately 48 square miles while the Beaver Creek drainage (above the confluence with Wetzel Creek) is about 317 square miles as shown in Figure 5.5.5. There are no active gaging stations located on Beaver Creek or its tributaries.

TABLE 5.5.2

AVERAGE ANNUAL OCCURRENCES OF RAINFALL EVENTS AT BYERS, COLORADO*

Rainfall Amount	Number of Events	Assumed Average Rainfall Depth
0.1 - 0.5"	32.4	0.20"
0.5 - 1.0"	6.2	0.70"
>1.0"	2.5	1.20

*From a 1931-1980 period of record where the average annual rainfall was 14.66".

TABLE 5.5.3

VOLUMES OF RUNOFF FROM THE PROJECT SITE

Antecedent Soil Moisture Conditions	Annual Rainfall	Annual Volume of Runoff (Million Gallons)
Dry	8"	0.6
	14"	1.1
	20"	1.6
Average	8"	7.5
	14"	13.2
	20"	18.9
Wet	8"	22.7
	14"	39.8
	20"	56.9

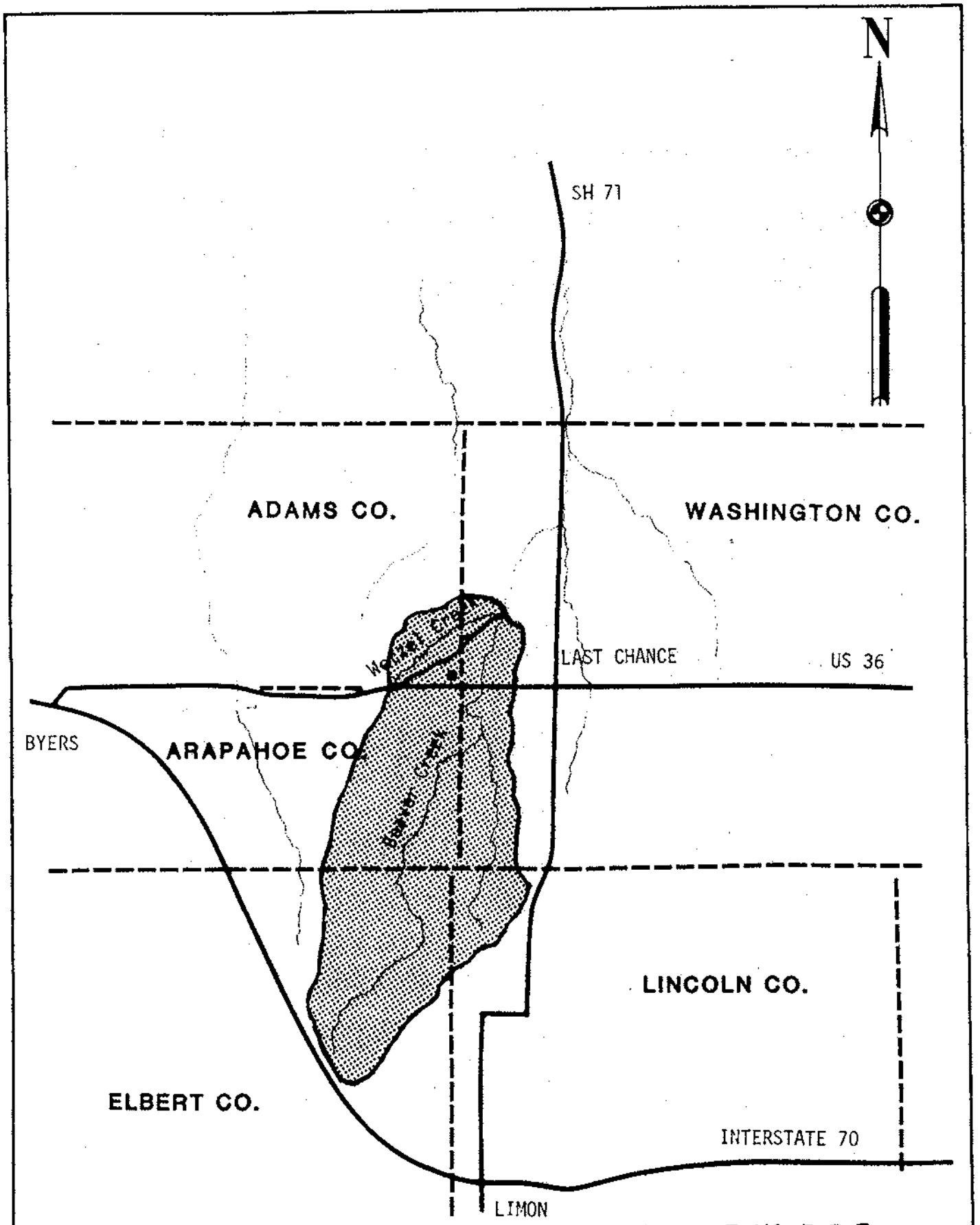


FIGURE Nº. 5.5.5

WETZEL AND BEAVER CREEKS DRAINAGE AREAS

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

Because there are no completed or on-going flood studies available for Beaver Creek, a hydrological study was conducted to establish the Beaver Creek flood plain and verify that the project site did not lie within it. The investigation utilized a mathematical model developed by the Colorado Water Conservation Board in cooperation with the U. S. Geological Survey. The model was derived by applying a Log-Pearson Type III statistical analysis to historical gaging station data(4).

For the statistical analysis, the state was divided into several regions of similar topographical conditions. The Beaver Creek drainage area is located in the central portion of the Plains Region. The Plains Region includes all of the Front Range up to an elevation of 7,500 feet above sea level.

The analysis correlated available gaging data to drainage area, mean annual precipitation, basin slope, and stream bed slope, to develop a mathematical model which describes 100-year flood conditions in ungaged basins of similar topography. The general form of the mathematical model employed was as follows:

$$Y = AX_1^{B1} X_2^{B2}$$

Where: Y = flood condition

$X_{1,2}$ = drainage basin characteristics

$B_{1,2}$ = respective correlation exponent

A = proportionality constant

The analysis revealed the 100-year flood depth in the Plains Region was best predicted on the basis of the stream bed slope alone, in accordance with the following equation:

$$D_{100} = 59.3\ S_s^{-0.517}$$

where: D_{100} = 100-year flood depth in feet

S_s = Stream bed slope in feet per mile

As required in the methodology(4), stream bed slopes were calculated at the lower most point in the drainage area by determining the quotient of up and down stream contour differences and the length between these contours. For the case at hand, this was at the confluence of Wetzel and Beaver Creeks. The above relationship was then used to calculate the 100-year flood depth:

$$S_s = \frac{\text{difference in contours}}{\text{length between contours}}$$

$$= \frac{4{,}600 \text{ ft.} - 4{,}580 \text{ ft.}}{2.85 \text{ miles}} = 7.02 \text{ feet/mile}$$

$$\text{thus, } D_{100} = 59.3\ S_s^{-0.517}$$

$$= 59.3\ (7.02)^{-0.517} = 21.6 \text{ feet}$$

As indicated above, the 100-year flood depth is estimated to be nearly 22 feet above the average stream elevation at the confluence of Wetzel and Beaver Creeks. To relate this flood depth to the active site, a conservative assumption was made to calculate the flood plain elevation at the intersection of Beaver Creek and Highway 36 shown on Figure 5.5.5. Given the existing elevation at this intersection (4,720 feet), and assuming the same increased flood depth at that intersection as was calculated for confluence of Beaver and Wetzel Creeks, a flood elevation of 4,742 would be encountered. Comparing this elevation to the lowest elevation at the active site (4,835 in the southeastern corner of the site), reveals that the active site is at least 93 feet above the 100-year flood depth of Beaver Creek. Thus, it is concluded that the site is not subject to flooding.

The quantity of water available for collection on the site will be increased by removal of vegetation and minimizing transpiration losses until the revegetation program is initiated. On-site grading will reduce depression storage and surface detention. Construction and soil compaction will reduce the permeability of the surface, thereby decreasing infiltration. Water collected at the site will be contained in ponds or possibly storage tanks with design and operational features to minimize evaporation.

BFI is continuing to study the hydrology and hydrogeology of the area in which the facility will be located. Studies presented previously indicated that 11% of the rainfall on an average annual basis runs off of the site. Thus, almost 90% of the water produced by major precipitation events is accounted for by interception, evapotranspiration, depression storage and surface detention, and infiltation. Less than 11% of the natural precipitation ever leaves the site as runoff. BFI believes that this runoff is de minimis. Analysis and location studies of the on-site groundwater indicates that infiltration does not significantly, if at all, contribute to ground or surface water supplies in the stream system.

5.5.4 Water Rights Issues

It has always been the law of Colorado that a water right is acquired by an appropriation of water to a beneficial use (see Colorado Revised Statutes 1973, § 37-92-3(a), as amended, and Yunker v. Nichols, 1 Colo. 551 (1872)). A court decree is not a prerequisite to the creation of a water right. As the Colorado Supreme Court held in this distinction in Cresson Consol. Gold Mining and Milling Co. v. Whitten, 139 Colo. 273, 338 P.2d 278 (1959):

> "A decree in a water adjudication is only confirmatory of pre-existing rights; the decree does not create or grant any rights; it serves as evidence of rights previously acquired." (at 283)

Thus, the acquisition of a water right decree from the Water Court is not required, and it would be premature for BFI to file for such a decree.

BFI may make an appropriation of water for use at the facility. Pursuant to various federal and state requirements, BFI is required to collect all of the precipitation which falls on the site. IF BFI releases the water, it will not have completed the appropriation because there will be no beneficial use. If, however, pursuant to environmental regulations, BFI can lawfully put the collected water to use, the appropriation will be complete and BFI will have a water right. BFI may then file for a Water Court decree confirming such water right but, as explained above, is not required to do so. At present, it would be premature to seek a Water Court decree because there will not be any beneficial use of any water for some time.

For reasons similar to those discussed above, there is no need or requirement to file a plan for augmentation with the Water Court. Colorado's water law defines a "plan for augmentation" as a detailed program to increase the supply of water available for beneficial use by developing new sources of water, water exchange projections, or other appropriate means (see Colorado Revised Statutes 1973, S 37-92-103(9), as amended). Generally, a plan for augmentation is utilized to allow a water user to continue appropriations which would otherwise be curtailed by operation of the priority system. The plan for augmentation provides water to the stream system to maintain historic stream conditions while

allowing the water user to divert and use water without injuring vested water rights. The development of an augmentation plan is a voluntary action for use in particular circumstances.

At this time, BFI has no plan for augmentation because it does not need one. Its water operations will not take water out of priority to the injury of vested water rights. The nature of the water supply for the site is discussed in Chapter 6 of this report.

Section 5.5.4 on water rights issues was prepared with consultation from Cheryl Signs(6).

5.5.5 References

1. U.S. Department of Agriculture, "Soil Survey of Adams County, Colorado," Soil Conservation Service, In Cooperation with Colorado Agricultural Experiment Station, October, 1974.

2. Urban Drainage and Flood Control District, Drainage Criteria Manual, Volume I, March, 1969.

3. U.S. Department of Commerce, Precipitation - Frequency Atlas of the Western United States, Volume III - Colorado, National Weather Service, 1973.

4. McCain, J. F., and Jarrett, R. D., Manual for Estimating Flood Characteristics of Natural Flow Streams in Colorado, Technical Manual No. 1, Colorado Water Conservation Board, Denver, Co., (1976).

5. Rallison, R. E., "Hydrology," SCS National Engineering Handbook, Soil Conservation Service, U.S. Dept. of Agricultural (August, 1972).

6. Cheryl Signs Engineering, 70 West 6th Avenue, Suite 601, Denver, Co. 80204.

5.6 BASE LINE WATER QUALITY

Extensive analytical testing of a variety of water and soil leachate samples was conducted so as to establish their background composition. The procedures and results of this program are summarized below from samples taken at the site fron January, 1981 through February 1982.

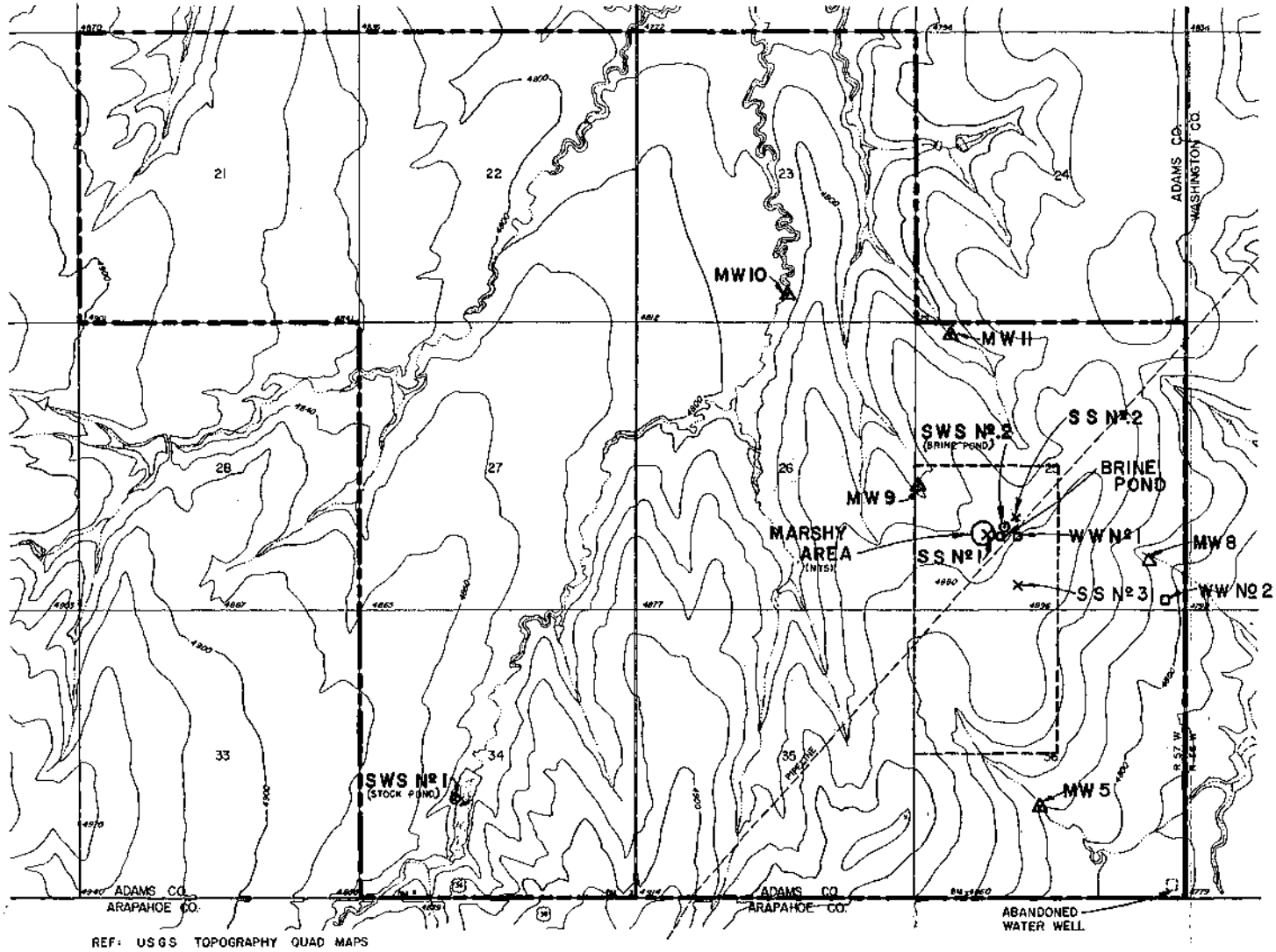
5.6.1 Selection of Sampling Locations

Groundwater samples were collected from each of seven new wells. These are indicated in Figure 5.6.1 as WW 1, WW 2, MW 5, MW 8, MW 9, MW 10, and MW 11. These samples provided a first round indication of groundwater quality in the vicinity of the facility.

An existing abandoned water well at the southeast corner of Section 36 was also sampled. However, the complete series of analyses was not performed on this sample because of obvious contamination resulting from deterioration of the well structure. The results for this sample (presented subsequently in Table 5.6.10) were not considered typical of actual groundwater quality and thus were not used in the base line study.

Several field inspections of Wetzel and Beaver Creeks were made in an attempt to locate surface water for sampling downstream from facility drainage. However, only dry creek beds were discovered, even as far north as Interstate 76 (about 37 miles). In lieu of creek samples, the stock pond (SWS 1), in Wetzel Creek was sampled. As can be seen in Figure 5.6.1, this pond is located to the west and upstream of the facility's drainage. This impoundment varies in size, sometimes covering as much as ten acres and sometimes dry or ice covered. The analytical results for this sample may vary more than a typical free flowing stream because evaportion and ice formation tend to concentrate the various dissolved chemicals present.

The only other surface water available at the site during the sampling program was the oil field brine pond (see Figure 5.6.1) which stores water recovered from the operating oil production well. This brine pond was sampled to evaluate its potential for contaminating the shallow



REF: USGS TOPOGRAPHY QUAD MAPS

LEGEND

SS = Soil Sample (X)
MW = Monitor Well (△)
SWS = Surface Water Sample (⊙)
WW = Water Well (⊡)

Property Line
Site Boundry

0 1000 2000 3000
SCALE (FEET)

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 15 MAR 91

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF SAMPLING POINTS
BASELINE WATER QUALITY STUDY

SHEET NO. 5.6.1

alluvium of the drainage swale which extends to the northwest. It appears that this pond continuously discharges to the surrounding area, forming approximately an acre of marsh-like ground between it and the swale leading toward monitoring well MW 9.

The points at which soil samples were collected are also illustrated in Figure 5.6.1. Soil sample no. 1 (SS 1) was collected from the marshy area about 50 yards to the west of the overflow point from the brine pond. In order to evaluate the possible effects of the pond discharge on soil, a second soil sample was collected (SS 2) upslope about 100 yards north of the pond. Soil sample no. 3 (SS 3) was collected about 100 yards south of the Phase I solidification basins.

5.6.2 Sampling and Analytical Methodology

Nine water quality and three soil quality samples were collected and analyzed over the period of January, 1981 to May, 1982. The water samples collected from the seven wells and two ponds were analyzed for 168 parameters carefully selected to characterize the water, well in excess of the terms of the requirements of 40 CFR 265.92. RCRA requies that only 30 parameters be monitored. All analyses were made by Rocky Mountain Analytical Laboratory in Denver, Colorado(2-9). The depth and water table measurements of the seven sampled wells are presented in Table 5.6.1 along with the exact water and soil sampling dates. For the water sample collected from the abandoned water well, only five parameters were measured because the sample was not considered to be representative of actual groundwater, as previously explained. Each of the three soil samples was analyzed for 25 trace metal and 114 organic pesticide parameters.

TABLE 5.6.1

STATIC GROUNDWATER LEVEL AT THE TIME OF SAMPLING

Date Sampled	WW 1		WW 2		MW 5		MW 8		MW 9		MW 10		MW 11	
1/22/81	190.1*	4689.3#	-	-	38.1	4788.8	-	-	39.5	4802.4	-	-	-	-
2/17/81	-	-	-	-	-	-	-	-	-	-	16.6	4788.5	10.7	4774.3
7/13/81	174.0	4705.4	101.0	4705.8	38.5	4788.4	40.0	4759.4	25.0	4816.9	14.4	4790.7	10.0	4775.0
8/24/81	-	-	-	-	36.0	4790.9	38.5	4760.9	18.0	4823.9	18.0	4789.1	11.0	4774.0
10/08/81	-	-	-	-	41.2	4785.7	42.5	4756.9	20.3	4821.6	16.3	4788.8	12.0	4773.0
10/31/81	175.5	4703.9	106.5	4700.3	-	-	-	-	-	-	-	-	-	-
11/03/81	-	-	-	-	38.0	4788.9	39.6	4759.8	18.5	4823.4	15.0	4790.1	10.3	4774.7
12/14/81	178.0	4701.4	111.0	4695.3	38.3	4788.6	39.5	4759.9	18.4	4823.5	14.8	4790.3	10.4	4774.6
2/11/82	186.7	4692.7	107.7	4699.1	38.8	4788.1	39.3	4760.1	19.7	4822.2	15.5	4789.6	11.0	4774.0
5/03/82	-	-	-	-	39.1	4787.8	39.6	4759.8	18.3	4923.6	12.3	4792.8	17.2	4762.8

*Static groundwater depth in feet below top of casing.

#Static groundwater elevation in feet above mean sea level.

A Kemmerer water sampler was used to collect surface water samples from about three feet below the surface of the stock pond. Brine pond water was collected directly into sample bottles from near the surface. At each soil sample site, five subsamples from the top ten inches were composited in a glass dish and then transferred to a prewashed glass bottle with a teflon lined cap. Groundwater samples were collected by bailing each well until three or four casing volumes had been removed or until it was dry. After allowing the well to recharge (normally 24-48 hours), the samples were collected with a stainless steel bailer, filtered, poured directly into prepared sample bottles, and labeled.

All samples were preserved in accordance with procedures defined by the Federal Register, 40 CFR 136, December 3 and December 18, 1979. Sample containers and preservation techniques used are given in Table 5.6.2. Section 7.6 contains a summary of the methodology and references to the methodology used to analyze the water and soil samples. The metals analyses for the soil samples were determined by leaching the samples for one-half hour at 90°C in dilute hydrochloric and nitric acid (see reference 1 in Table 5.6.2). The results were calculated as the milligrams of leachable metals per dry kilogram of soil. The organochlorine pesticides were extracted with methylene chloride for 12 hours in Soxhlet extractors, as specified by the EPA, and exchanged into hexane before analysis.

The data from each site were tabulated on a parameter-by-parameter basis. Two criteria were used to delete data that might bias any statistical analysis of the data. Firstly, the metals and radiochemical data from

TABLE 5.6.2

SAMPLE CONTAINERS AND PRESERVATION

Parameter Group	Sample Containers and Preservation
(1) Metals	Polyethylene bottle, 1-l, filtered, then add 5 ml/l conc. HNO_3
(2) Radiochemistry	Polyethylene bottle, 1-l, filtered, then add 5 ml/l conc. HNO_3
(3) Inorganic other	Polyethylene bottle, 500 ml, filtered, store at 4°C
(4) Inorganics solids, pH, alkalinity	Polyethylene bottle, 500 ml, unfiltered, store at 4°C
(5) Fecal Coliform	Sterile glass bottle, 250 ml, unfiltered, store at 4°C
(6) Nutrients	Glass bottle, 1-l, filtered, then add 2 ml/l conc. H_2SO_4, store at 4°C
(7) TOX	Polyethylene bottle, 500 ml, decanted, add 2 ml/l sodium thiosulfate and 2 ml/l conc. HNO_3, store at 4°C
(8) Cyanide	Polyethylene bottle, 500 ml, filtered, then add 2 ml/l 12.5 N NaOH, store at 4° C
(9) Pesticides	Glass bottle, 1-l, with Teflon-lined cap, filtered, store at 4°C
(10) Herbicides	Glass bottle, 1-l, with Teflon-lined cap, filtered, store at 4°C
(11) Volatile Organics	Two 40 ml septum capped vials, unfiltered, store at 4°C
(12) Acidic Organics	Glass bottle, 1-l, with Teflon-lined cap, centrifuged, store at 4°C
(13) Base/Neutral Organics	Glass bottle, 1-l, with Teflon-lined cap, centrifuged, store at 4°C
(14) Soils	Glass bottle, 1-l, with Teflon-lined cap, store at 4°C

the January, 1981 sampling were deleted because their values were artifically elevated from suspended material left in the sample. The unfiltered samples were added directly to preserved bottles which caused metals to be leached from the particulate matter to a soluble form. Subsequent sampling (July, 1981 and after) provided sample filtration prior to preservation and analysis. Secondly, any data which were statistical outliers were also deleted. Abnormal results can be caused by contamination during sample collection, filtration or preservation, or by an analytical error(10).

5.6.3 Results

The analytical results for the water samples were presented in Rocky Mountain Analytical Lab's reports to BFI(2-9). A statistical analysis calculating the mean and standard deviation was performed for sampling done January, 1981 through February, 1982(10). At least five measurements of each parameter at each monitoring site were used to perform the statistical analysis. To calculate means where non-detectable values were obtained, a number that was half the detection limit was used. Where all values were non-detected, the mean was listed as non-detected and no standard deviation was calculated. Tables 5.6.3 through 5.6.7 present the mean and standard deviations for water samples, and those for the soil samples are presented in Tables 5.6.8 and 5.6.9. The analytical results for the one sample from the abandoned water well are given in Table 5.6.10. For comparison purposes, drinking water standards are listed in Table 5.6.11.

TABLE 5.6.3

PARAMETERS CHARACTERIZING THE SUITABILITY OF THE GROUNDWATER AS A DRINKING WATER SUPPLY
(40 CFR 265.92.b.1)

		MW-5		MW-11		MW-9	
Parameter	Units	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Arsenic	mg/l	ND	---	0.003	0.002	0.015	0.022
Barium	mg/l	ND	---	0.06	0.02	ND	---
Cadmium	mg/l	0.004	0.004	0.008	0.004	0.026	0.012
Chromium	mg/l	0.018	0.002	0.021	0.010	0.045	0.034
Fluoride	mg/l	0.75	0.21	0.50	0.36	0.96	0.62
Lead	mg/l	0.028	0.019	0.107	0.018	0.229	0.066
Mercury	mg/l	ND	---	ND	---	ND	---
Nitrate (as N)	mg/l	0.84	0.41	5.91	2.42	2.6	1.9
Selenium	mg/l	0.002	0.002	0.006	0.010	0.019	0.029
Silver	mg/l	ND	---	ND	---	0.013	0.010
Endrin	mg/l	ND	---	ND	---	ND	---
Lindane	mg/l	ND	---	ND	---	ND	---
Methoxychlor	mg/l	ND	---	ND	---	ND	---
Toxaphene	mg/l	ND	---	ND	---	ND	---
2,4-D	mg/l	ND	---	ND	---	ND	---
2,4,5-TP (Silvex)	mg/l	ND	---	ND	---	ND	---
Radium 226	pCi/l	0.3	0.3	0.4	0.3	0.6	0.4
Gross Alpha	pCi/l	26	10	31.6	20.2	238	96
Gross Beta	pCi/l	15	12	20	18	128	149
Coliform Bacteria	No./100 ml	ND	---	ND	---	ND	---

TABLE 5.6.3 (Continued)

PARAMETERS CHARACTERIZING THE SUITABILITY OF THE GROUNDWATER AS A DRINKING WATER SUPPLY
(40 CFR 265.92.b.1)

		MW-10		Stock Pond		Brine Pond	
Parameter	Units	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Arsenic	mg/l	0.001	0.001	0.008	0.005	0.002	0.002
Barium	mg/l	0.29	0.13	0.10	0.08	ND	---
Cadmium	mg/l	ND	---	0.005	0.004	0.005	0.003
Chromium	mg/l	0.024	0.016	0.029	0.019	0.026	0.020
Fluoride	mg/l	0.36	0.16	0.45	0.19	7.3	2.1
Lead	mg/l	0.026	0.021	0.023	0.014	0.025	0.021
Mercury	mg/l	ND	---	ND	---	ND	---
Nitrate (as N)	mg/l	47.8	4.3	0.10	0.11	0.06	0.02
Selenium	mg/l	ND	---	ND	---	0.002	0.004
Silver	mg/l	ND	---	ND	---	ND	---
Endrin	mg/l	ND	---	ND	---	ND	---
Lindane	mg/l	ND	---	ND	---	ND	---
Methoxychlor	mg/l	ND	---	ND	---	ND	---
Toxaphene	mg/l	ND	---	ND	---	ND	---
2,4-D	mg/l	ND	---	0.0001	0.0003	ND	---
2,4,5-TP (Silvex)	mg/l	ND	---	ND	---	ND	---
Radium 226	pCi/l	0.4	0.4	0.6	0.7	0.3	0.4
Gross Alpha	pCi/l	4.6	3.6	3.7	3.5	9.2	11.2
Gross Beta	pCi/l	13.9	9.2	27.8	5.6	16	11
Coliform Bacteria	No./100 ml	ND	---	ND	---	ND	---

TABLE 5.6.3 (Continued)

PARAMETERS CHARACTERIZING THE SUITABILITY OF THE GROUNDWATER AS A DRINKING WATER SUPPLY
(40 CFR 265.92.b.1)

		WW-1		WW-2		MW-8	
Parameter	Units	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Arsenic	mg/l	0.013	0.016	0.014	0.017	0.016	0.017
Barium	mg/l	0.45	0.22	0.20	0.13	ND	---
Cadmium	mg/l	0.005	0.003	0.006	0.004	0.018	0.003
Chromium	mg/l	0.025	0.017	0.028	0.026	0.038	0.037
Fluoride	mg/l	0.88	0.58	0.67	0.13	0.27	0.05
Lead	mg/l	0.039	0.032	ND	---	0.190	0.023
Mercury	mg/l	ND	---	ND	---	ND	---
Nitrate (as N)	mg/l	0.061	0.020	0.077	0.065	11.9	4.9
Selenium	mg/l	0.010	0.021	0.012	0.022	0.033	0.038
Silver	mg/l	ND	---	ND	---	0.009	0.007
Endrin	mg/l	ND	---	ND	---	ND	---
Lindane	mg/l	ND	---	ND	---	ND	---
Methoxychlor	mg/l	ND	---	ND	---	ND	---
Toxaphene	mg/l	ND	---	ND	---	ND	---
2,4-D	mg/l	ND	---	ND	---	ND	---
2,4,5-TP (Silvex)	mg/l	ND	---	ND	---	ND	---
Radium 226	pCi/l	0.9	0.6	0.6	0.6	0.5	0.3
Gross Alpha	pCi/l	8.9	8.0	10	13	161	81
Gross Beta	pCi/l	4.1	6.1	20	30	70	66
Coliform Bacteria	No./100 ml	ND	---	ND	---	ND	---

TABLE 5.6.4

REQUIRED PARAMETERS ESTABLISHING GROUNDWATER QUALITY
(40 CFR 265.92.b.2)

Parameter	Units	MW-5		MW-11		MW-9	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Chloride	mg/l	15	4	54	21	441	72
Iron	mg/l	0.13	0.16	0.14	0.14	0.15	0.17
Manganese	mg/l	0.03	0.04	0.31	0.07	0.14	0.09
Phenolics	mg/l	ND	---	ND	---	ND	---
Sodium	mg/l	118	23	275	236	2620	410
Sulfate	mg/l	442	86	1780	757	8000	1350

		MW-10		Stock Pond		Brine Pond	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Chloride	mg/l	5	2	8	2	14	10
Iron	mg/l	0.13	0.20	0.36	0.34	0.15	0.16
Manganese	mg/l	ND	---	0.11	0.08	0.03	0.03
Phenolics	mg/l	ND	---	ND	---	0.117	0.028
Sodium	mg/l	8.1	4.1	37	12	640	28
Sulfate	mg/l	24	17	92	38	247	32

		WW-1		WW-2		MW-8	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Chloride	mg/l	1720	70	1710	58	120	13
Iron	mg/l	0.13	0.15	0.98	0.93	0.14	0.13
Manganese	mg/l	0.09	0.06	0.05	0.01	0.19	0.15
Phenolics	mg/l	ND	---	ND	---	ND	---
Sodium	mg/l	1200	110	1250	55	1600	141
Sulfate	mg/l	9	9	11	10	5850	637

TABLE 5.6.5

PARAMETERS USED AS INDICATORS OF GROUNDWATER CONTAMINATION
(40 CFR 265.92.b.3)

Parameter	Units	MW-5		MW-11		MW-9	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
pH	pH units	7.72	0.34	7.43	0.23	7.56	0.22
Specific Conductance	umhos/cm	1330	147	3330	1220	14,340	2090
TOC	mg/l	4.0	2.6	8.1	2.5	14.4	3.4
TOX	ug Cl/l	12.1	3.2	17	5	49	19

		MW-10		Stock Pond		Brine Pond	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
pH	pH units	7.63	0.19	8.32	0.44	8.13	0.35
Specific Conductance	umhos/cm	849	42	491	123	2870	149
TOC	mg/l	3.3	2.2	21.3	4.8	15.2	6.4
TOX	ug Cl/l	12	9	19	17	8.6	6.9

		WW-1		WW-2		MW-8	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
pH	pH units	7.70	0.25	8.49	0.10	7.49	0.27
Specific Conductance	umhos/cm	5670	177	5610	170	9500	298
TOC	mg/l	14.6	5.8	10.4	2.3	12.6	7.1
TOX	ug Cl/l	39	7	44	9	18	5

TABLE 5.6.6

OTHER INORGANIC PARAMETERS TO ESTABLISH BASELINE GROUNDWATER QUALITY

Parameter	Units	MW-5		MW-11		MW-9	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Aluminum	mg/l	0.14	0.09	ND	---	0.13	0.07
Antimony	mg/l	0.004	0.003	0.004	0.005	0.043	0.069
Beryllium	mg/l	0.005	0.007	0.005	0.006	0.004	0.004
Calcium	mg/l	156	31	548	99	400	22
Cobalt	mg/l	0.040	0.060	0.046	0.011	0.105	0.038
Copper	mg/l	0.017	0.017	0.021	0.012	0.037	0.028
Magnesium	mg/l	49	12	70.6	50.7	656	39
Molybdenum	mg/l	ND	---	ND	---	ND	---
Nickel	mg/l	0.038	0.034	0.060	0.036	0.140	0.050
Potassium	mg/l	2.5	0.3	8.7	6.0	27	7
Thallium	mg/l	0.002	0.003	0.004	0.005	0.007	0.011
Tin	mg/l	0.083	0.088	0.085	0.084	0.392	0.466
Titanium	mg/l	ND	---	ND	---	ND	---
Zinc	mg/l	0.031	0.033	0.059	0.066	0.091	0.097
Alkalinity (pH 4.5 as $CaCO_3$)	mg/l	287	18	326	34	644	58
Alkalinity (pH 8.3 as $CaCO_3$)	mg/l	ND	---	ND	---	ND	---
Ammonia (as N)	mg/l	ND	---	0.25	0.30	1.1	1.6
Boron	mg/l	0.35	0.17	0.36	0.25	2.38	0.60
Bromide	mg/l	0.92	0.07	0.95	0.26	7.63	5.19
Cyanide	mg/l	ND	---	ND	---	ND	---
Phosphate	mg/l	0.006	0.002	0.006	0.003	0.006	0.002
Total Dissolved Solids	mg/l	968	131	3280	1140	14,300	1950
Total Suspended Solids	mg/l	937	1010	3790	1790	1920	1510

TABLE 5.6.6 (Continued)

OTHER INORGANIC PARAMETERS TO ESTABLISH BASELINE GROUNDWATER QUALITY

Parameter	Units	MW-10		Stock Pond		Brine Pond	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Aluminum	mg/l	0.14	0.11	0.45	0.44	ND	---
Antimony	mg/l	0.001	0.001	0.002	0.003	0.007	0.007
Beryllium	mg/l	ND	---	0.004	0.003	0.003	0.002
Calcium	mg/l	112	38	49	30	2.3	0.5
Cobalt	mg/l	0.019	0.015	0.040	0.046	0.048	0.085
Copper	mg/l	0.015	0.016	0.012	0.008	0.009	0.004
Magnesium	mg/l	24.3	4.6	18	6	6.3	15.3
Molybdenum	mg/l	ND	---	ND	---	ND	---
Nickel	mg/l	0.028	0.031	0.048	0.053	0.019	0.011
Potassium	mg/l	5.0	2.1	12.5	6.8	4.2	1.4
Thallium	mg/l	0.004	0.005	0.003	0.005	0.002	0.002
Tin	mg/l	0.037	0.026	0.100	0.110	0.071	0.064
Titanium	mg/l	ND	---	ND	---	ND	---
Zinc	mg/l	0.048	0.061	0.040	0.050	0.026	0.042
Alkalinity (pH 4.5 as $CaCO_3$)	mg/l	310	93	176	42	1080	86
Alkalinity (pH 8.3 as $CaCO_3$)	mg/l	ND	---	5	0.5	17	20
Ammonia (as N)	mg/l	ND	---	0.68	0.75	0.44	0.75
Boron	mg/l	0.08	0.05	0.09	0.06	3.12	1.21
Bromide	mg/l	0.72	0.26	1.0	0.6	1.7	1.9
Cyanide	mg/l	ND	---	ND	---	0.008	0.005
Phosphate (as P)	mg/l	0.025	0.027	0.022	0.031	0.017	0.023
Total Dissolved Solids	mg/l	553	24	386	94	1870	81
Total Suspended Solids	mg/l	4400	2730	69	56	31	28

TABLE 5.6.6 (Continued)

OTHER INORGANIC PARAMETERS TO ESTABLISH BASELINE GROUNDWATER QUALITY

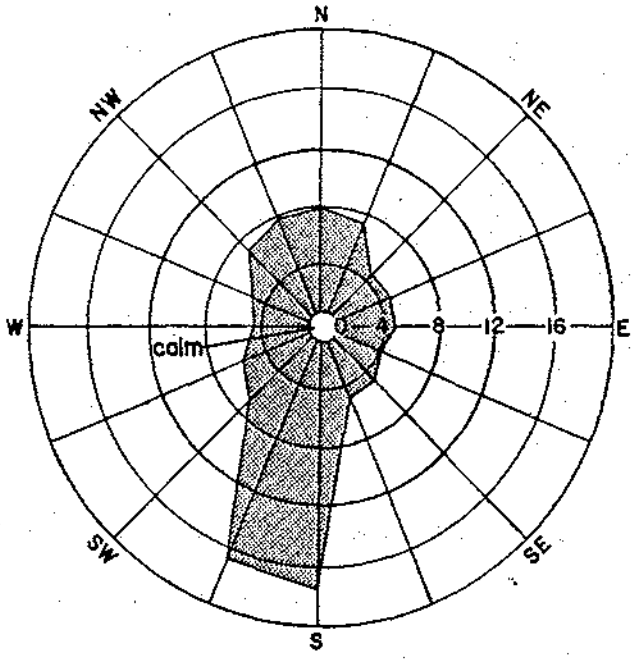
Parameter	Units	WW-1 Mean	WW-1 Standard Deviation	WW-2 Mean	WW-2 Standard Deviation	MW-8 Mean	MW-8 Standard Deviation
Aluminum	mg/l	0.13	0.08	0.67	0.72	ND	---
Antimony	mg/l	0.007	0.016	0.008	0.016	0.006	0.009
Beryllium	mg/l	0.004	0.003	0.003	0.002	0.004	0.002
Calcium	mg/l	24	4	26	21	468	103
Cobalt	mg/l	0.064	0.106	0.023	0.021	0.096	0.047
Copper	mg/l	0.060	0.080	0.017	0.011	0.029	0.013
Magnesium	mg/l	6.3	1.2	6.1	1.2	624	15
Molybdenum	mg/l	ND	---	ND	---	ND	---
Nickel	mg/l	0.040	0.040	0.057	0.057	0.130	0.030
Potassium	mg/l	7.8	5.8	4.7	1.3	23	4
Thallium	mg/l	0.017	0.027	0.016	0.028	0.007	0.009
Tin	mg/l	0.086	0.055	0.083	0.042	0.290	0.320
Titanium	mg/l	ND	---	ND	---	ND	---
Zinc	mg/l	0.053	0.054	0.046	0.061	0.070	0.040
Alkalinity (pH 4.5 as $CaCO_3$)	mg/l	280	30	300	82	666	66
Alkalinity (pH 8.3 as $CaCO_3$)	mg/l	ND	---	14	8	ND	---
Ammonia (as N)	mg/l	2.0	0.6	2.8	0.9	ND	---
Boron	mg/l	3.70	0.42	4.04	0.93	2.48	0.66
Bromide	mg/l	30.5	8.3	30.3	8.4	4.1	1.4
Cyanide	mg/l	ND	---	ND	---	ND	---
Phosphate (as P)	mg/l	0.214	0.156	7.32	5.33	ND	---
Total Dissolved Solids	mg/l	3260	87	3230	162	10,050	547
Total Suspended Solids	mg/l	787	706	2490	2330	2970	1310

TABLE 5.6.7

LIST OF ORGANIC CHEMICALS DETECTED IN WATER SAMPLES

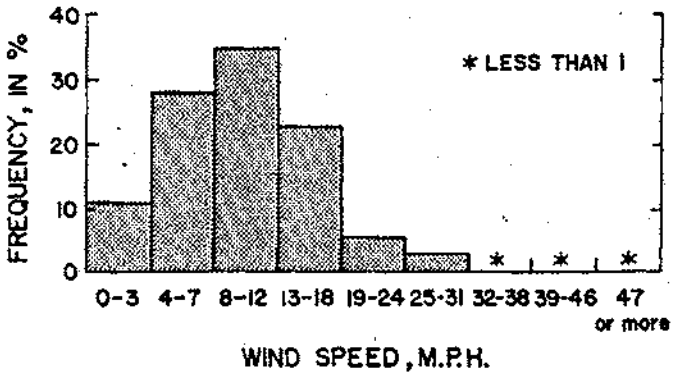
	Units	MW-5		MW-11		MW-9	
		Mean	Range	Mean	Range	Mean	Range
Volatile Priority Pollutants							
tetrachloroethylene	ug/l	1	---	ND	---	5	---
Acidic Priority Pollutants	ug/l	ND	---	ND	---	ND	---
Base/Neutral Priority Pollutants	ug/l	ND	---	ND	---	ND	---
Chlorinated Pesticides/PCB's	ug/l	ND	---	ND	---	ND	---
Phosphorus Pesticides	ug/l	ND	---	ND	---	ND	---
Nitrogen Pesticides	ug/l	ND	---	ND	---	ND	---
Other Organics	ug/l						
hexahydro-2H-azepin-2-one		15	---	ND	---	19	---
N-(phenylmethyl)-benzenemethaneamine		ND	---	10	---	ND	---
unidentified compound with mole. wt. 147		ND	---	68	---	ND	---

	Units	MW-10		Stock Pond		Brine Pond	
		Mean	Range	Mean	Range	Mean	Range
Volatile Priority Pollutants	ug/l						
benzene		ND	---	ND	---	17	---
Acidic Priority Pollutants	ug/l						
phenol		ND	---	ND	---	28	10-37
2,4-dimethylphenol		ND	---	ND	---	32	---
dimethyl phenol		ND	---	ND	---	39	35-44
Base/Neutral Priority Pollutants	ug/l						
naphthalene		ND	---	ND	---	23	16-34
Chlorinated Pesticides/PCB's	ug/l						
endrin aldehyde		0.062	---	ND	---	ND	---
α-BHC		ND	---	0.019	0.012-0.023	0.013	---
Phosphorus Pesticides	ug/l	ND	---	ND	---	ND	---
Nitrogen Pesticides	ug/l	ND	---	ND	---	ND	---
Other Organics	ug/l	ND	---	ND	---	3000(total)	2000-4000(total)
aliphatic hydrocarbons							
aromatic hydrocarbons							
polynuclear hydrocarbons							
phenolic hydrocarbons							



YEARLY WIND ROSE

NUMBERS ARE % OF TIME FOR DIRECTION.



WIND SPEED AND FREQUENCY

HNTB
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FIGURE Nº 5.7.2

YEARLY WIND ROSE AND SPEED AT DENVER, CO.

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TABLE 5.7.3

ESTIMATED 1982 NOISE LEVELS FOR
SEVERAL HIGHWAYS IN COLORADO

Highway & Location	Noise Level (dBA Leq)
I-25 between Colorado Springs & Denver	74
I-70 between Denver and Byers	70
U.S. 36 between Byers & the Site	67
U.S. 36 between Last Chance & the Site	67
U.S. 36 east of Last Chance	67
S.H. 71 north of Last Chance	67
S.H. 71 south of Last Chance	65

The Noise Control Act of 1972 gave the Environmental Protection Agency the authority to identify items that were excessively loud and to prepare emission standards for these items. The EPA has identified construction equipment as a major source of noise. Chapter 8 identifies anticipated noise impacts from construction equipment at the site. Typical sound levels from several types of construction equipment are given in Table 5.7.4.

TABLE 5.7.4

CONSTRUCTION EQUIPMENT SOUND LEVELS(5,6)

Equipment Type	Sound Level (dBA) at 50 Feet
Off-Highway Truck	82-93
Bulldozer	70-95
Earthmover	76-95
Motor Grader	72-91

5.7.3 References

1. Code of the Federal Regulations, 40 (50), June, 1979.

2. Colorado Department of Health, Air Pollution Control Division.

3. National Oceanographic and Atmospheric Administration, Local Climatological Data; Denver, Colorado, (1979).

4. Community Noise, Wyle Laboratories for U.S. Office of Noise Abatement and Control, Washington, D.C. (December 31, 1971).

5. U.S. EPA, "Report to the President and Congress on Noise," (February, 1972).

6. "Highway Construction Noise: Measurement, Prediction, and Mitigation," U.S. Dept. of Transportation (June, 1976).

5.8 ENVIRONMENTAL INVENTORY

5.8.1 Climate

5.8.1.1 Regional Characteristics

The climate of the study area and vicinity is continental steppe, typical of the semiarid high plains. The area is characterized by cold winters, hot summer days, cool summer nights, abundant sunshine, low relative humidity, and low but highly variable precipitation. Most precipitation falls during the late spring and summer as thunderstorms, but periodically spring rains fail, resulting in droughts. The climate is modified somewhat by the Rocky Mountains to the west(1). Figure 5.8.1 depicts the study area and vicinity.

5.8.1.2 Temperature and Growing Season

The average annual temperature is near 50°F, with relatively wide ranges in daily and seasonal temperatures (Table 5.8.1). Extremely hot summer weather or extremely cold winter weather is generally of short duration and is followed by more moderate temperature.

The average annual growing season in Adams County is about 150 days, with the last killing frost occurring in early May and the first killing frost occurring in late September or early October. The soil temperature is above 41°F for about 250 days, from April 10th to about December 18th (at 20 inches depth). During the summer months, soil temperature averages about 70°F, with slightly higher temperatures on exposed cropland than areas with grass cover(2).

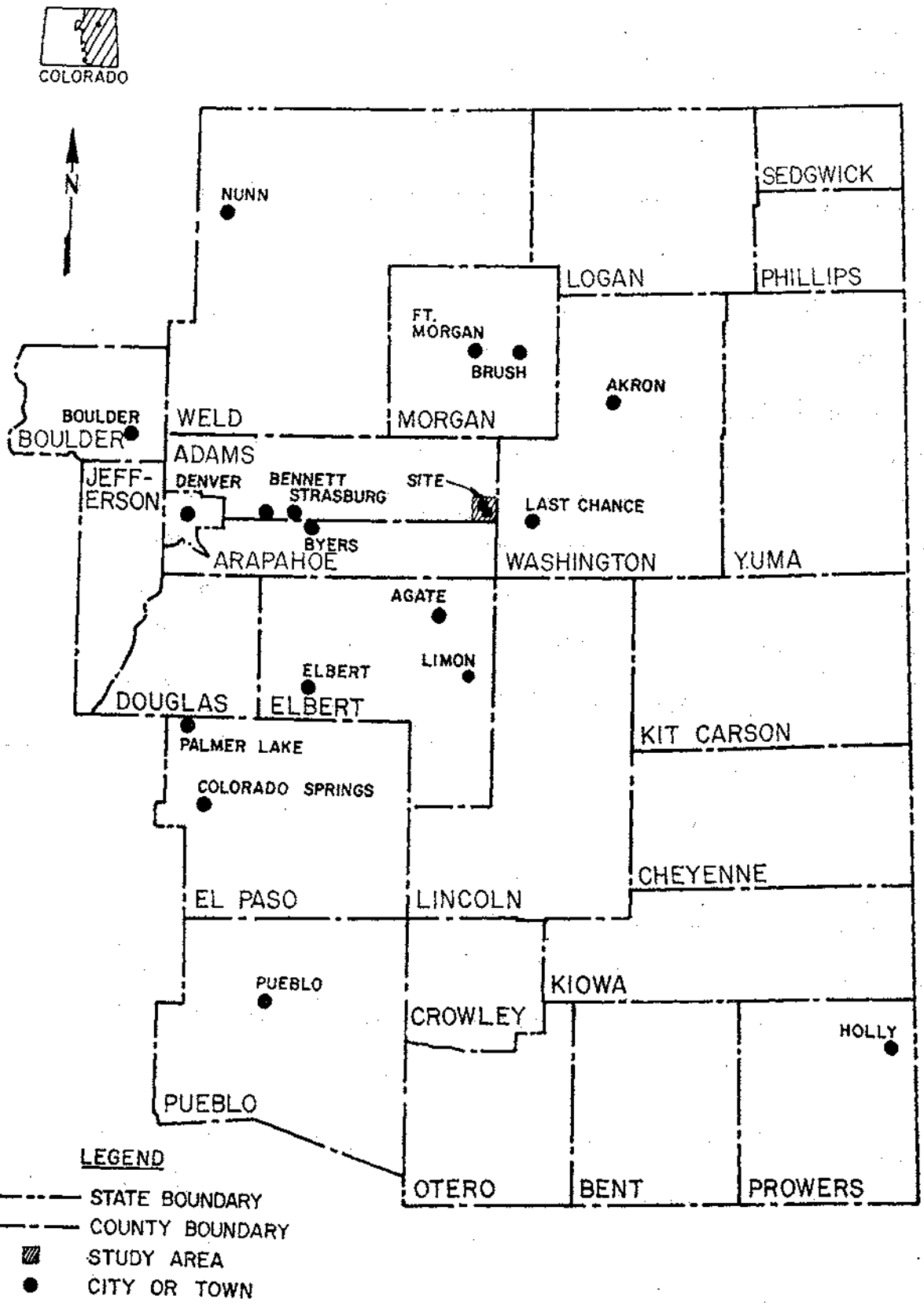

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FIGURE Nº 5.8.1
GENERAL LOCATION AND STUDY AREA
FOR ENVIRONMENTAL INVENTORY
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TABLE 5.8.1
TEMPERATURE AND PRECIPITATION DATA (2)

MONTH	TEMPERATURE				PRECIPITATION				
	Average daily Maximum	Average daily Minimum	2 years in 10 will have at least 4 days with –		Average Total	2 years in 10 will have –		Average Number of Days With Snow Cover	Average Depth of Snow on Days With Snow Cover
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than–		Less than–	More than–		
	°F.	°F.	°F.	°F.	Inches	Inches	Inches		Inches
January	43	14	61	-6	0.43	0.1	0.8	8	2
February	46	18	64	-2	.47	.2	.7	9	3
March	52	23	70	4	.87	.4	1.6	7	3
April	62	33	79	19	1.86	.7	2.8	3	4
May	71	42	86	32	2.54	.9	3.7	1	3
June	84	51	96	40	1.58	.7	2.6	0	0
July	91	57	99	50	2.01	1.0	3.2	0	0
August	89	56	98	49	1.49	.7	2.1	0	0
September	80	47	94	35	1.14	.2	1.7	1/2	4
October	69	36	83	25	.72	.1	1.5	1	2
November	54	23	71	7	.54	.2	.9	5	3
December	46	18	64	2	.40	.1	.6	7	4
Year	66	35	101 *	-14**	14.05	9.2	18.3	41	3

* Average annual highest temperature.

** Average lowest annual temperature.

Source: Data for Byers, Arapahoe County, Period of record 1889-1972

5.8.1.3 Precipitation, Humidity, and Evapotranspiration

Data collected over long periods indicate that the annual precipitation for Adams County ranges from 12.5 to 14.5 inches(2). The average annual rainfall at Byers is 14.05 inches (Table 5.8.1). The average annual snowfall at Byers is about 46 inches.

There is considerable variability in the amount of precipitation from year to year and between nearby localities in the same general area, particularly during the spring and summer months. However, historical data from weather stations such as at Byers, Colorado are considered the best available long-term data representative of the site. A meterological monitoring program will be established when Phase I is initiated to measure actual site meterological conditons (see Chapter 7).

Typically, the 24-hour duration, maximum ever recorded rainfall in the vicinity of the site averages around 4 inches. Table 5.8.2 lists this data as reported by the Colorado State Climatologist. The maximum ever recorded 24-hour storm in the State of Colorado occurred on June 17, 1965 in Holly, Colorado where 11.08 inches were recorded at the National Weather Service station. Statistically, this rainfall event represents a storm that would occur less frequently than once every 500 years.

The average relative humidity is 39% during daylight hours and 62% at night. It is slightly higher in winter than in summer. On the average, the sun shines 69% of the possible sunlight hours annually.

TABLE 5.8.2

HISTORICAL RAINFALL DATA FOR A
24-HOUR EVENT IN SEVERAL COLORADO CITIES

Place	Period of Record	Date	Inches of Rain
Byers	1951-1973	Aug. 3, 1951	4.02
Ft. Morgan	1888-1980	July 31, 1956	4.60
Limon	1931-1971	Aug., 1965	3.72
Akron	1951-1970	May 26, 1967	3.11
Denver City	1873-1973	May, 1876	6.53
Holly	1894-1981	June 17, 1965	11.08
Palmer Lake	Unofficial Measurement	June 16, 1965	14
Near Elbert	Unofficial Measurement	June 17, 1965	12
Nunn	Unofficial Measurement	June 14-15, 1965	5.75

Evaporation and transpiration moisture loss from soils exceeds precipitation from June 15th to the early part of November. During this period, the moisture supply on the upper 3 to 12 inches of the soil is depleted below the wilting point and plants must depend on summer rainfall for additional growth. The normal annual Class A pan evaporation is about 65 inches per year(3). The mean annual lake evaporation is about 55 inches per year, about 74% of which occurs between the months of May and October, as shown in Table 5.8.3(4). Lake evaporation, rather than pan evaporation, is considered to be the best estimate of evaporation that would occur, for example, on surface impoundments and holding ponds.

TABLE 5.8.3

LAKE EVAPORATION FOR DENVER, COLORADO(4)

Month	Mean Monthly Value (Inches)
January	1.6
February	1.8
March	2.5
April	3.7
May	5.0
June	7.4
July	8.8
August	8.4
September	6.7
October	4.6
November	3.0
December	1.9
TOTAL ANNUAL LAKE EVAPORATION	55.4

5.8.2 Natural Ecosystems

5.8.2.1 Natural Vegetation

Natural vegetation covers approximately 2% of the study area. Most of this vegetation consists of native grassland. This grassland cover is almost entirely restricted to the narrow stream valley of Wetzel Creek and its tributaries, with most of the rolling upland areas in winter wheat cropland. Numerous forbs are associated with the grass species, but few trees or shrubs are present on the site.

Grasslands of this area are referred to as mixed grass prairie. Mid-grass prairie species generally predominate on the deeper, more moist soils of flood plains, while short-grass prairie species predominate on the dry upland soils. Common mid-grass species found along Wetzel Creek include needle and thread grass (*Stipa commata*), western wheatgrass (*Agropyron Smithii*), sand dropseed (*Sporobolus cryptandrus*), and alkali sacaton (*Sporobolus airoides*).

Short-grass prairie species are found on some dry upland areas along the upper terraces of Wetzel Creek. Dominant grasses include blue grama (Bouteloua gracilis) and buffalo grass (Buchloe dactyloides), with Indian rice grass (Orysopsis hymenoides) also well represented. Numerous legumes, composites, and other forbs are found in association with the short-grass prairie community.

Wetland vegetation is found along an impoundment on Wetzel Creek on the southwest corner of the site. Water tolerant vegetation growing in this area includes bullrush (Scirpus spp.), spikerush (Eleocharis sp.), smartweeds (Polygonum spp.), cattails (Typha latifolia), and various other wetland grasses and sedges. Slightly higher areas around this impoundment as well as moist areas along Wetzel Creek support grasses which require a moist soil including switchgrass (Panicum virgatum) and Canada ryegrass (Elymus canadensis).

The stream bed of Wetzel Creek is often dry and lacks vegetative cover in most places. However, some portions of the stream bed and banks have been colonized by an assemblage of plants characteristic of disturbed areas. Among those present are cocklebur (Zanthium strumarium), Russian thistle (Kochia scoparia), Amaranthus (Amaranthus sp.), and saltbush (Atriplex sp.)

5.8.2.2 Wildlife

The Colorado Division of Wildlife has developed and maintains a computer data bank on the distribution of wildlife species in the State of Colorado. As part of the wildlife inventory for this assessment, a computerized listing of vertebrates was generated and is included in this report as requested by the Division of Wildlife (Table 5.8.4). In addition, two

TABLE 5.8.4

WILDLIFE SPECIES EXPECTED IN EASTERN ADAMS COUNTY (6)

Common Name	Scientific Name	Seasonal Status
American Avocet	Recurvirostra americana	Likely Breeder
American Golden Plover	Pluvialis dominica	Accidental
American Green-Winged Teal	Anas crecca	Accidental
American Kestrel	Falco sparverius	Likely Breeder
American Redstart	Setophaga ruticilla	Accidental
American Robin	Turdus migratorius	Likely Breeder
Badger	Taxidea taxus	Breeding
Baird's Sandpiper	Calidris bairdii	Migrant
Bald Eagle	Haliaeetus leucocephalus	Winter Visitor
Barn Owl	Tyto alba	Breeding
Barn Swallow	Hirundo rustica	Breeding
Barred Tiger Salamander	Ambystoma tigrinum mavortium	Breeding
Belted Kingfisher	Megaceryle alcyon	Accidental
Black-and-White Warbler	Mniotilta varia	Accidental
Black-Bellied Plover	Pluvialis squatarola	Migrant
Black-Billed Magpie	Pica pica hudsonia	Likely Breeder
Black-Headed Grosbeak	Pheucticus melanocephalus	Likely Breeder
Black-Tailed Jackrabbit	Lepus californicus	Breeding
Black-Tailed Prairie Dog	Cynomys ludovicianus	Breeding
Black Tern	Chlidonias niger	Migrant
Blue-Winged Teal	Anas discors	Migrant
Blue Grosbeak	Guiraca caerulea	Likely Breeder
Blue Jay	Cyanocitta stelleri	Likely Breeder
Boreal Chorus Frog	Pseudacris triseriata maculata	Breeding
Brewer's Blackbird	Euphagus cyanocephalus	Likely Breeder
Brewer's Sparrow	Spirella breweri	Likely Breeder
Broad-Winged Hawk	Buteo platypterus	Accidental
Brown-Headed Cowbird	Molothrus ater	Likely Breeder
Brown Thrasher	Toxostoma rufum	Breeding
Bullfrog	Rana catesbiana	Breeding
Bullsnake	Pituophis melanoleucus sayi	Breeding
Burrowing Owl	Athene cunicularia	Breeding
Canada Goose	Branta canadensis	Winter Visitor
Cassin's Kingbird	Tyrannus vociferans	Likely Breeder
Cassin's Sparrow	Aimophila cassinii	Likely Breeder
Chipping Sparrow	Spizella passerina	Likely Breeder
Clay-Colored Sparrow	Spizella pallida	Migrant
Cliff Swallow	Petrochelidon pyrrhonota	Breeding
Common Crow	Corvus brachrhynchos	Likely Breeder
Common Flicker	Colaptes auratus	Breeding
Common Grackle	Quiscalus quiscula	Breeding
Common Nighthawk	Chordeiles minor	Likely Breeder
Common Raven	Corvus corax sinuatus	Winter Visitor
Common Snipe	Capella gallinago	Resident
Common Tern	Sterna hirundo	Accidental
Common Yellowthroat	Geothlypis trichas	Likely Breeder
Coyote	Canis latrans	Breeding
Dark-Eyed Junco	Junco hyemalis	Winter Visitor
Deer Mouse	Peromyscus maniculatus	Breeding
Desert Cottontail	Sylvilagus audobonii	Breeding
Dickcissel	Spiza americana	Breeding
Double-Crested Cormorant	Phalacrocorax auritus	Accidental
Downy Woodpecker	Picoides pubescens	Likely Breeder
Eastern Bluebird	Sialia sialis	Accidental
Eastern Cottontail	Sylvilagus floridanus	Breeding
Eastern Kingbird	Tyrannus tyrannus	Likely Breeder
Eastern Short-Horned Lizard	Phrynosoma douglassi brevirostre	Breeding
Eastern Wood Rat	Neotoma floridana	Breeding
Eastern Yellow-Bellied Racer	Coluber constrictor flaviventris	Breeding
Ferruginous Hawk	Buteo regalis	Likely Breeder
Fox Sparrow	Passerella iliaca	Accidental
Fox Squirrel	Sciurus niger	Breeding
Gadwall	Anas strepera	Likely Breeder
Golden-Crowned Kinglet	Regulus satrapa	Winter Visitor
Golden Eagle	Aquila chrysaetos	Likely Breeder
Grasshopper Sparrow	Ammodramus savannarum	Likely Breeder
Greater Yellowlegs	Tringa melanoleucus	Migrant
Great Blue Heron	Ardea herodias	Likely Breeder
Great Horned Owl	Bubo virginianus	Breeding
Great Plains Toad	Bufo cognatus	Breeding
Green-Tailed Towhee	Pipilo chlorurus	Accidental
Hispid Pocket Mouse	Perognathus hispidus	Breeding
Horned Lark	Eremophila alpestris	Likely Breeder
House Finch	Carpodacus mexicanus	Likely Breeder
House Sparrow	Passerdo mesticus	Likely Breeder
House Wren	Troglodytes aedon	Breeding
Killdeer	Charadrius vociferus	Breeding
Lark Bunting	Calamospiza melanocorys	Likely Breeder
Lark Sparrow	Chondestes grammacus	Breeding
Lazuli Bunting	Passerina amoena	Likely Breeder
Least Sandpiper	Calidris minutilla	Migrant
Leopard Frog	Rana pipiens	Breeding
Lesser Earless Lizard	Holbrookia maculata maculata	Breeding
Lesser Yellowlegs	Tringa flavipes	Migrant
Loggerhead Shrike	Lanius ludovicianus	Likely Breeder
Long-Billed Curlew	Numenius americanus	Likely Breeder
Long-Billed Dowitcher	Limnodromus scolophaceus	Migrant
Long-Tailed Weasel	Mustela frenata	Breeding

TABLE 5.8.4
(Continued)

Common Name	Scientific Name	Seasonal Status
MacGillivray's Warbler	Oporornis tolmiei	Migrant
Mallard	Anas platyrhynchos	Breeding
Marsh Hawk	Circus cyaneus	Likely Breeder
McCown's Longspur	Calcarius mccownii	Breeding
Mississippi Kite	Ictinia mississippiensis	Nonbreeder-Nesting Season Resident
Mockingbird	Mimus polyglottos	Likely Breeder
Mountain Bluebird	Sialia currucoides	Migrant
Mountain Plover	Charadrius montanus	Breeding
Mourning Dove	Zenaida macroura	Breeding
Mule Deer	Odocoileus hemionus	Breeding
Northern Grasshopper Mouse	Onychomys leucogaster	Breeding
Northern Green Heron	Butorides striatus	Likely Breeder
Northern Lined Snake	Tropidoclonion lineatum lineatum	Breeding
Northern Many-Lined Skink	Eumeces multivirgatus multivirgatus	Breeding
Northern Oriole	Icterus galbula	Breeding
Northern Pocket Gopher	Thomomys talpoides	Breeding
Northern Prairie Lizard	Sceloporus undulatus garmani	Breeding
Opposum	Didelphis marsupialis	Breeding
Orchard Oriole	Icterus spurius	Likely Breeder
Ord's Kangaroo Rat	Dipodomys ordii	Breeding
Ornate Box Turtle	Terrapene ornata ornata	Breeding
Pectoral Sandpiper	Caalidris melanotos	Migrant
Pine Siskin	Carduelis pinus	Winter Visitor
Pintail	Anas acuta	Likely Breeder
Plains Harvest Mouse	Reithrodontomys montanus	Breeding
Plains Hognosed Snake	Heterodon nasicus nasicus	Breeding
Plains Pocket Gopher	Geomys bursarius	Breeding
Plains Spadefoot	Scaphiopus bombifrons	Breeding
Porcupine	Erethizon dorsatum	Breeding
Prairie Falcon	Falco mexicanus	Resident
Prairie Rattlesnake	Crotalus viridis viridis	Breeding
Prairie Six-Lined Racerunner	Cnemidophorus sexlineatus	Breeding
Prairie Vole	Microtus ochrogaster	Breeding
Pronghorn	Antilocapra americana	Breeding
Raccoon	Procyon lotor	Breeding
Redhead	Aythya americana	Accidental
Red-Eyed Vireo	Vireo olivaceus	Migrant
Red-Headed Woodpecker	Melanerpes erythrocephalus	Breeding
Red-Tailed Hawk	Buteo jamaicensis	Likely Breeder
Red-Winged Blackbird	Agelaeius phoeniceus	Breeding
Ring-Billed Gull	Larus delwarensis	Migrant
Ring-Necked Pheasant	Phasianus colchicus	Resident
Rock Dove	Columba livia	Likely Breeder
Rock Wren	Salpinctes obsoletus	Breeding
Rough-Legged Hawk	Buteo lagopus	Winter Visitor
Rough-Winged Swallow	Stelgidopteryx ruficollis	Likely Breeder
Ruddy Duck	Oxyura jamaicensis	Accidental
Ruddy Turnstone	Arenaria interpres	Accidental
Rufous-Sided Towhee	Pipilo erythrophthalmus	Migrant
Sandhill Crane	Grus canadensis	Migrant
Say's Phoebe	Sayornis saya	Breeding
Scissor-Tailed Flycatcher	Muscivora forticata	Accidental
Short-Eared Owl	Asio flammeus	Winter Visitor
Silky Pocket Mouse	Perognathus flavus	Breeding
Solitary Sandpiper	Tringa solitaria	Migrant
Song Sparrow	Melospiza melodia	Likely Breeder
Spotted Sandpiper	Actitus macularia	Likely Breeder
Starling	Sturnus vulgaris	Breeding
Stilt Sandpiper	Micropalama himantopus	Migrant
Summer Tanager	Piranga rubra	Accidental
Swainson's Hawk	Buteo swainsoni	Breeding
Swainson's Thrush	Catharus ustulata	Accidental
Swift Fox	Vulpes velox	Breeding
Thirteen-Lined Ground Squirrel	Spermophilus tridecemlineatus	Breeding
Townsend's Solitaire	Myadestes townsendi	Winter Visitor
Tree Sparrow	Spizella arborea	Winter Visitor
Tree Swallow	Iridoprocne bicolor	Migrant
Turkey Vulture	Cathartes aura	Migrant
Veery	Catharus fuscescens	Migrant
Vesper Sparrow	Pooecetes gramineus	Breeding
Warbling Vireo	Vireo gilvus	Likely Breeder
Water Pipit	Anthus spinoletta	Migrant
Western Grebe	Aechmophorus occidentalis	Nonbreeder-Nesting Season Resident
Western Harvest Mouse	Reithrodontomys megalotis	Breeding
Western Kingbird	Tyrannus verticalis	Breeding
Western Massasauga	Sistrurus catenatus tergiminus	Likely Breeder
Western Meadowlark	Sturnella neglecta	Likely Breeder
Western Milk Snake	Lampropeltis triangulum gentilis	Breeding
Western Painted Turtle	Chrysemys picta belli	Breeding
Western Plains Garter Snake	Thamnophis radix haydeni	Breeding
Western Sandpiper	Calidris mauri	Migrant
Western Tanager	Piranga ludoviciana	Accidental
Western Wood Pewee	Contopus sordidulus	Likely Breeder
White-Crowned Sparrow	Zonotrichia leucophrys	Winter Visitor
White-Faced Ibis	Plegadis chihi	Accidental
White-Necked Raven	Corvus cryptoleucus	Likely Breeder
White-Rumped Sandpiper	Calidris fuscicollis	Accidental
White-Tailed Jackrabbit	Lepus townsendii	Breeding
Willet	Catoptrophorus semipalmatus	Migrant
Wilson's Phalarope	Steganopus tricolor	Migrant
Wilson's Warbler	Wilsonia pusilla	Migrant
Woodhouse's Toad	Bufo woodhousei woodhousei	Breeding
Yellow-Headed Blackbird	Xanthocephalus xanthocephalus	Likely Breeder
Yellow-Rumped Warbler	Dendroica coronata	Migrant
Yellow Warbler	Dendroica petechia	Breeding

biological reconnaissance visits were made to the site, and a site inspection with representatives of the Colorado Division of Wildlife was also made to supplement the wildlife inventory.

Mixed grass prairie and agriculture fields provide essentially all of the terrestrial wildlife habitat on the site. Some intermittent aquatic habitat is provided by Wetzel Creek and several impoundments on this stream system. The only permanent body of water on the site is an impoundment on Wetzel Creek in the southwest corner of the site.

Principal wildlife associated with the grassland on the site include various field songbirds, numerous small rodents, various hawks and owls, and game animals such as jack rabbits and cottontail rabbits. A pronghorn antelope population of 200-300 occurs within a five mile radius of the site, and 100-150 mule deer are present in this same area(5). Groups of these animals undoubtedly range to the site on occasion. Other mammals probably in the area include coyote, badger, fox, and raccoon. Game birds occurring on or in the vicinity of the site include mourning dove and pheasant.

The impoundment on the southwest corner of the site provides seasonal use by shorebirds and migratory waterfowl. Since streams in the area are intermittent, no fishery resource is expected in the area. The above mentioned impoundment is too small and shallow to sustain a fisheries resource. This impoundment is probably subject to freeze out during the coldest part of the winter.

5.8.2.3 Threatened and Endangered Species

A number of state and/or federally threatened or endangered wildlife species occur in the prairie province of eastern Colorado or have occurred there within historical times (Table 5.8.5). However, there is no evidence that any of these species presently occur on or in close proximity to the site. Also, no "essential habitat," as defined by the Colorado Division of Wildlife and delineated on state maps for each state or federally threatened or endanged species, occurs within the study area (6). The Colorado Division of Wildlife defines "essential habitat" as any geographic area that is absolutely necessary for the maintenance and recovery of a threatened or endangered species and bases the determination on an evaluation of several habitat factors.

Since mixed prairie habitat is essentially the only wildlife habitat that is present on the site other than cropland, only those state and federally threatened or endangered species dependent on such habitat will be considered for the purposes of this discussion. Species which meet these criteria for Colorado include the greater prairie chicken, the lesser prairie chicken, the prairie sharp-tailed grouse, and the black-footed ferret. Below is a discussion of each of these species and its state and federal status.

Greater Prairie Chicken (*Tympanuchus cupido pinnatus*)

Status: Endangered State of Colorado

Historically, the greater prairie chicken is thought to have occurred throughout much of northeastern Colorado. Presently, its known range in Colorado is limited to southern Phillips and northern Yuma Counties where about 600 birds are thought to occur. This area is about 75 miles ENE of the study area.

TABLE 5.8.5

THREATENED OR ENDANGERED WILDLIFE

COMMON NAMES	SCIENTIFIC NAME	
Johnny Darter	Estheostoma nigrum	State Threatened
Plains Orangethroat Darter	Estheostoma spectabile pulchellum	State Threatened
White Pelican	Pelecanus erythrorhynchos	State Threatened
Southern Bald Eagle	Haliaeetus leucocephalus leucocephalus	Federally Endangered
Greater Praire Chicken	Tympanuchus cupido pinnatus	State Endangered
Lesser Prairie Chicken	Tympanuchus pallidicinctus	State Threatened
Prairie Sharp-Tailed Grouse	Pediocetes phasianellus jamesi	State Endangered
Gray Wolf	Canis lupus	Federally Endangered
Grizzly Bear	Ursus arctos	Federally Endangered
Black-Footed Ferret	Mustela nigripes	Federally Endangered
River Otter	Lutra canadensis	State Endangered

The greater prairie chicken requires relatively undisturbed tall grass or mixed grass prairie vegetation for survival(6). To sustain a viable population, it is thought that at least eight square miles of land use are required, with at least 50% in grassland. Ideally, the grassland should be interspersed with cropland and have available surface water.

Lesser Prairie Chicken (*Tympanuchus pallidicinctus*)

Status: Threatened State of Colorado

The lesser prairie chicken was found historically in southeastern and east central Colorado on both sides of the Arkansas River, but primarily south of the river(6). It is thought to have occurred in both the mixed prairie and sand sagebrush grassland. Presently, the species is known from separate populations in Prowers and Baca Counties about 130 miles southeast of the study area where it is restricted to sagebrush grassland interspersed with agricultural areas. The above populations consist of a total of 350-450 birds.

The limiting factor for the lesser prairie chicken is lack of adequate nesting and broodrearing habitat. A minimum of eight sections of land that are at least 50% sand sagebrush grassland should be maintained to ensure the existence of viable populations. At least 25% of this should constitute acceptable nesting habitat: tall grass sufficient to conceal nesting birds.

Prairie Sharp-tailed Grouse (*Pedioecetes phasianellus jamesii*)

Status: Endangered Subspecies State of Colorado

The prairie sharp-tailed grouse is an inhabitant of the ecotone between prairie and large shrub communities. Historically, it ranged widely south of the South Platte River in northeastern and east central Colorado. Presently, a population of 150-300 birds occurs in Elbert and Douglas Counties, about 60 miles west southwest of the study area.

The best composite habitat for the sharp-tailed grouse consists of the mixed or tall grass shrub ecotone with light grazing, but some stands of shrub present without grazing(6). It is thought that to maintain a viable population, a tract of at least eight square miles is desirable with at least 50% grassland. At least 25% of the remainder should have grass shrubland cover.

Black-footed Ferret (*Mustela nigripes*)

Status: Endangered State of Colorado and Federally

The black-footed ferret is apparently limited by the distribution and abundance of prairie dogs (*Cynomys* spp.) upon which it preys almost exclusively. Although probably never common, the species occurred historically throughout Colorado except in the high mountains. There are no confirmed sightings of the species in Colorado in recent times, but there are unverified sightings from Prowers County in the past 13 years(7). The principal known populations of ferrets occur in South Dakota.

5.8.3 Land Use and Population

5.8.3.1 Regional and Local Land Use Planning

The Adams County Comprehensive Plan of 1975 (as amended) provides a framework for land use within the county(10). The Comprehensive Plan establishes general guidelines, recommendatory in nature, to assist the county in making land use decisions. The Comprehensive Plan has been supplemented by five development plans coinciding with five county planning areas.

The proposed Highway 36 facility is located in planning area 5, known as the east end. The east end is the largest of the five planning areas, encompassing approximately 960 square miles. Supplemental planning for the east end was completed in 1977. The resulting guidelines are set forth in the East End Development Plan(15).

As indicated above, the purpose of the Comprehensive Plan is to provide guidelines to achieve county goals in an orderly manner. These goals include increasing county development while maintaining the quality of the present environment and enhancing that of the future. Through the planning process, the county also wishes to provide additional, more diverse employment opportunities and a better standard of living for county residents(10).

The East End Development Plan (EEDP), as a supplement to the Comprehensive Plan, contains guidelines specific to the eastern end of the county. The salient east end goals are as follows:

- To retain or improve the present quality of life of the east end rural environment.
- To strengthen depressed areas with activities which increase employment opportunities and will be compatible with agriculture.

- To support industrial growth to strengthen the economic base and provide more employment opportunities to east end residents.

Further, the EEDP recognizes that development is necessary for the east end to remain economically viable. Therefore, development consistent with the established goals and policies is encouraged.

The final pertinent element of the Comprehensive Plan is the Adams County Waste Management Plan(16), completed and adopted by the Adams County Planning Commission in August, 1982 and endorsed by the Adams County Board of County Commissioners in September, 1982. The Waste Management Plan (WMP) was developed after the Adams County Waste Advisory Committee conducted a thorough study of existing county waste management problems. The Committee recommended that the county permit one site for hazardous waste disposal. Further, the Committee found that "recovery/neutralization/incineration and solidification are the most desirable methods of hazardous waste management"(16).

Based on the work of this Committee and the input of local, county, state, and federal regulatory agencies, the WMP recommended policies for waste management in Adams County. With respect to hazardous waste, the WMP acknowledges that the lack of an approved secure disposal site in Colorado is causing the related problems of illegal dumping and unsafe storage of wastes. To meet these and other hazardous waste disposal problems, the WMP announced a county policy that no more than one hazardous waste disposal site be operated within county boundaries at any given time if need for such a facility can be demonstrated on the part of Adams County industry.

5.8.3.2 Regional and Local Land Use

The predominant land use in Adams County is agricultural, with 94% of total county acreage or approximately 755,000 acres in some form of agricultural use. In the eastern two-thirds of the county, land is used almost exclusively for agricultural purposes. A breakdown of overall county land use is provided in Table 5.8.6. The primary non-irrigated crops are forage, sorghum, barley, and winter wheat. The primary irrigated crops are barley, corn, alfalfa, sugar beets, wheat, oats and rye.

TABLE 5.8.6

ADAMS COUNTY LAND USE (ACRES)

Winter Wheat and Barley (Dry Land Farming)	360,000
Irrigated Crop Land	155,000
Grazing and Native Grass	240,000
Urban Land	45,000
Total	800,000

Agricultural land use in Adams County is characterized by large farms and ranches engaged primarily in the production of cash crops and livestock. Farms tend to be very large with 160 acres considered a small operation. The average farm size for the county in 1978 was 870 acres, down from 1,056 acres in 1974(11). Additional information regarding farming operations is summarized in Tables 5.8.7 and 5.8.8.

The urban areas of Adams County are located in the western third of the county. These urban areas are characterized by low to medium density development in the residential, commercial, and industrial categories. Commercial and residential uses are most prevalent in the incorporated areas, with the main industrial uses occurring along the primary highway routes, i.e., Interstate 25, Interstate 76, and Colorado State Highway 2.

TABLE 5.8.7

FARMS BY TYPE OF ORGANIZATION, 1978

Individual or Family	639
Partnership	108
Corporation	56
Other	0

TABLE 5.8.8

FARM OPERATOR CHARACTERISTICS, 1974 & 1978

	1974	1978
Tenure of Operator		
Full Owner	356	380
Part Owner	271	262
Tenant	133	161
Average Age of Operator	52.1	50.2
Sex of Operator		
Male	NA	764
Female	NA	39

Land use within the incorporated areas is made up of office buildings, financial institutions, shopping centers, neighborhood service establishments, and various commercial activities, in addition to the residential areas. There are also several large residential areas in the unincorporated urban section of the county.

In the east end, which encompasses approximately 960 square miles, 98% of the land is used for agricultural purposes. Ninety-seven percent of the agricultural acreage is non-irrigated farm land, of which 69% is used to produce dry land crops, and 28% is used for grazing. The remaining 3% of total agricultural acreage is used to produce irrigated crops. Winter wheat is the largest crop produced in the east end.

Land use in the vicinity of the site is agricultural. Grazing and dry land wheat farming are the predominate uses. The 1977 EEDP indicates that the proposed site was used primarily for dry land farming, with a small portion of the site used for grazing. Currently, the site is used exclusively for dry land wheat farming. This use will continue throughout the life of the proposed facility on the half-mile buffer zone and the seven sections not used for waste disposal.

The active portion of the site, described as the southwest quarter of Section 25 and the northwest quarter of Section 36, Township 3 South, Range 57 West of the Sixth Prime Meridian, Adams County, consists of 325 acres. The predominate soils in these two quarter sections are as follows:

> ADENA LOAM, 0-3% SLOPES - This soil is in the eastern two-thirds of the county. Surface runoff is medium to rapid, and the hazard of water erosion is moderate. Soil blowing is a severe hazard in unprotected areas. Included in mapping are small areas of Weld loam in depressions.
>
> Most areas of this soil are cultivated. Many small scattered areas have a cover of native grass that is used for grazing.
>
> ADENA LOAM, 3-5% SLOPES - This soil has the profile described as representative for the series. Runoff is rapid, the hazard of water erosion is severe, especially if protection cover is inadequate. Soil blowing is a severe hazard in unprotected areas.
>
> Most areas of this soil are cultivated. Many small scattered areas are under native grass that is grazed.
>
> ADENA-COLBY ASSOCIATION, GENTLY SLOPING - This association consists of intermingled Adena, Colby, and Wiley loams. Adena loam, 3-5% slopes, is the dominant soil and makes up about 40% of the association. It normally has slopes facing east and southeast. Colby loam, 3-5% slopes, makes up about 30% of the association. It is on ridgetops and knolls that are more exposed to the wind. Wiley loam is in slightly more sloping areas facing west to north; it forms about 30% of the association.
>
> Included in mapping, where the association is dissected by drainageways, are small areas of Loamy alluvial land.
>
> Soils of this mapping unit are suitable for dryfarming if they are carefully managed. They are commonly used for rangeland where they are adjacent to steep Colby soils.

WELD-DEERTRAIL COMPLEX, 0-3% SLOPES - This complex is on uplands. About 60% of it is Weld loam and 40% is Deertrail loam. The Weld soil is similar to Weld loam, 1-3% slopes, but it is closely intermingled with patches of the Deertrail soil. The patches are bare and commonly are called slickspots.

Areas of the complex in native pasture can be readily recognized by the bare spots that are characteristic of Deertrail soils. These have a growth of bunchgrass or buffalograss around their edges and are surrounded by a cover of grama grasses. In cultivated fields, the slickspots are difficult to see in some areas, but they cause crop growth to be stunted and the surface layer to crust.

Much of this complex is dryfarmed, but a large acreage remains in native grass. The main crops are winter wheat and sorghums. Runoff is slow. The hazards of water erosion and soil blowing are moderate, but they increase in severity if gullies form. Soil blowing is a severe hazard if the soils are dryfarmed in years when rainfall is not sufficient.

WILEY-ADENA-RENOHILL COMPLEX, 3-20% SLOPES - The soils in this complex have intermediate slopes between river terraces or upland drainage channels and the gently sloping soils on uplands.

Wiley loam makes up about 40% of the complex; Adena loam about 35%; Renohill loam about 20%; and Loamy alluvial land nearly 5%. Included in mapping are small areas of Colby, Samsil, and Shingle soils. Scattered slickspots also are included.

Adena loam is the smoothest of the major soils. It is at the top of slopes in narrow bands and has slopes of 3-5%. Wiley loam has somewhat stronger slopes. It adjoins narrow thin ridges of Colby soils that are generally at right angles to the slopes around the brow of the hill or extend downward parallel to the slope as steeper ridges outlining drainage channels. Renohill loam is in the heads of drainageways. Samsil and Shingle soils are at the bottom of the slopes where erosion has exposed the shale and interbedded shale and sandstone. Loamy alluvial land is the fill material in the drainageways.

Some less sloping areas of the complex have been cultivated, but most have been abandoned and allowed to return to grass cover. The soils are not suitable for cultivation because of the strong slopes and the severe hazard of erosion.

According to the Soil Conservation Service (United States Department of Agriculture), none of the land contained in the two quarter sections is prime and unique farm land(2). The Weld-Deertrail Complex and the Wiley-Adena-Renohill Complex soils are lower quality agricultural soils. The other soils identified are good quality soils, but due to steep slopes and an absence of irrigation, the area cannot be designated as prime and unique farm land.

5.8.3.3 Population Characteristics

Adams County is located adjacent to and east of the Denver metropolitan area. It contains approximately 1,240 square miles and has a population of approximately 246,000 residents. The county is bordered by the City and County of Denver and Arapahoe, Boulder, Jefferson, Weld, Morgan, and Washington Counties. The western third of the county is part of the Denver metropolitan area and is growing rapidly. The eastern portion of the county remains rural in character.

Historically, Adams County has been one of the more rapidly growing counties in the Denver region. During the 1950's, the county almost tripled in population. The growth rate continued to increase, at a slower pace, through the 1960's and into the mid-1970's. For much of that period, the growth rate in Adams County was higher than that of Denver. The rapid population increase has occurred primarily in the western third of the county, adjacent to the Denver metropolitan area. The population figures for Adams County for the period 1950-1980 are shown below. They reflect a steady increase in population, again, primarily in the urban areas adjacent to Denver.

Adams County Population, 1950-1980		% Change
1950	40,234	-
1960	120,296	198.9
1970	185,789	54.4
1980	245,944	32.4

Though the western two-thirds of the County nearly doubled in population during the 1970's, only an approximate 1% of the total county population, or 3,100 persons, resided in the east end at the end of that period.

The average median age in Adams County is 23.7 years. Racial composition is 97.6% white, 0.8% Negro, and 1.6 percent other races. Of the total population, 40.9% are under the age of 18 and 4.7% over the age of 65. The age group 18-65 accounts for 54.4% of the total county population(8).

The population in the vicinity of the site is extremely sparse. The two closest towns are Byers and Last Chance. Byers, located 30 miles from the site in Arapahoe County, has a population of 875. Last Chance, located in Washington County seven miles from the site, has a population of about 50.

In 1977, a total of approximately 927 housing units, or about 1.8% of the total number of housing units in the county, were located in the east end. Approximately 95 residential structures are located within 10 miles of the nine section property boundaries. Table 5.8.9 and Figure 5.8.2 details results from a 1981 house-to-house survey.

TABLE 5.8.9

HOUSING & POPULATION WITHIN 10 MILES OF NINE SECTION PROPERTY BOUNDARY

Miles from Property	No. of Houses	No. of Occupied Houses	Population
0-1	3	1	3
1-2	5	3	12
2-3	8	5	13
3-4	4	1	4
4-5	4	3	12
5-6	14	14	50
6-7	25	21	72
7-8	10	9	20
8-9	12	12	35
9-10	10	10	26
Total	95	79	247

5.8.3.4 Zoning

The Adams County land use plans and policies as set forth in the Comprehensive Plan, the Waste Management Plan and the five sub-area plans, are implemented by the Adams County Zoning Regulations(14).

The zoning regulations provide for a broad scope of allowed uses in agricultural zones. The Adams County use charts indicate that airports, animal slaughter for commercial purposes, automobile drag race strips, commercial kennels, dog tracks, public heliports, meat processing, meat packing and slaughtering facilities, and water and sewage treatment plants are allowed uses in agriculture zones by conditional use permit. Commerical kennels and fertilizer manufacturing and processing are uses by right in A-3 zone districts. Solids waste disposal sites are allowed uses in all three agricultural zones by certificate of designation. Automobile salvage and organic waste disposal is allowed at solid waste disposal sites located in A-3 zones. The proposed facility is located in an A-3 zone.

The regulations establish three agricultural districts, A-1, A-2, and A-3. Agriculture is defined as "the use of land for agricultural purposes, including farming, dairying, grazing land, animal and poultry husbandry, greenhouses, nurseries, livestock and poultry confinement and including the necessary accessory uses for packing, treating, storing and shipping of farm products." (Reference 15, Section 2.202). The three districts are described as follows:

A-1:

Exclusively a rural, single family dwelling district where the minimum lot area for a home site is dependent on the availability of public water

and sewer facilities and other necessary utilities and services. Limited farming uses are permitted including the cultivation of land and the keeping of a limited amount of animals for individual homeowners use.

A-2:

Land use in this district is for rural subdivisions of at least 10 acres in size where adequate provisions are made for internal and external roads and access, water and sewer facilities, for fire protection and other emergency services, and for other public services and utilities. Farming uses are permitted, including the cultivation of land and the keeping of a limited amount of animals.

A-3:

Land in this district is primarily in holdings of at least 35 acres of dry land or irrigated farming, pasturage, or other related food production use.

The zoning regulations do not address disposal of hazardous wastes. Disposal of hazardous waste is neither specifically prohibited nor allowed. Solid waste disposal is, however, allowed in all zone districts by a certificate of designation, a use listed in the regulations at Section 3.260. Solid waste is defined as "materials such as garbage, refuse, sludge of sewage disposal plants, mill tailings, mining wastes, junk automobiles and parts thereof, and other discarded solid waste material, including solid wastes resulting from industrial, commercial and community activities, but does not include agricultural wastes." (Reference 15, Section 2.258). This definition is sufficiently broad to include hazardous waste. Such a conclusion is reinforced by the fact that disposal of organic wastes, a class of wastes almost exclusively hazardous, is specifically allowed by the zoning regulations at solids waste disposal facilities located in A-3 zones.

5.8.4 Economic Activities

5.8.4.1 Employment

The economic structure of Adams County is predicated on a variety of industries and occupations. Employment patterns indicate a diverse economy with predominant trends in several categories. Table 5.8.10 shows the industry of employed persons for Adams County and the State of Colorado for the years 1970 and 1978. Total county employment in 1970 was 69,284. This figure dropped 14.8% to 60,343 in 1978. The predominant industries in Adams County are manufacturing, which in 1978 represented 22.7% of the total, construction activity at 10.4%, wholesale trade at 9.8%, and eating and drinking places at 7.2%. The State generally indicates the same downward trends, with a slightly lower volume of manufacturing and construction activity. Wholesale employment for the State is 7.1% of the total, compared with 9.8% for the county. The State also shows a slightly higher percentage of employment in the eating and drinking establishments category.

The occupation of employed persons for Adams County and the State of Colorado is shown in Table 5.8.11. These figures reflect the same types of trends as the employment data in Table 5.8.10. Clerical and kindred workers are the largest occupational employment category for the county, accounting for 20.5% of total county employment. They are followed by craftsmen, foremen, and kindred workers at 16.1%, and professional, technical and kindred workers at 12.9%. State occupational employment data varies somewhat from these figures but still reflects the predominant categories.

TABLE 5.8.10

INDUSTRY OF EMPLOYED PERSONS, ADAMS COUNTY AND STATE OF COLORADO, 1970 and 1978.

	COUNTY				STATE			
	1970		1978		1970		1978	
	NUMBER	%	NUMBER	%	NUMBER	%	NUMBER	%
TOTAL [1]	69,284	100.0	60,343	100.0	825,776	100.0	920,811	100.0
Agricultural, forestry, and fisheries	1,723	2.5	471	.8	38,093	4.6	3,306	.4
Mining	442	.6	226	.4	14,232	1.7	27,417	3.0
Construction	5,249	7.6	6,286	10.4	54,668	6.6	78,992	8.6
Manufacturing	13,138	19.0	13,728	22.7	120,581	14.6	167,079	18.1
Railroads and railway express service	660	.9	NA		7,108	.8	NA	
Trucking service and warehousing	2,639	3.8	3,658	6.0	12.890	1.6	16,395	1.8
Other transportation	2,184	3.2	1,231	2.0	12,520	1.5	14,432	1.6
Communications	1,036	1.5	(F)[5]		13,330	1.6	21,958	2.4
Utilities	1,105	1.6	329[2]	.5	14,840	1.8	9,292[2]	1.0
Wholesale trade	5,373	7.8	5,914	9.8	37,798	4.6	65,606	7.1
Food, bakery, and dairy stores	2,145	3.1	2,560[3]	4.2	18,761	2.3	26,109[3]	2.8
Eating and drinking places	2,667	3.8	4,354	7.2	31,886	3.9	79,994	8.7
General merchandise retailing	2,257	3.3	2,863	4.7	23,743	2.9	24,762	2.7
Motor vehicle retailing and service stations	1,844	2.7	2,390	4.0	22,599	2.8	29,238	3.2
Other retail trade	3,242	4.7	3,780	6.3	48,824	5.9	60,869	6.6
Banking and credit agencies	1,398	2.0	1,285	2.1	14,953	1.8	25,455	2.8
Insurance, real estate, and other finance	2,418	3.5	2,207	3.7	31,456	3.8	43,641	4.7
Business and repair services	2,590	3.6	2,168	3.6	28,559	3.5	43,055	4.7
Private households	349	.5	NA		8,617	1.1	NA	
Other personal services	2,055	3.0	2,446	4.1	31,217	3.8	46,453	5.0
Entertainment and recreation services	595	.8	416	.7	8,569	1.0	12,642	1.4
Hospitals	2,360	3.4	(F)[5]		34,677	4.2	28,250	3.1
Health services, except hospitals	1,165	1.7	2,533	4.2	20,234	2.5	31,505	3.4
Elementary, secondary schools, and colleges—government	3,292	4.8	502[4]	.8	63,430	7.7	9,971[4]	1.1
Elementary, secondary schools, and colleges—private	848	1.2			15,832	1.9		
Other education and kindred services	271	.4	NA		4,551	.5	NA	
Welfare, religious, and nonprofit membership organizations	810	1.2	613	1.0	13,587	1.6	14,992	1.6
Legal, engineering, and miscellaneous professional services	1,231	1.8	NA		23,321	2.8	NA	
Public administration	4,198	6.0	NA		54,900	6.6	NA	

1. 16 years old and over.
2. Electric, gas and sanitary services.
3. Food stores.
4. Educational services, all schools.
5. (F): 500-999

Source: 1970 Census of the Population, Colorado, Vol. 1.
1978 County Business Patterns, Colorado, Bureau of the Census

TABLE 5.8.11

OCCUPATION OF EMPLOYED PERSONS, ADAMS COUNTY AND STATE OF COLORADO, 1970

OCCUPATION	COUNTY Number	COUNTY %	STATE Number	STATE %
Total*	69,284	100.0	825,776	100.0
Professional, Technical, and kindred workers	8,972	12.9	148,351	18.0
Managers and administrators, except farm	5,335	7.8	78,725	9.5
Sales workers	4,818	7.0	63,513	7.7
Clerical and kindred workers	14,225	20.5	154,465	18.7
Craftsmen, foremen, and kindred workers	11,141	16.1	102,957	12.5
Operatives, except transport	7,586	10.9	67,670	8.2
Transport equipment operatives	3,993	5.8	30,052	3.6
Laborers, except farm	3,216	4.6	33,385	4.0
Farmers and farm managers	781	1.1	19,580	2.4
Farm laborers and farm foremen	602	.9	12,551	1.5
Service workers, except private household	8,263	11.9	105,809	12.8
Private household workers	352	.5	8,718	1.1

* 16 years old and over

Source: 1970 Census of the Population, Colorado, Vol. 1.

The preceding data is actually more descriptive of the west end of the county, which is more urbanized than the eastern two-thirds. The employment centers in Adams County are concentrated primarily around the urban areas adjacent to Denver, and along the main highway routes in that portion of the county. Employment patterns in the vicinity of the project site are primarily agricultural with some scattered oil and gas activity. Employment within the agricultural category may be further subdivided into employment associated with cattle grazing and breeding, other livestock and poultry production, production of crops, and agricultural services. These are the most prevalent occupations in the east end of the county.

5.8.4.2 Income

The income characteristics of Adams County reflect a fairly equitable distribution of personal income among the various sectors of the economy. Personal income in the county has grown steadily in the past decade, particularly in the urban areas on the west end. This growth may be attributed to the economic diversification of the county and the subsequent employment increases in each area. The county has traditionally been dependent on its agricultural resources for income generation, but as it becomes more urbanized different income patterns and sources begin to emerge. Income generation from non-farm uses such as manufacturing, retail trade, government sources, and services are becoming more prevalent, while farm income as a percentage of the total remains small.

Personal income distribution by industry for Adams County and the State for the years 1971-1976 is shown in Tables 5.8.12 and 5.8.13. These figures reflect a steady increase in total personal income for the State and county over the six year period.

TABLE 5.8.12

ADAMS COUNTY - PERSONAL INCOME BY MAJOR SOURCES 1971-1976 (THOUSDANDS OF DOLLARS)

Source:	1971		1972		1973		1974		1975		1976	
	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total
By Industry -												
Farm	8,231	2.2	8,314	1.8	12,359	2.2	17,230	2.9	19,530	2.9	13,764	1.9
Non-Farm	370,298	97.8	461,718	98.2	542,394	97.8	572,460	97.1	657,387	97.1	721,153	98.1
Private	265,703	70.2	349,352	74.3	418,152	75.4	431,893	73.3	491,809	72.7	545,963	74.3
Ag. Serv., For., Fish & other	(D)		(D)		(D)		2,062	.3	(D)		(D)	
Mining	(D)		(D)		(D)		4,459	.7	(D)		(D)	
Construction	49,726	13.1	66,221	14.1	83,917	15.1	73,735	12.5	66,033	9.8	68,180	9.3
Manufacturing	81,135	21.4	125,173	26.6	143,228	25.8	141,555	24.0	144,424	21.3	159,380	21.6
Non-Durable Goods	27,836	7.4	32,290	6.8	36,459	6.6	40,184	6.8	47,498	7.0	55,346	7.5
Durable Goods	53,299	14.0	92,883	19.8	106,769	19.2	101,371	17.2	96,926	14.3	104,034	14.2
Transportation & Public Utilities	14,414	3.8	16,324	3.5	19,996	3.6	21,506	3.6	41,806	6.2	49,295	6.7
Wholesale Trade	18,060	4.8	22,925	4.9	27,552	5.0	36,070	6.1	67,114	9.9	71,900	9.8
Retail Trade	40,949	10.8	47,166	10.1	60,468	10.9	69,431	11.7	78,418	11.6	89,615	12.2
Finance, Insurance & Real Estate	22,370	5.9	23,057	4.9	25,868	4.7	26,395	4.5	22,248	3.3	25,108	3.4
Services	35,516	9.4	44,384	9.4	51,933	9.4	56,680	9.6	63,262	9.3	72,390	9.8
Government & Government Enterprises	104,595	27.6	112,366	23.9	124,242	22.4	140,567	23.8	165,578	24.4	175,190	23.8
Federal, Civilian	32,092	8.5	36,450	7.8	39,504	7.1	45,524	7.7	55,190	8.2	54,231	7.4
Federal, Military	24,013	6.3	21,322	4.5	20,295	3.7	23,487	3.9	23,294	3.4	21,782	2.9
State and Local	48,490	12.8	54,594	11.6	64,443	11.6	71,556	12.1	87,094	12.8	99,177	13.5

Source: Local Area Personal Income, Vol. 7, Southwest Region, August, 1978, U.S. Department of Commerce, Department of Economic Analysis.

TABLE 5.8.13

COLORADO - PERSONAL INCOME BY MAJOR SOURCES 1971-1976 (THOUSANDS OF DOLLARS)

Source:	1971		1972		1973		1974		1975		1976	
	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total	Income	% of Total
By Industry -												
Farm	279,334	3.7	309,123	3.5	547,435	5.3	532,674	4.8	487,286	4.1	327,199	2.5
Non-Farm	7,310,437	96.3	8,410,171	96.5	9,634,279	94.7	10,526,961	95.2	11,370,590	95.9	12,705,146	97.5
Private	5,566,510	73.4	6,465,292	74.2	7,459,660	73.3	8,144,248	73.6	8,705,849	73.4	9,795,073	75.2
Ag. Serv., For., Fish & other	25,241	.3	28,870	.3	33,307	.3	37,812	.3	36,510	.3	38,745	.3
Mining	149,054	2.0	169,622	1.9	193,405	1.9	271,749	2.5	362,652	3.1	419,967	3.2
Construction	634,990	8.4	795,757	9.3	957,896	9.4	956,927	8.6	838,486	7.1	924,158	7.1
Manufacturing	1,159,171	15.3	1,374,094	15.7	1,555,240	15.3	1,736,040	15.7	1,827,075	15.4	2,066,891	15.8
Non-Durable Goods	448,884	5.9	500,837	5.7	553,760	5.4	619,931	5.6	690,753	5.8	776,582	6.0
Durable Goods	710,287	9.4	873,257	10.0	1,001,480	9.8	1,116,109	10.1	1,136,322	9.5	1,290,309	9.9
Transportation & Public Utilities	589,801	7.8	683,012	7.8	782,208	7.7	862,064	7.8	922,148	7.7	1,036,498	8.0
Wholesale Trade	499,379	6.6	527,097	6.0	609,605	5.9	693,024	6.3	793,782	6.7	895,108	6.9
Retail Trade	905,858	11.9	1,035,135	11.8	1,191,469	11.7	1,285,678	11.6	1,346,785	11.3	1,539,841	11.8
Finance, Insurance, & Real Estate	434,448	5.7	514,399	5.9	582,473	5.7	583,591	5.3	611,371	5.2	695,071	5.3
Services	1,168,568	15.4	1,337,306	15.3	1,554,057	15.2	1,717,363	15.5	1,967,040	16.6	2,178,794	16.7
Government & Government Enterprises	1,743,927	22.9	1,944,879	22.3	2,174,619	21.4	2,382,713	21.5	2,664,741	22.5	2,910,073	22.3
Federal, Civilian	502,931	6.6	542,505	6.2	583,953	5.7	647,021	5.8	717,180	6.0	761,712	5.8
Federal, Military	346,881	4.6	411,253	4.7	463,995	4.5	477,565	4.3	471,688	4.0	488,333	3.7
State and Local	894,115	11.8	991,121	11.3	1,126,671	11.0	1,258,127	11.5	1,475,873	12.4	1,660,028	12.7

Source: Local Area Personal Income, Vol. 7, Southwest Region, August, 1978, U.S. Department of Commerce, Department of Economic Analysis.

Per capita income for Adams County has been rising steadily since 1971, as can be seen in Table 5.8.14. In 1971, per capita income for the county was $4,084 compared with $4,167 for the State. This upward trend continues to 1976 with the county surpassing State per capita income(12).

TABLE 5.8.14

ADAMS COUNTY PER CAPITA INCOME(12)

Year	County	% Change	State	% Change
1971	$ 4,084		$ 4,167	
1972	4,425	8.3	4,540	8.9
1973	4,884	10.4	5,046	11.1
1974	5,391	10.4	5,495	8.9
1975	5,894	9.3	5,938	8.1
1976	6,468	9.7	6,440	8.4

Household income distribution is another good indicator of the economic condition of an area. These figures for Adams County indicate a stable economy with a large middle class income range (see Table 5.8.15). Of the five counties listed, Adams has the second highest median household income at $19,114. Arapahoe County is first at $19,783.

Effective buying income (EBI), average household EBI, retail sales, and the buying power index (BPI) are some other good indicators of the economic stability of an area. These are indirect measurements which can generally indicate the direction and intensity of an area's economic structure. Table 5.8.16 outlines the effective buying power, retail sales, and buying power index for Adams County for the years 1978 and 1980. Data for the State, Arapahoe and Jefferson Counties has also been included for purposes of comparison. These figures show slight increases for Adams County in all areas.

TABLE 5.8.15

1977 HOUSEHOLD INCOME DISTRIBUTION BY JURISDICTION

Counties	$0-4,000	4-8,000	8-12,000	12-16,000	16-20,000	20-28,000	28-36,000	$36,000+	TOTAL	MEDIAN
Adams	1,888	6,219	10,521	11,383	8,913	18,981	5,087	10,908	73,900	$19,114
Arapahoe	3,371	7,060	8,352	12,036	11,030	16,936	7,818	15,897	82,500	19,783
Boulder	5,557	8,284	9,053	12,846	9,764	12,794	3,261	6,451	68,010	15,460
Denver	19,640	36,860	26,052	34,669	33,324	42,407	2,004	10,189	205,145	14,310
Jefferson	2,516	7,593	12,823	20,943	18,580	29,534	7,840	15,471	115,300	18,866
Municipalities *										
Arvada	275	1,252	3,412	5,001	4,021	6,933	992	1,795	23,681	$17,890
Aurora	2,913	5,243	4,865	5,056	3,689	7,417	5,039	9,719	43,941	20,221
Northglenn	44	398	1,287	1,712	981	1,980	989	2,216	9,607	21,541
Thornton	158	814	1,498	1,513	803	1,655	1,020	2,353	9,814	20,585
Westminster	140	593	1,289	1,651	1,720	4,236	307	817	10,753	19,961
5-County Total	32,972	66,016	66,801	91,877	81,611	120,652	26,010	58,916	544,855	$16,724

* All municipalities are in Adams County

Sources:
1. 1970 Census of the Population.
2. 1976 National Planning Data Corporation Income Update.
3. 1975 Bureau of the Census Estimate for the State of Colorado.

TABLE 5.8.16

EFFECTIVE BUYING INCOME, RETAIL SALES, AND BUYING POWER INDEX, STATE OF COLORADO
ADAMS, ARAPAHOE, AND JEFFERSON COUNTIES

		EBI ($000)	% of U.S.	% of Change from 1978*	Average Household EBI	Retail Sales ($000)	% of U.S.	% Change from 1978*	Per Household Retail Sales ($)	Buying Power Index (BPI)
STATE	1978	17,673,704	1.2278		18,196	10,969,562	1.3419		11,294	1.2632
	1980	21,843,767	1.2647	2.5	21,177	13,300,822	1.3577	.6	12,895	1.2923
ADAMS	1978	1,390,572	.0966		19.314	871,839	.1066		12,109	.1013
	1980	1,711,399	.0911	2.1	22,459	1,069,244	.1091	1.8	14,032	.1037
ARAPAHOE	1978	1,741,150	.1209		20,581	1,291,174	.1580		15,262	.1304
	1980	2,150,009	.1245	1.8	22,560	1,597,628	.1630	2.7	16,764	.1357
JEFFERSON	1978	2,553,321	.1774		21,786	1,392,053	.1702		11,878	.1711
	1980	3,200,216	.1853	3.8	24,885	1,706,703	.1742	1.7	13,271	.1784

* Adjusted For Inflation

Source: Sales and Marketing Management Magazine, 1980 Survey of Buying Power Forecaster's Handbook, 1980.

5.8.5 Heritage and Cultural Resources

A cultural resources survey and assessment of the site was performed by archeologists from Heartfield, Price and Greene, Inc.(13). The survey was conducted to conform to all relevant Federal cultural resource legislation including PL 91-190 (NEPA of 1969), PL 89-665 (NHPA of 1966), and the Advisory Council's Procedures for the Protection of Historic and Cultural Properties, defined by 36 CFR 800 and Executive Order #11593.

5.8.5.1 Methodology

As illustrated in Figure 5.8.3, the western limit of the area surveyed was 1,000 feet west of the western boundary of sections 25 and 36, T3S, R57W. The eastern boundary was 1,000 feet west of the eastern boundary of Sections 25 and 36, T3S, R57W. The northern boundary was 1,000 feet south of the northern boundary of Section 25, and the southern boundary was 1,000 feet north of the southern boundary of Section 36.

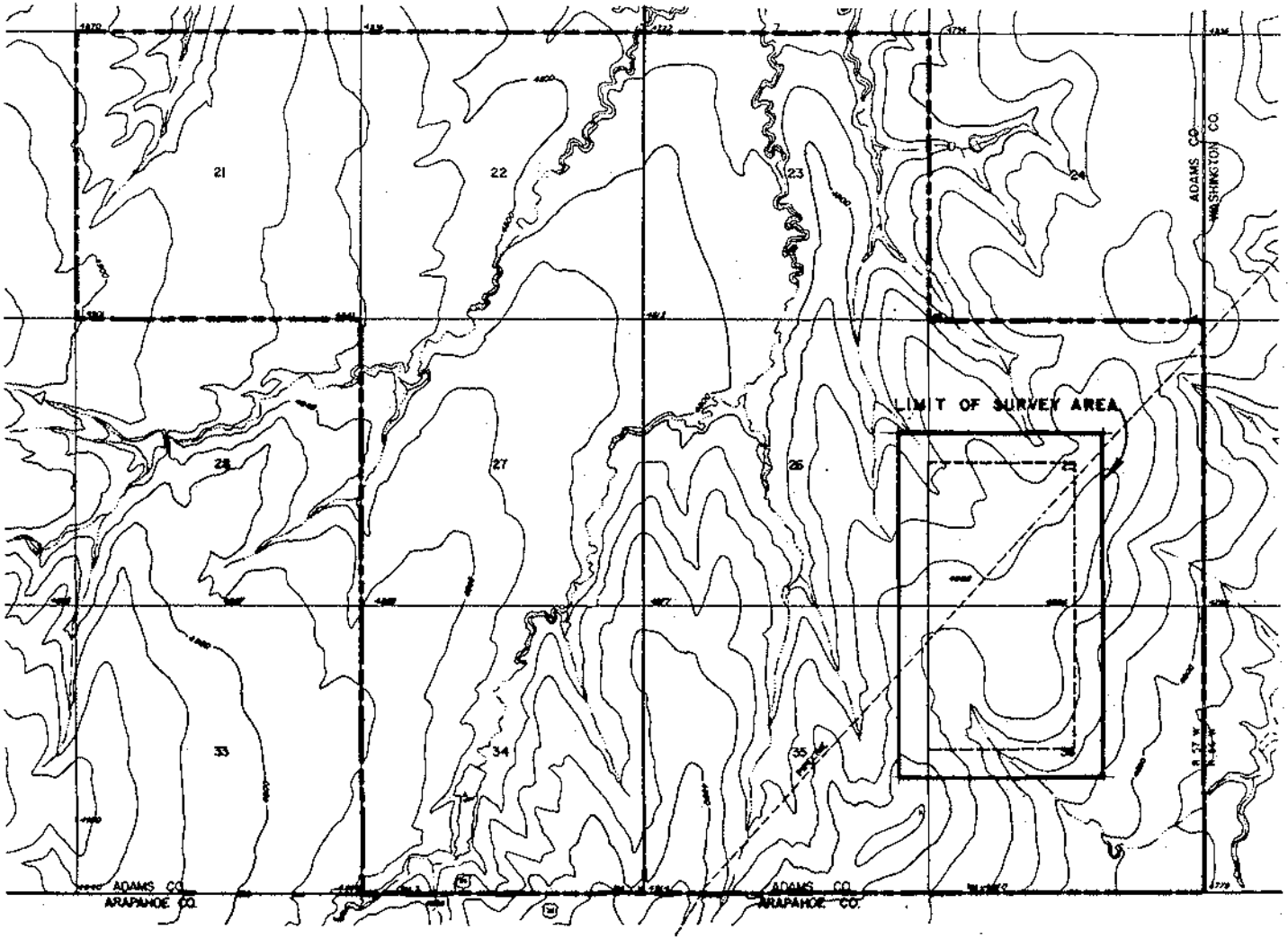
The archival/literature search and an on-the-ground survey were conducted, as summarized below.

5.8.5.1.1 Archival/Literature Search

The National Register of Historic Places and its supplements were checked for listed sites within the study area.

The Colorado Historical Society conducted a search of the Colorado Inventory of Cultural Resources for previously recorded sites within T3S, R57W, Sections 25 and 36 (Figure 5.8.4).

Personnel from Heartfield, Price and Greene, Inc. checked map files maintained by the Colorado Inventory of Cultural Resources for previously recorded sites on the Cottonwood Valley North, Last Chance Northwest, Shamrock Southeast, and Wetzel Creek USGS 7.5' quadrangle maps.



REFERENCE: U.S.G.S. QUAD. MAP

SCALE (FEET)

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

HERITAGE & CULTURAL RESOURCES SURVEY LIMITS

SHEET NO.
FIG. 5.8.3

FIGURE 5.8.4

Project No. HWS

Record of Use Files

CO	T	R	S
AD	3S	57W	25&36

COLORADO HISTORICAL SOCIETY

The Colorado Heritage Center 1300 Broadway Denver, Colorado 80203

Date Received 1/15/81

Date Responded 1/15/81

At your request this office has conducted a search of the Colorado Inventory of of Cultural Resources.

The result of this file search is indicated below:

[X] There are no documented cultural properties in the area of impact of the proposed undertaking.

[ ] Information regarding previously documented resources in these areas is attached. These resources have not been evaluated for inclusion in the National Register. However, they must be considered to be Eligible for inclusion in the National Register until a formal determination has been completed.

[ ] Information regarding cultural resources pending nomination to or on the National Register of Historic Places in the proposed project area is attached.

Our files contain incomplete information for this area as the vast majority of Colorado has not been inventoried. There is the possibility that as yet unidentified Cultural Resources exist within the proposed impact area.

Therefore, the federal agency is required to conduct a professional survey to Identify any Eligible Cultural Resources in the proposed project area.

We anticipate consultation with this office regarding the Effect of the proposed project on any Eligible resource in accordance with the Advisory Council Procedures for the Preservation and Protection of Historic and Cultural Resources (36 CFR 800).

Please provide this office with the results of the survey for our review of professional adequacy and compliance.

Arthur C. Townsend
State Historic Preservation Officer

Howard J. Pomerantz
Acting State Archaeologist

*Information regarding significant archaeological resources is excluded from the Freedom of Information Act. Therefore, legal locations of these resources must not be included for public distribution.

Form No. 011 rev 10/80
File Search Request

The Stephen H. Hart Library of the Colorado Heritage Society, Denver, was checked for early maps and historical background information. The University of Colorado Library in Boulder was checked for pertinent historical and environmental data.

The Adams County Clerk of Court and Tax Assessor were consulted for information on early landowners and maps for the area. The Adams County Historical Society provided important historical information on the early history and land development of the area.

Finally, Quest Consulting provided information concerning conveyance records, early maps of Adams County, and provided a USDA Soil Survey for Adams County.

5.8.5.1.2 On-the-Ground Survey

Prior to conducting the on-the-ground survey, an archeological permit (#81-5, Figure 5.8.5) was obtained by the principal investigator from the Colorado Historical Society. The intensive, on-the-ground survey of 100% of the study area was conducted on January 18, 19, and 20, 1981 by a crew of two archeologists, the principal investigator, and his assistant.

The area was surveyed in a series of contiguous transects, approximately 100 meters wide and oriented east-west, until the total area had been surveyed. Transects were set up and maintained using a compass and 7.5' USGS topographic quads. Within each transect, the two surveyors, spaced approximately 40 meters apart, walked a zig-zag path from one end to the other.

Subsurface shovel testing was conducted approximately every 100 meters along the transects. Dimensions for the shovel tests were approximately

FIGURE 5.8.5

NO. 81-5

OFFICE OF THE STATE ARCHEOLOGIST

ARCHAEOLOGICAL PERMIT

Issued under the authority of the Colorado Historical, Prehistorical, and Archaeological Resources Act, CRS 1973 24-80-401 et seq, and under the procedures of the State Administrative Procedure Act, CRS 1973 24-4-101 et seq.

THIS IS TO CERTIFY that: Richard Hurt
(Name)

of: 301 Bres Suite C, Monroe, LA 71201
(Address)

representing: Heartfield, Price, and Greene, Inc.
(Institution)

has been found to be a qualified applicant for the conduct of Archaeological studies and is hereby authorized to conduct archaeological investigations as described below, subject to (a) the terms and conditions listed below and (b) in the Permit Description published by the Office of the State Archaeologist.

Nature of investigations and location: Reconnaissance and non-collecting, intensive surface survey of ca. 1000 contiguous acres within Sections 25, 26, 35, and 36 of Township 3 South, Range 57 West as illustrated on the appended U.S.G.S. 7.5 minute Quadrangles of Last Chance N.W. and Wetzel Creek.

Disposition of materials collected (subject, however, to such reservation as the State Archaeologist may impose under CRS 1973 24-80-406d): This permit stipulates that there will be no removal of material: either social, biological, paleonotological or geological.

Other Conditions: The right to access and permission to proceed are at the sole discretion of the private property owner working in concert with the project agent. A preliminary status report and copies of the site forms are required 1 week subsequent to the termination of the permit, with a final report to follow no later than 6 months after the termination of the permit.

Issued this 16 day of January, 19 81.
This Permit is valid for the Project term: 16 January, 1981 to February 15, 1981.

NOTE: You should have this Permit in your immediate possession, for inspection, in the event you are challenged.

State Archaeologist of Colorado

0.5 x 0.5 meters and varied in depth from 0.4 to 0.6 meters below the surface. This was done in order to assess the depth of the plow zone and to determine the presence or absence of cultural remains.

Vertical exposures, present from recent construction activities, were shovel cleaned and inspected for cultural remains. Similarly, backdirt from recent apparent bore holes was examined for evidence of buried cultural remains.

5.8.5.2 Summary

It has been documented that Native Americans occupied northeastern Colorado as early as 12,000 years ago. A number of prehistoric sequences are represented in northeastern Colorado which provide evidences of the presence and cultural traditions of the people who lived there. Among these sequences were the Paleo-Indian Tradition (ca 10000-5500 BC), Archaic (5500 BC-0 BC), and Plains Woodland (0 AD-1750 AD).

Prior to the settlement of Euro-Americans in eastern Colorado, the area was occupied periodically by various historic native American tribes, including the Utes, Apache, Comanche, Cheyenne, Arapahoe, Kiowa-Apache, and Kiowa. These native Americans had a subsistence base of hunting game, principally bison, supplemented by incipient agriculture. Most of these people lived in semipermanent villages.

Euro-American settlement of eastern Colorado began in the 18th century. The area was settled by waves of trappers, traders, and explorers in the 18th and 19th centuries. These were followed by gold seekers in the mid-19th century and later by cattlemen and pioneer farmers. The South Platte River Valley was extensively utilized as a passage to the west.

By the end of the mid-19th century, Colorado was established as a leading ranching state. Ranching has remained important in eastern Adams County, but dry land farming has also become important since its inception here in the early 20th century.

5.8.5.3 Conclusions

The archival/literature review covering the study area (Figure 5.8.3) revealed no previously recorded cultural resource sites. This review included a search of the National Register of Historic Places, a computer search carried out by the Colorado Historical Society, and a search of USGS 7.5' quadrangle maps of cultural resource sites which are maintained by the Colorado Historical Society.

The on-the-ground survey of cultural features revealed no culturally significant resource sites.

5.8.6 References

1. Hansen, Wallace, et. al., Climatography of the Front Range Urban Corridor and Vicinity, Colorado, USGA, Geological Survey Professional Paper 1019, 1978.

2. Sampson, J. and Baker, T., Soil Survey of Adams County Colorado, USDA Soil Conservation Service, 1974.

3. Hynes, J. and Sutton, C., Hazardous Wastes in Colorado, Colorado Geological Survey and Colorado Department of Health, Denver, Colorado, 1980.

4. Todd, D. K., The Water Encyclopedia - A Compendium of Useful Information on Natural Resources, Water Information Center (1970).

5. Budde, L., District Wildlife Manager, Colorado Division of Wildlife, Brush, Colorado; Personal Communication, Feb. 13, 1981.

6. Torres, J., et. al., Essential Habitat for Threatened or Endangered Wildlife in Colorado, Colorado Division of Wildlife, Denver, Colorado, January, 1978.

7. Snow, C., Habitat Management Series for Endangered Species, BLM Technical Note, Report No. 2 Black-footed Ferret, Musteal Nigripes, Nov. 27, 1972.

8. 1970 Census of the Population, Characteristics of the Population, Colorado, Vol. 1.

9. Denver Regional Council of Governments, Denver, Colorado, 1981.

10. Adams County Comprehensive Plan, 1975, Adams County Planning Commission.

11. 1978 Census of Agriculture, Bureau of the Census.

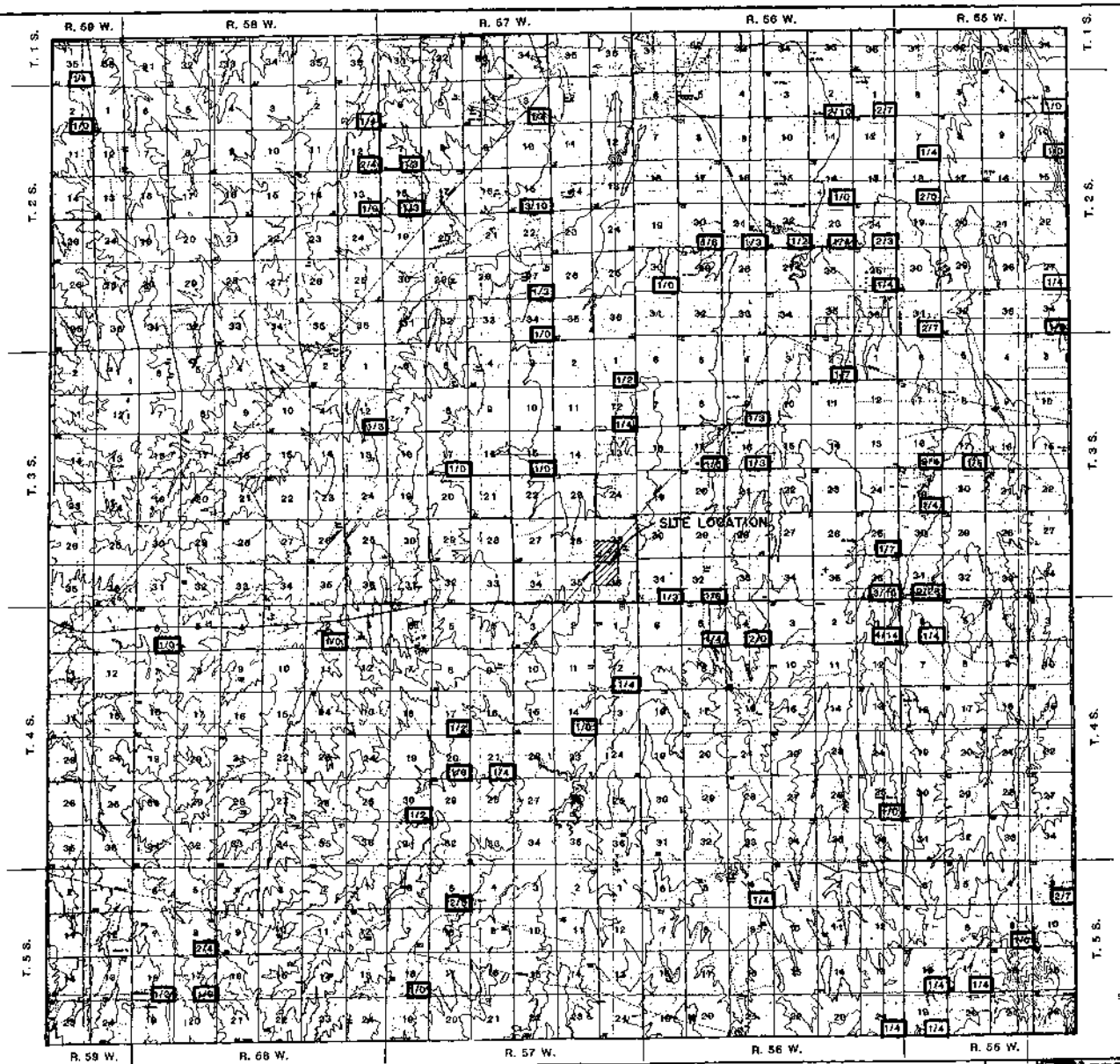
12. Local Area Personal Income, Vol. 7, Southwest Region, August, 1978, U.S. Dept. of Commerce, Dept. of Economic Analysis.

13. Heartfield, Price and Greene, Inc., "A Cultural Resources Survey and Assessment of the Location of a Proposed Hazardous Waste Facility, Adams County, Colorado," Report No. 1981-VI, February, 1981.

14. Adams County, Colorado Zoning Regulations, 1980.

15. "East End Development Plan," Board of County Commissioners, Adams County, Colorado (October 27, 1977).

16. Adams County Waste Management Plan, Adams County Planning Commission (August, 1982).



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JOB NO.
DATE

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

HOUSING UNITS & POPULATION COUNT WITHIN A TEN MILE RADIUS OF SITE

SHEET NO.
FIG. 5.8.2
OF

CHAPTER 6

DESCRIPTION OF THE FACILITY

6.1 INTRODUCTION

The design and operation of the treatment/solidification and disposal facility will protect the environment by incorporating the following features:

- o treatment of certain wastes prior to solidification so as to essentially preclude the potential for leaching;
- o solidification of all liquid and semi-solid wastes to physically immobilize potential contaminants;
- o disposal of the solidified product in secure disposal cells to prevent contamination of shallow groundwater;
- o collection and treatment of disposal cell leachate, in the unlikely event that leachate should form, to further prevent contamination of groundwater;
- o a high level of additional protection provided by the natural subsurface geological and hydrogeological conditions at the site;
- o positive control of rainfall run-on and runoff to protect surface waters;
- o an extensive monitoring program to ensure the facility has no adverse environmental effects;
- o a contingency plan to ensure effective remedial action in the event of any emergency.

The purpose of this chapter is to provide a detailed description of the functions, layout, and design of the treatment/solidification and disposal operations and related facilities. The operational controls, monitoring program, and contingency plans are described in Chapter 7.

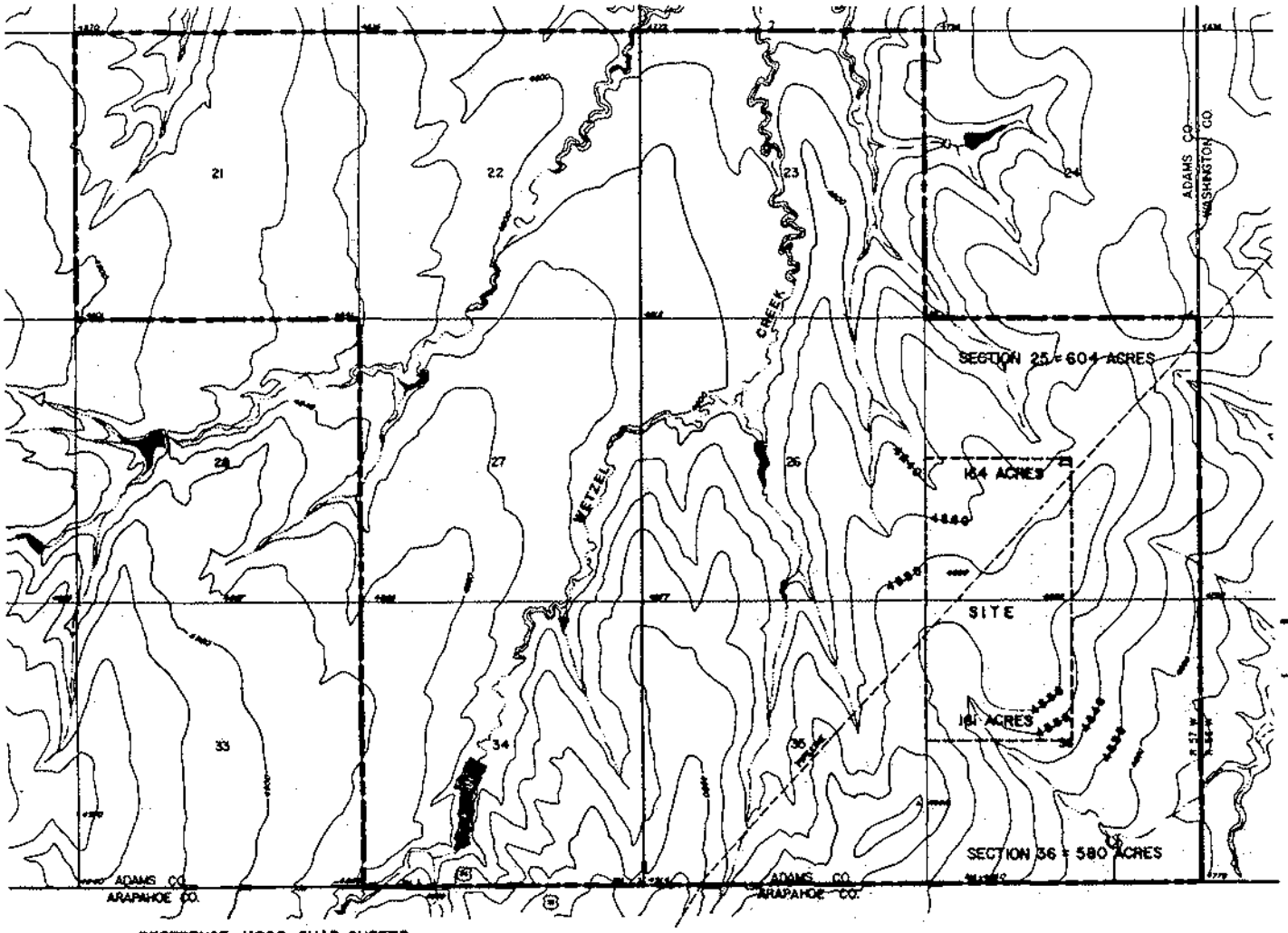
Alternate facility locations within the nine sections of property were evaluated by considering the following factors:

- o topography and surface drainage;
- o site access;
- o location of existing structures and utilities;
- o acreage required for the site.

In addition to the above, it was assumed that for ease of operation the processing facilities and secure disposal cells should be integrated at a single location. To meet these considerations, 325 acres within Sections 25 and 36 were selected as illustrated in Figure 6.1.1. These two quarter sections are herein referred to as the "site."

Facility operation has been planned in two phases, as discussed in Chapter 1. For Phase I operations, treatment/solidification will be conducted in clay-lined earthen cells. The treatment/solidification operation for the Phase II facilities (which will be completed while the Phase I system is in operation) will employ concrete tanks totally enclosed in a building. For both operational phases, the solidified product will be buried in secure disposal cells.

The Phase I operations serve as short-term, intermediate facilities until the Phase II facilities can be constructed. It is anticipated that Phase II construction can be completed within 24 months after start-up of Phase I. Construction specifications for the Phase II facilities should be completed and available for review approximately four months after BFI receives a Certificate of Designation. The Phase I facilities are expected to be operational within only a few months after final approval of the project by federal, state, and local agencies. The Phase I facilities will serve an immediate need for the State of Colorado and its hazardous waste generators. At the present time, there are <u>no</u> other hazardous waste disposal sites in the state. Hazardous waste that is



REFERENCE · USGS QUAD SHEETS

LEGEND

HIGHWAY 36 LAND DEVELOPMENT COMPANY PROPERTY LINE

BOUNDARY OF TREATMENT, SOLIDIFICATION AND DISPOSAL AREA (i.e., the "SITE")

CONTOUR INTERVAL = 20'

SCALE (FEET)

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DATE 10 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

SITE LOCATION

SHEET NO. FIG 8.1.1

generated within the state must be either stored/treated by the generator or hauled out of the state. The Phase I facilities, upon approval, can relieve almost immediately the burden of storage and long distance hauling of these hazardous wastes and at the same time provide an environmentally sound and economical method of disposal.

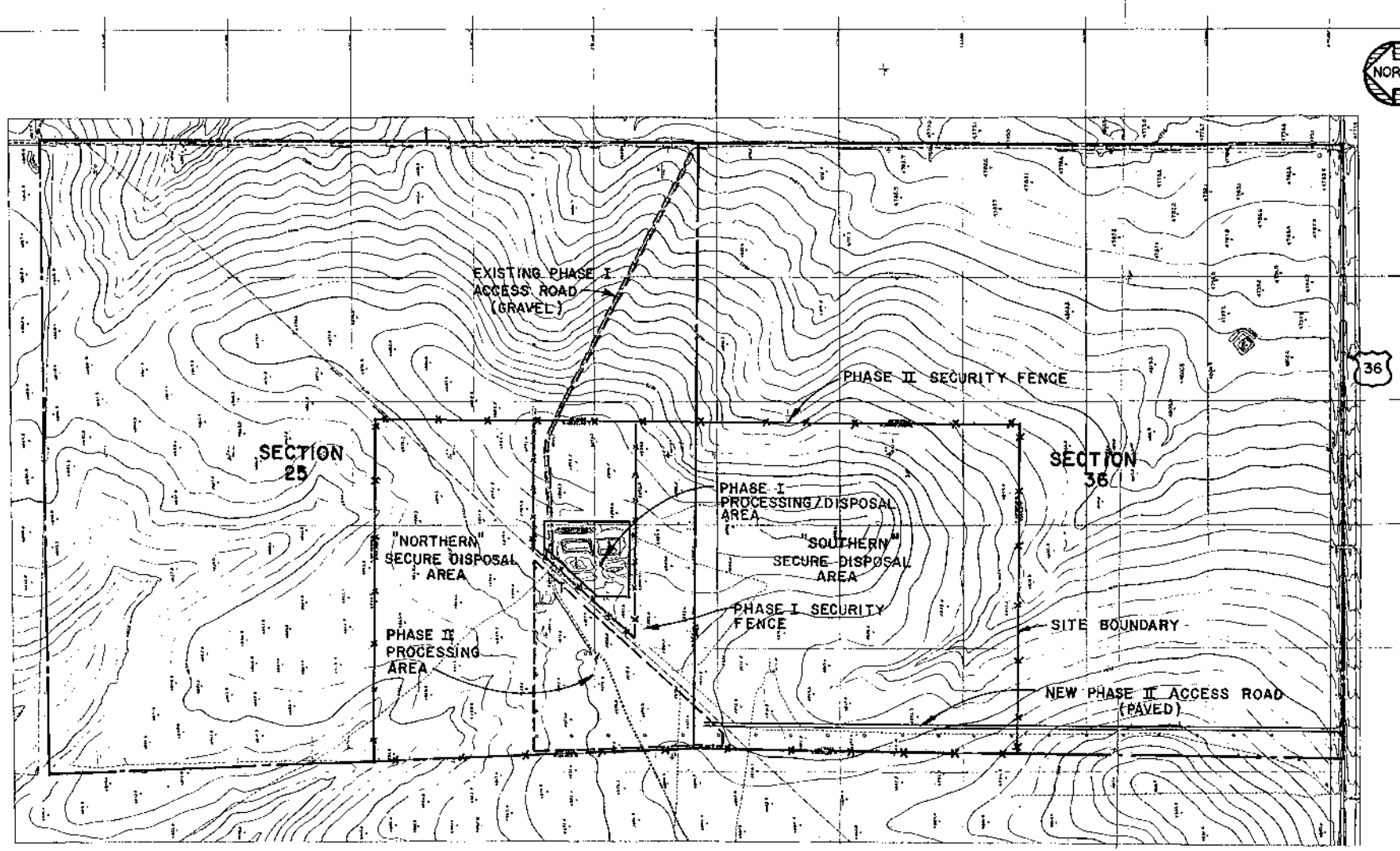
6.2 DESIGN CONSIDERATIONS AND PROCEDURES

6.2.1 Relative Location of Phase I & Phase II Processing Areas

In order to implement the facility plan, it is desirable that the location of the Phase II processing area be separate from the Phase I processing area so that construction of the Phase II facilities can take place without interrupting or interfering with the Phase I operations. The Phase I facility is located so as to take advantage of the existing on-site access road on the eastern side of the site, as illustrated in Figure 6.2.1. The Phase II facilities will be constructed on the western side of the site and will be served by a new, all-weather access road. These are also illustrated in Figure 6.2.1. The particular location for the Phase II facilities was selected because of its easy access from Highway 36, its location relative to existing power lines, and efficiency of space utilization. Further, this location serves to simplify overall control of surface water run-on/runoff and development of the secure disposal cells.

6.2.2 Placement of Overburden

After the general location and space requirements for the Phase I and Phase II processing facilities had been determined, the layout and number of secure disposal cells were estimated. It was found that the equivalent of about 40 standard sized cells (600 feet long, 300 feet wide, 30



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0 800 1600

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HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB

ARCHITECTS ENGINEERS PLANNERS

JOB NO.

DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF PHASE I & PHASE II PROCESSING AREAS

SHEET NO.

FIG. 6.2.1

OF

feet deep, with 2:1 wall slope) could be located on the remaining site area. Because the volume of overburden (i.e., excess excavated material) is significant, computer assisted studies were performed to determine the optimal placement of the overburden. Given that each secure disposal cell would yield a maximum of about 67,100 cubic yards of excess overburden (see Table 6.5.1 presented subsequently in Section 6.5.2), the maximum total quantity of overburden ultimately to be distributed is about 2,700,000 cubic yards. The primary considerations employed for developing the overburden distribution plan were as follows:

- Overburden should be distributed so as to produce a final site topography consistent with the original and surrounding landscape.
- Overburden to be used for cell construction or cover material should be temporarily stored at several locations close to the secure cell so as to minimize haul distance.
- Overburden not to be used for cell construction or cover material would be placed outside of the active disposal area.
- Overburden would not be placed in those areas designated for the processing facilities including the secure cell sites and main access roads.
- Overburden would be placed in such a manner as to minimize erosion rates.

The results of the study are presented in Figure 6.2.2 which shows that the 2,700,000 cubic yards of overburden would be distributed in the four general areas indicated by the dashed lines. The resultant topography within those areas is also indicated. It is to be emphasized that the overburden will be moistened and compacted upon placement. The top three feet of placed overburden is to be compacted to 85% of Modified Proctor Density for erosion protection. Further, these areas will be revegatated during the course of facility operation to aid in erosion control and

prevent the growth of weeds. If the placement of overburden covers any monitoring wells, the well casings will be extended vertically to maintain the use of the wells.

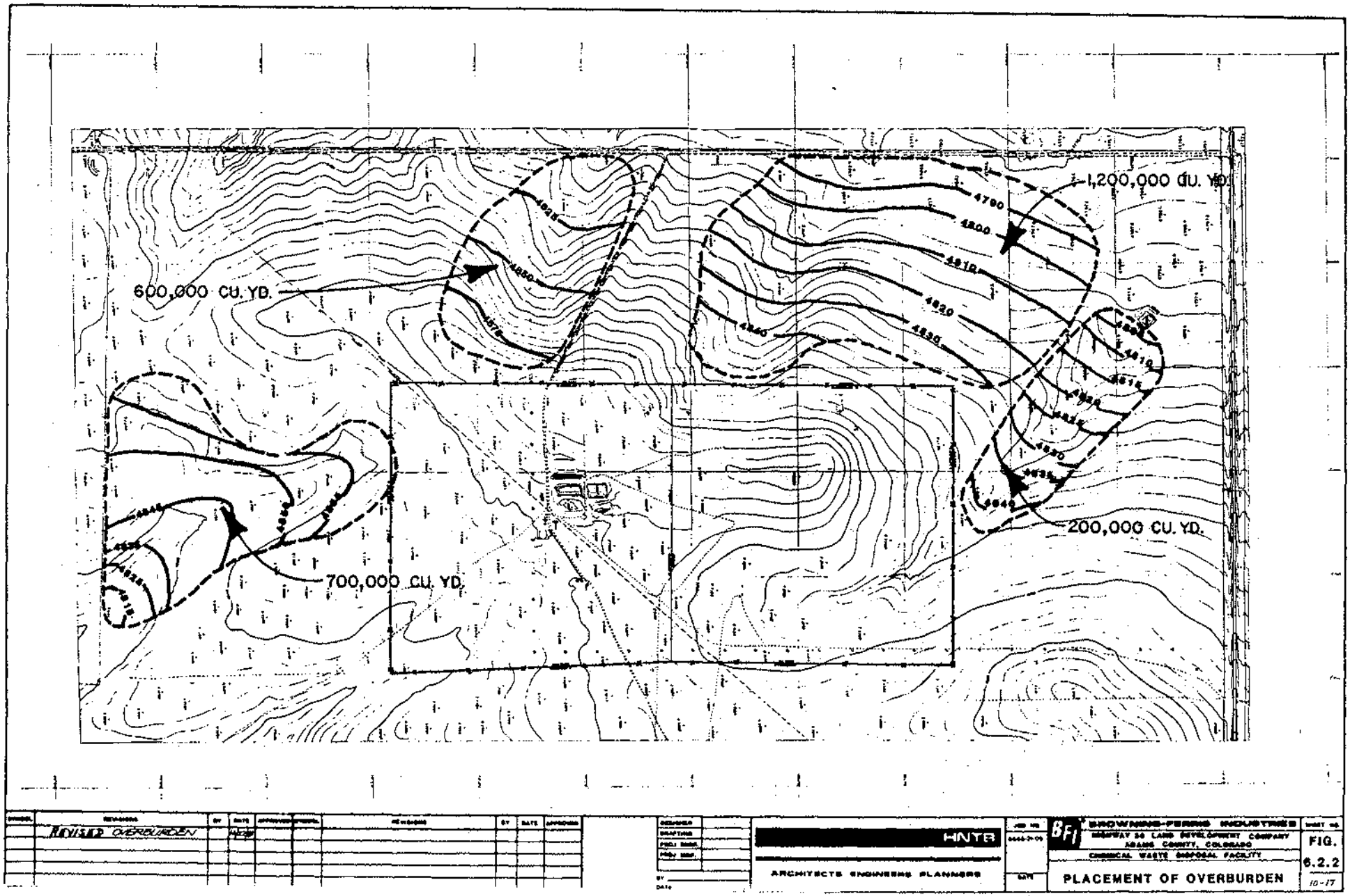
Figure 6.2.2 is of particular importance because it illustrates the estimated final topography of the site after closure.

6.2.3 Control of Surface Drainage

Once the topography of the site after closure had been projected, provisions for berms to control rainfall run-off/run-on, fences to provide security, and non-contaminated surface water collection ponds for non-potable water uses were established.

As a part of the Phase I construction, a 3-foot high berm will be constructed around the active area to collect and convey all rainfall runoff to a contaminated water holding and evaporation pond, as illustrated in Figure 6.2.3. This pond was sized so as to be able to accommodate and evaporate the maximum runoff within the Phase I processing area resulting from a 100-year, 24-hour maximum rainfall event. The design of this pond is discussed in Section 6.6.1.

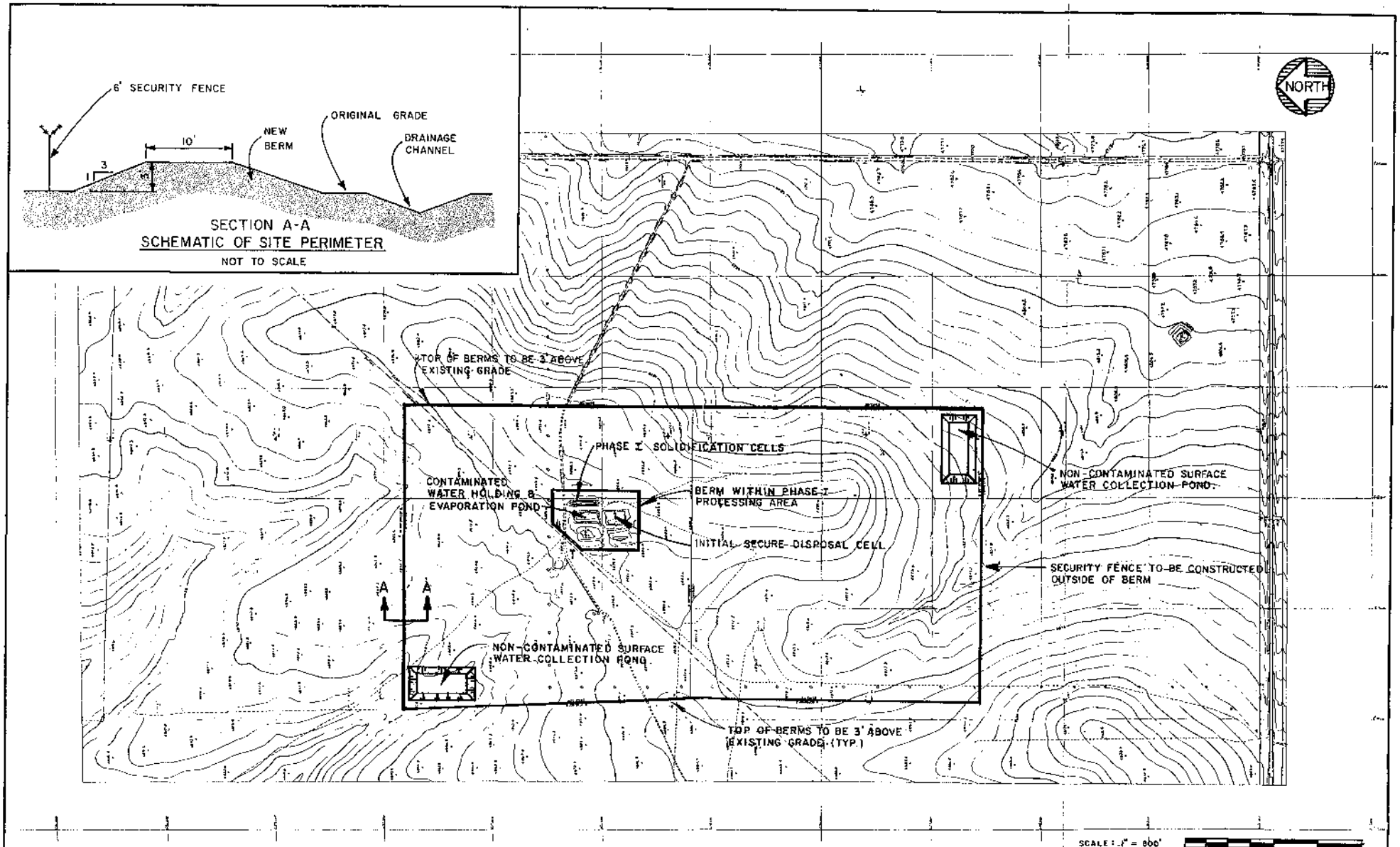
As a part of the Phase II construction, a berm will be constructed around the entire site (i.e., around the two quarter sections in Sections 25 and 36). The height of the berm will be a minimum of three feet. Additional berm height may be constructed in some areas where a deeper drainage channel is required for conveyance of drainage by gravity to one of the two ponds. These non-contaminated surface water run-off collection ponds will be constructed in both the northwest corner and southeast corner of the site (see Section 6.2.7.2). The surface dimensions of these ponds


1,200,000 CU. YD.
600,000 CU. YD.
700,000 CU. YD.
200,000 CU. YD.
4790
4800
4810
4820
4830
4840
REVISED OVERBURDEN
HNTB
ARCHITECTS ENGINEERS PLANNERS
BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
PLACEMENT OF OVERBURDEN
FIG.
6.2.2
10-17

will be the same as a standard sized secure disposal cell. The general layout of these surface drainage berms and collection ponds, illustrated in Figure 6.2.3, has the following advantages:

- Over the life of the site, the berm will eliminate surface water run-on to the site and runoff from the site.
- By constructing the berm on the perimeter of the active site, the placement of overburden becomes well-defined at the onset of facility operations.
- The berm serves to force on-site, non-contaminated runoff to collect in the two surface water impoundments so as to provide a source of non-potable water for site use.
- If on-site erosion occurs, it will be contained.
- In accordance with the environmental monitoring program (discussed in Chapter 7), the collection ponds provide a convenient means of monitoring the quality of surface water drainage.
- Upon closure of the site and the related collection ponds, the berms will be leveled and non-contaminated site drainage will runoff to the buffer zone and into the Beaver Creek drainage area, as occurred prior to site development.
- Upon closure of the northern or southern portions of the secure disposal cell areas, the respective surface water collection ponds will be excavated to the final depth to serve as the final secure disposal cell at that area.
- The required security fence can be permanently constructed outside of the berm, on the active site perimeter, so that it need not be periodically relocated or repositioned.

The top of the berms around the site will be approximately 10 feet wide to accommodate an accessway for complete site inspection, and the sides will be sloped at no more than 3 to 1 so that vegetation can be established. The soil removed by construction of the runoff diversion channels will be used to construct the berms and will be moistened and compacted upon placement.



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DATE 18 MAR 81

BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
GENERAL ARRANGEMENT OF BERMS & RUN-OFF COLLECTION FACILITIES

SHEET NO. 6.2.3 OF

6.2.4 Layout of Secure Disposal Cells

The optimum layout of the secure disposal cells is illustrated in Figure 6.2.4. These cells will be constructed on an "as needed" basis over the active lifetime of the facility. Experience at other facilities indicates that as a rule-of-thumb, no more than a 6 to 12 month disposal capacity need be available at any one time. The cells will be separated by about 50 feet on each side to provide an access road during use. As can be seen in Figure 6.2.4, none of the cells overlie any of the recorded abandoned oil wells, even though they do not impose any problem with respect to the secure disposal cell operations.

In general, the first cells to be used will be those closest to the solidification facilities. The last cells to be used will be those at the extreme southern or northern boundaries of the site. By confining the active cells to within a small local area, the problem of segregating potentially contaminated rainfall runoff from non-contaminated rainfall runoff is greatly simplified.

As a means of minimizing earth moving requirements, a portion of the material excavated during disposal cell construction will be temporarily placed near the cell for subsequent use as cover material and for construction of the liner in the new disposal cell. All overburden will be removed from an area designated for a new disposal cell prior to construction of that cell.

6.2.5 Site Capacity

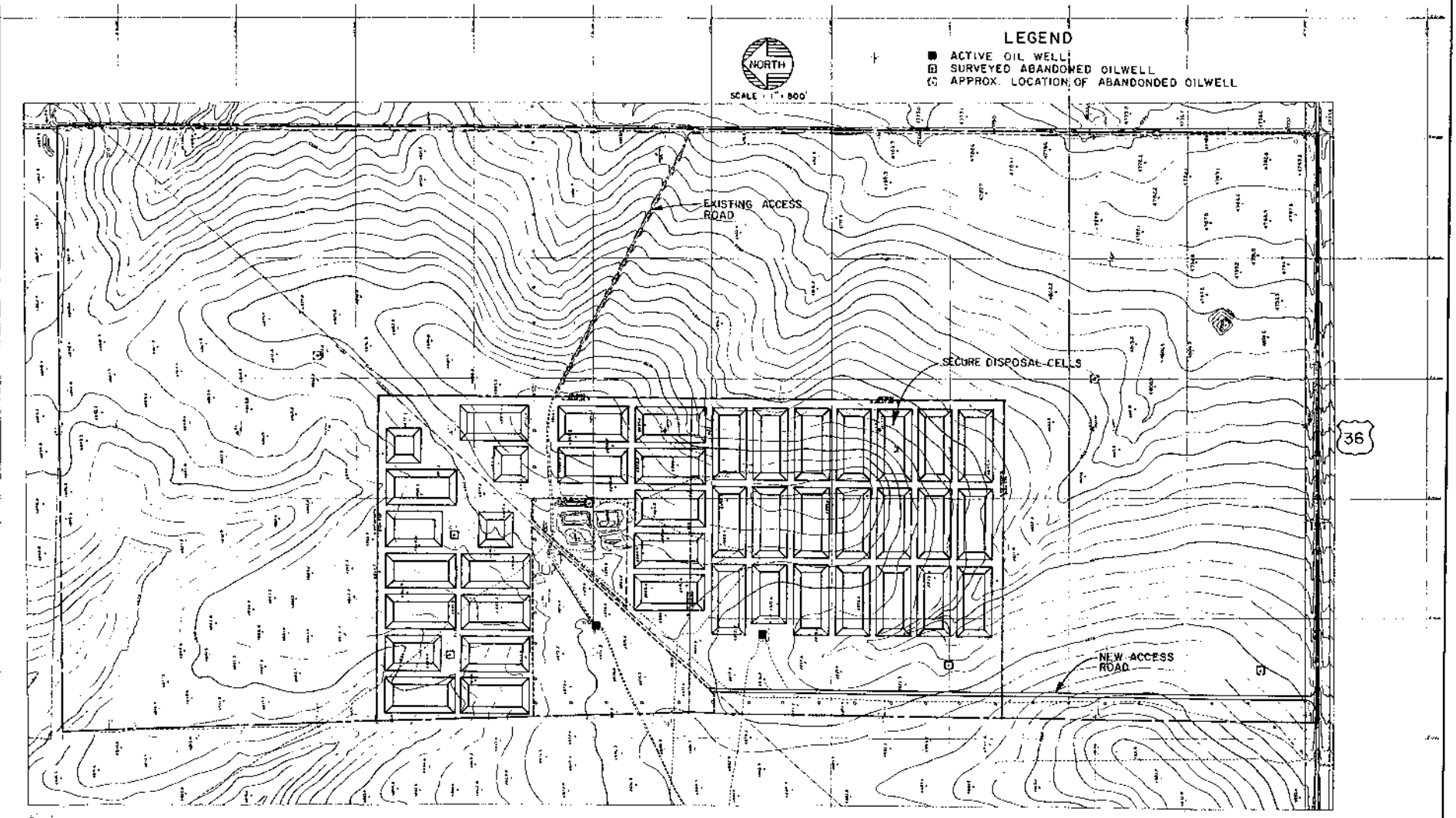
Although the initial secure disposal cell (located in Figure 6.2.3) will be about 230 feet long by 150 feet wide and 20 feet deep, the dimensions of subsequent cells will generally range from 300 to 600 feet long by 300

feet wide by 30 feet deep. A standard size cell is defined herein as one which is 600 feet long, 300 feet wide, and 30 feet deep with a 2:1 wall slope. The size of the cell will be adjusted to match the incoming waste load in accordance with the rule-of-thumb noted earlier. Other than the dimensions, the design of the initial and subsequent cells are the same.

As can be seen in Figure 6.2.4, the site can accommodate a total of 43 cells (including the initial Phase I cell) that have a total volume equivalent to approximately 40 of the standard sized cells. Taking into account the space occupied by intermediate cover and the cap, the usable volume of a standard cell is about 117,100 cubic yards. Thus, the capacity of the site is about 4,700,000 cubic yards of solid and/or solidified wastes.

6.2.6 Active Lifetime of the Site

The active lifetime of the site, i.e., the length of time required to exhaust the total capacity of the secure disposal cells, is a function of the overall rate at which wastes are received. As was pointed out earlier, the Phase II treatment/solidification operations are designed to process between 10,000,000 and 12,000,000 gallons of waste material per year. The active lifetime of the site is also dependent on the relative proportions of specific waste types received. This is because the ratio of the resultant solidified product volume to the original waste volume differs depending on the type of solidification reagent required (e.g., cement kiln dust or fly ash) and whether the waste is a liquid, intermediate sludge, or solid material. Past BFI operating experience at similar facilities suggests that, on the average, the volume of solidified product is about twice that of the waste. Combining the selected



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	REVISE OIL WELL								

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DATE: 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LAYOUT OF SECURE DISPOSAL CELLS

SHEET NO. FIG 6.2.4 OF

long-term design peak processing rate of 12,000,000 gallons per year with the ratio of solidified product volume to waste volume, the long-term waste loading is equivalent to 119,000 cubic yards of solidified product per year. For this loading, the site life would be about 40 years (4,700,000 ÷ 119,000).

6.2.7 Water Requirements and Sources

6.2.7.1 Potable Water

As was indicated previously in the hydrogeological and base line water quality sections of this report, on-site sources of potable water are virtually non-existent. Consequently, potable water (for drinking, showers, eye wash, etc.) will be purchased and transported to the site by truck. Portable storage units will be utilized for the Phase I operations, whereas for the Phase II facility (when potable water demands will be larger), an above-ground enclosed water tank will be constructed.

The quantity of potable water needed was estimated on the basis of typical per capita requirements (35 gallons per person per shift) in conjunction with the number of personnel anticipated for the Phase I and Phase II operations.

It was estimated that for the Phase I operation, an average of about 700 gallons per day will be required; and for the Phase II operations, an average of about 1,200 gallons per day will be required. Based on a two-week supply, the size of the Phase II potable water storage tank will be about 17,000 gallons.

6.2.7.2 Non-Potable Water

The major requirements for non-potable water include the following:

- o preparation of secure disposal cell liners and caps;

- o truck washing facilities;
- o irrigation to establish vegetation;
- o fugitive dust control;
- o moisturizing overburden;
- o fire protection.

The estimated annual water requirements for the Phase I and Phase II operations are summarized in Table 6.2.1. The estimated water requirements for Phase I operations were based on a processing rate of 8,000,000 gallons per year, and the Phase II water requirements were based on a processing rate of 12,000,000 gallons per year. The assumptions used to determine the estimated water requirements are discussed in Section 6.2.7.2.1 for the Phase II operations. The same basic assumptions apply to Phase I operations.

TABLE 6.2.1

ESTIMATED ANNUAL NON-POTABLE WATER REQUIREMENTS

	Phase I (Gallons/Year)	Phase II (Gallons/Year)
Secure Disposal Cell Construction	770,000	1,130,000
Truck Washing	600,000	900,000
Irrigation to Establish Vegetation	600,000	1,020,000
Fugitive Dust Control	500,000	1,080,000
Moisturizing Overburden	500,000	540,000
Fire Protection*	260,000	1,090,000
TOTAL	2,970,000	4,670,000

*Fire protection requirements are not included in the total of annual non-potable water requirements. This requirement is not used every year but must be available in case of fire.

The non-potable water required during Phase I operations will be purchased and trucked to the site. At this time, it is anticipated that non-potable water demands during the Phase II operations will be supplied primarily from the on-site, non-contaminated surface water collection

ponds noted earlier. These ponds will be designed to store surface water runoff from the 325 acres comprising the site. No precipitation will be collected in the area surrounding the site. If the supply of non-potable water from these sources proves to be inadequate, either through operation of the priority system or due to the lack of sufficient precipitation, non-potable water will be purchased and trucked to the site from off-site sources or operations will be adjusted to reduce water demand during extreme dry periods. Because of the lack of water, no new water wells will be constructed on-site to supply water needs.

6.2.7.2.1 Estimated Rate of Use

The annual quantity of non-potable water required is primarily a function of the annual incoming raw waste load because it determines the rate at which secure disposal cells are constructed, the number of trucks washed, etc. At a Phase II waste loading of 12,000,000 gallons of raw waste per year, it is estimated that approximately 1,130,000 gallons will be required for construction of secure disposal cell liners and caps, and about 900,000 gallons will be required for the truck wash facilities. These are based on estimated water requirements of 11 gallons water per cubic yard of liner prepared, and 300 gallons per truck washed, respectively.

The estimated quantity of water required for revegetation is about 1,020,000 gallons per year, based on irrigations totalling five inches per acre. The annual amount estimated for fugitive dust control is 1,080,000 gallons. This is comprised of 400,000 gallons for the access road between the solidification building and the secure disposal cell; 400,000 gallons for the access road between a secure disposal cell and

irrigation within the site to further promote ground cover and evaporation, (3) spray irrigation around the site buffer zone, and (4) storing water in both collecton ponds so as to increase the evaporation rate.

6.2.8 Sanitary Sewage Treatment

During the Phase I level of operation, portable sanitary sewage collection units will be provided. The septage will be periodically transported to municipal wastewater treatment facilities.

For the Phase II facility, an extended aeration activated sludge treatment system will be constructed to provide secondary treatment of the sanitary sewage. The treated effluent (about 1,200 gallons per day) will then be utilized on-site to maintain ground cover. At an application rate of two inches per week, an area of about 6,000 square feet could be utilized. The resultant sludge generated will be dried on sand drying beds and then used either as a soil amendment to promote ground cover for site beautification or buried in the secure disposal cells. Prior to land application of the sludge, it will be analyzed by the BFI laboratory or a qualified outside laboratory to ensure that it is not a hazardous waste.

The above method of sanitary wastewater treatment and reuse was determined to be the most cost-effective wastewater management alternative. The concept of treatment and reuse of the sanitary wastewater as a potable water supply was discarded because it is not cost-effective.

6.3 GENERAL LAYOUT AND DESCRIPTION OF THE FACILITIES

6.3.1 Phase I

The general location and layout of the facilities for Phase I operations is presented in Figure 6.3.1 which shows the treatment/solidification cells, initial secure disposal cell, a drum storage area, and an evaporation pond for collecting rainfall runoff from within the bermed areas that could be contaminated. Trailers will be provided to accommodate an on-site laboratory, administrative operations, and employee lockers/ lunchroom. A guardhouse will also be provided and incorporated in the laboratory trailer.

The Phase I facilities will be reconstructed in accordance with the design criteria discussed in Section 6.6. All clay liners and leachate collection/detection systems will be inspected during installation. The liner installations in the mixing basins will be tested using field density testing equipment to determine if the clay liner meets the compaction specifications. Inspection and testing will be performed by F. M. Fox & Associates, Inc., who will certify that these liners were installed and compacted in conformance with the design and compaction requirements. Design concepts and criteria for these operations are subsequently discussed in Sections 6.4, 6.5, and 6.6.

Off-highway vehicular equipment will be essentially the same as that for the Phase II level of operation and will include one or more of each of the following: back-hoe, off-highway dump truck, bulldozer, front-end loader, earth scraper, road grader, water truck, and fork lift.

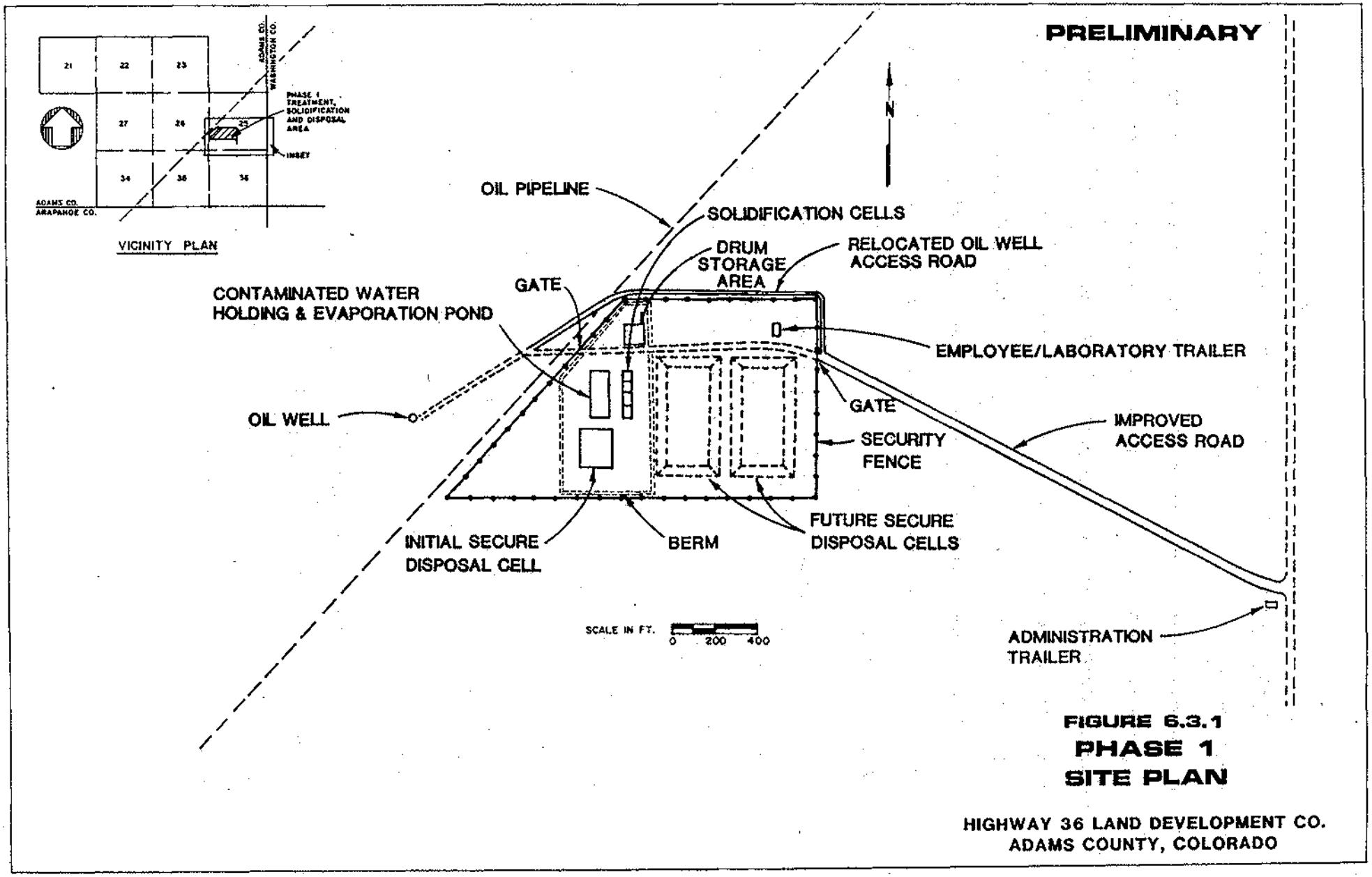


FIGURE 6.3.1
PHASE 1
SITE PLAN

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS COUNTY, COLORADO

6.3.2 Phase II

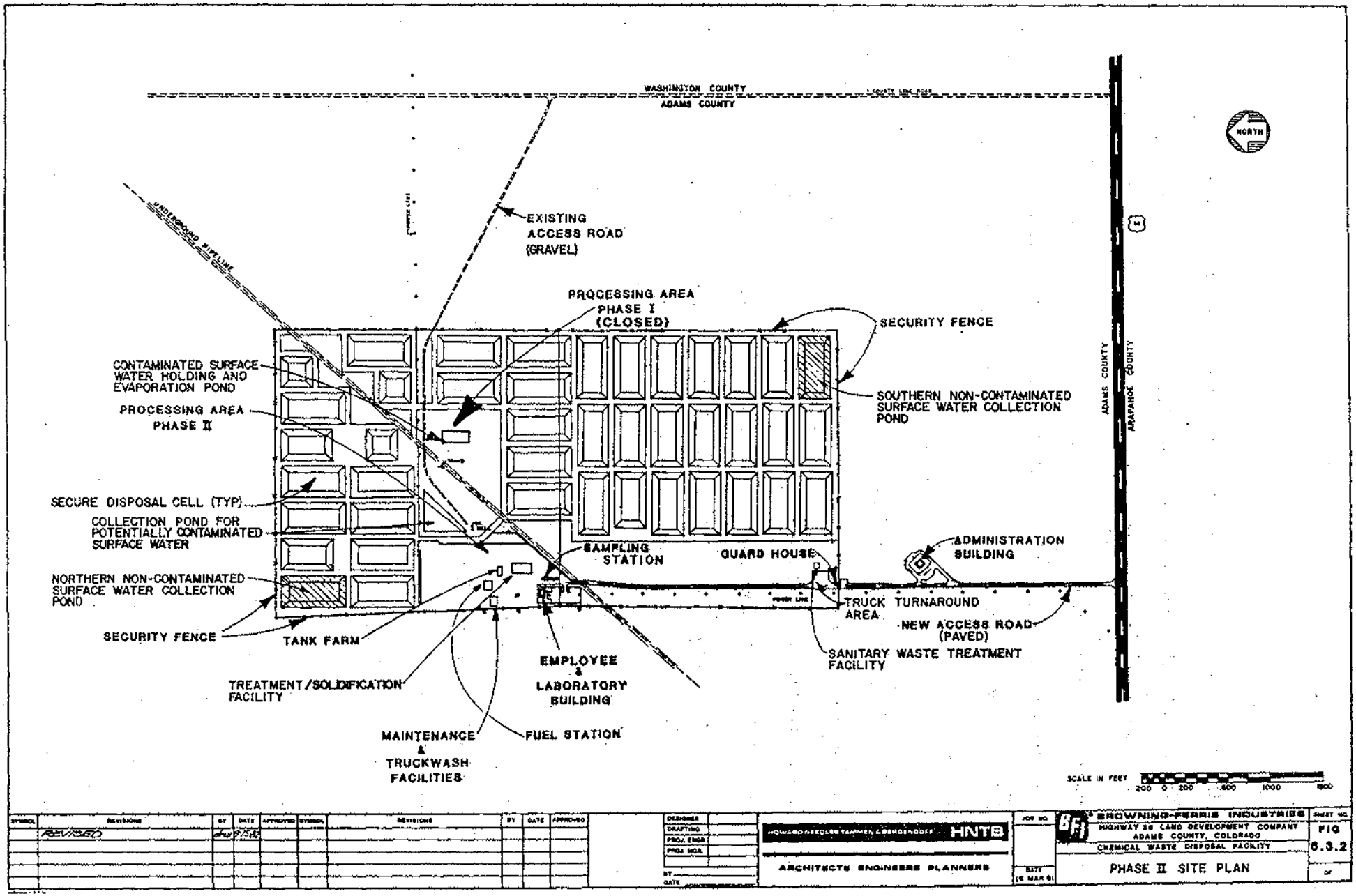
The site plan of the Phase II facilities is presented in Figure 6.3.2. These facilities are more advanced than any other existing BFI treatment/solidification and disposal facility. As will be discussed subsequently, a key feature of the complex is that wastes will be treated/solidified in a totally enclosed building. The major components of the Phase II processing facilities are detailed in Figures 6.3.3 through 6.3.8.

6.3.3 Access Road and Drainage

During Phase I, the main access to the site will be via the existing gravel roadway which is north from U.S. 36 approximately one mile on the Adams/Washington County Line. No alternative route will be constructed. However, if the existing route should become blocked, the terrain is such that emergency access may be obtained by driving off the road and around the blockage.

For Phase II operation, a new main access road will be constructed. This new main access road leading to the processing area will be constructed of asphalt on a granular base, or equivalent, and will be capable of handling the traffic intended. The Phase I access route will be maintained as an alternative access route during Phase II. Parking areas for off-site vehicles will also be paved for Phase II operation. Drainage for paved areas outside the active site will be to the adjacent buffer zone. The rain water runoff from the paved access road within the site will be drained to the non-contaminated surface water ponds.

The roads and facilities have been laid-out so as to permit orderly and efficient traffic patterns. The concept has been developed whereby the traffic patterns for transport vehicles and site vehicles are segregated.


WASHINGTON COUNTY
ADAMS COUNTY
NORTH
UNDERGROUND PIPELINE
EXISTING ACCESS ROAD (GRAVEL)
PROCESSING AREA PHASE I (CLOSED)
SECURITY FENCE
CONTAMINATED SURFACE WATER HOLDING AND EVAPORATION POND
PROCESSING AREA PHASE II
SOUTHERN NON-CONTAMINATED SURFACE WATER COLLECTION POND
ADAMS COUNTY
ARAPAHOE COUNTY
SECURE DISPOSAL CELL (TYP)
COLLECTION POND FOR POTENTIALLY CONTAMINATED SURFACE WATER
SAMPLING STATION
GUARD HOUSE
ADMINISTRATION BUILDING
NORTHERN NON-CONTAMINATED SURFACE WATER COLLECTION POND
TRUCK TURNAROUND AREA
NEW ACCESS ROAD (PAVED)
SECURITY FENCE
TANK FARM
SANITARY WASTE TREATMENT FACILITY
EMPLOYEE & LABORATORY BUILDING
TREATMENT/SOLIDIFICATION FACILITY
MAINTENANCE & TRUCKWASH FACILITIES
FUEL STATION
SCALE IN FEET
200 0 200 600 1000 1500
REVISED
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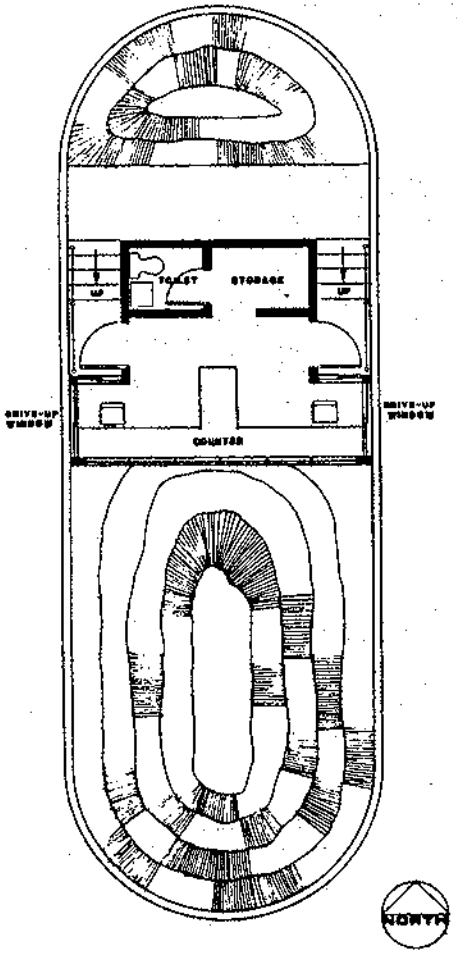
BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
PHASE II SITE PLAN
FIG 6.3.2

PRELIMINARY



GUARD HOUSE
FLOOR PLAN PHASE II

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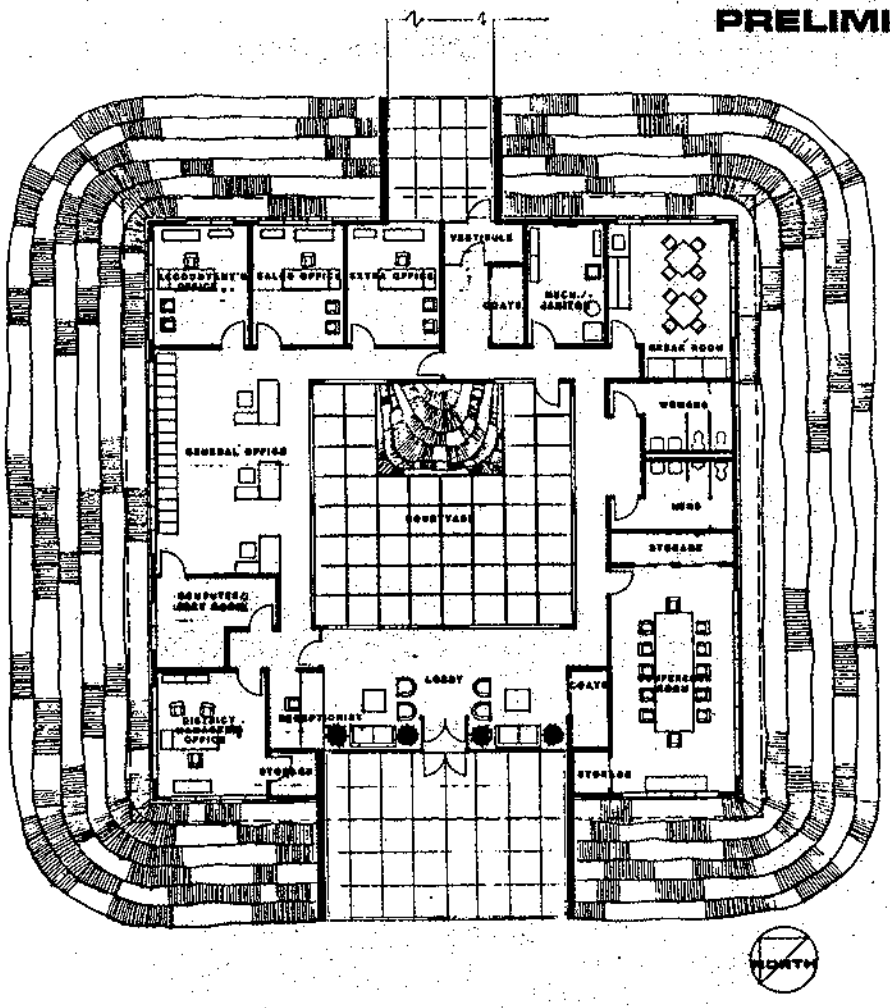

ADMINISTRATION BUILDING
FLOOR PLAN PHASE II

SCALE IN FT. 0 2 4 6 8

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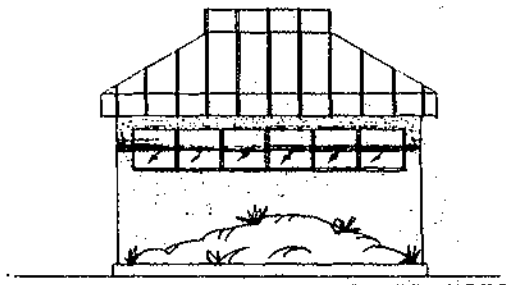
HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

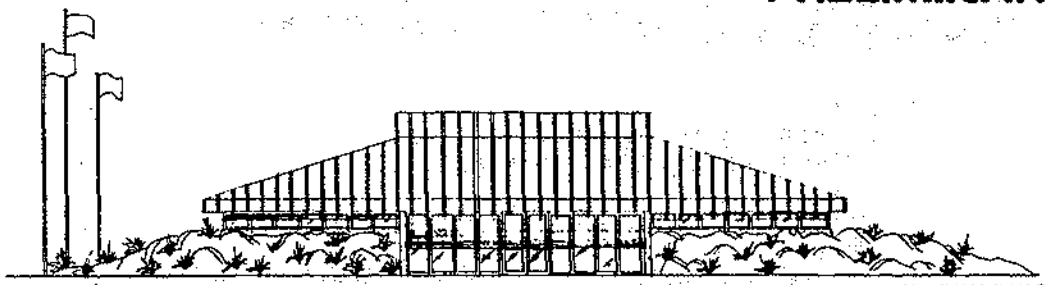
BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
ADMINISTRATION BLDG. & GUARD HOUSE
FLOOR PLANS

SHEET NO. FIG 6.3.3

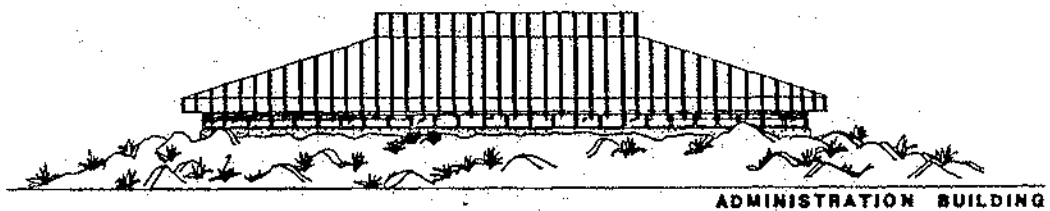
PRELIMINARY



GUARD HOUSE
SOUTH ELEVATION
PHASE II
SCALE IN FT. 0 1 2 4 6



ADMINISTRATION BUILDING
SOUTHWEST ELEVATION
PHASE II
SCALE IN FT. 0 2 4 8 12



ADMINISTRATION BUILDING
NORTHWEST ELEVATION
PHASE II
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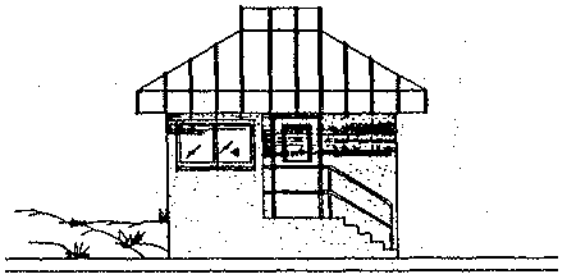

GUARD HOUSE
EAST ELEVATION
PHASE II
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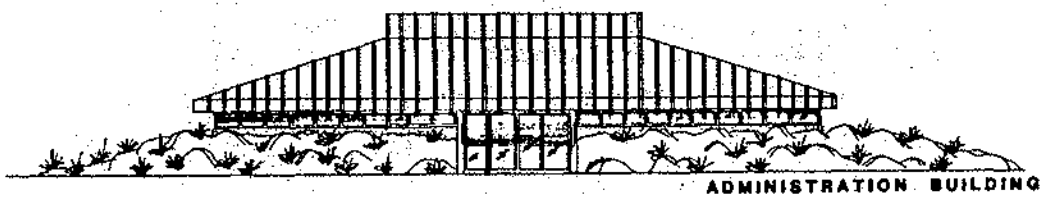


ADMINISTRATION BUILDING
NORTHEAST ELEVATION
PHASE II
SCALE IN FT. 0 2 4 8 12

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

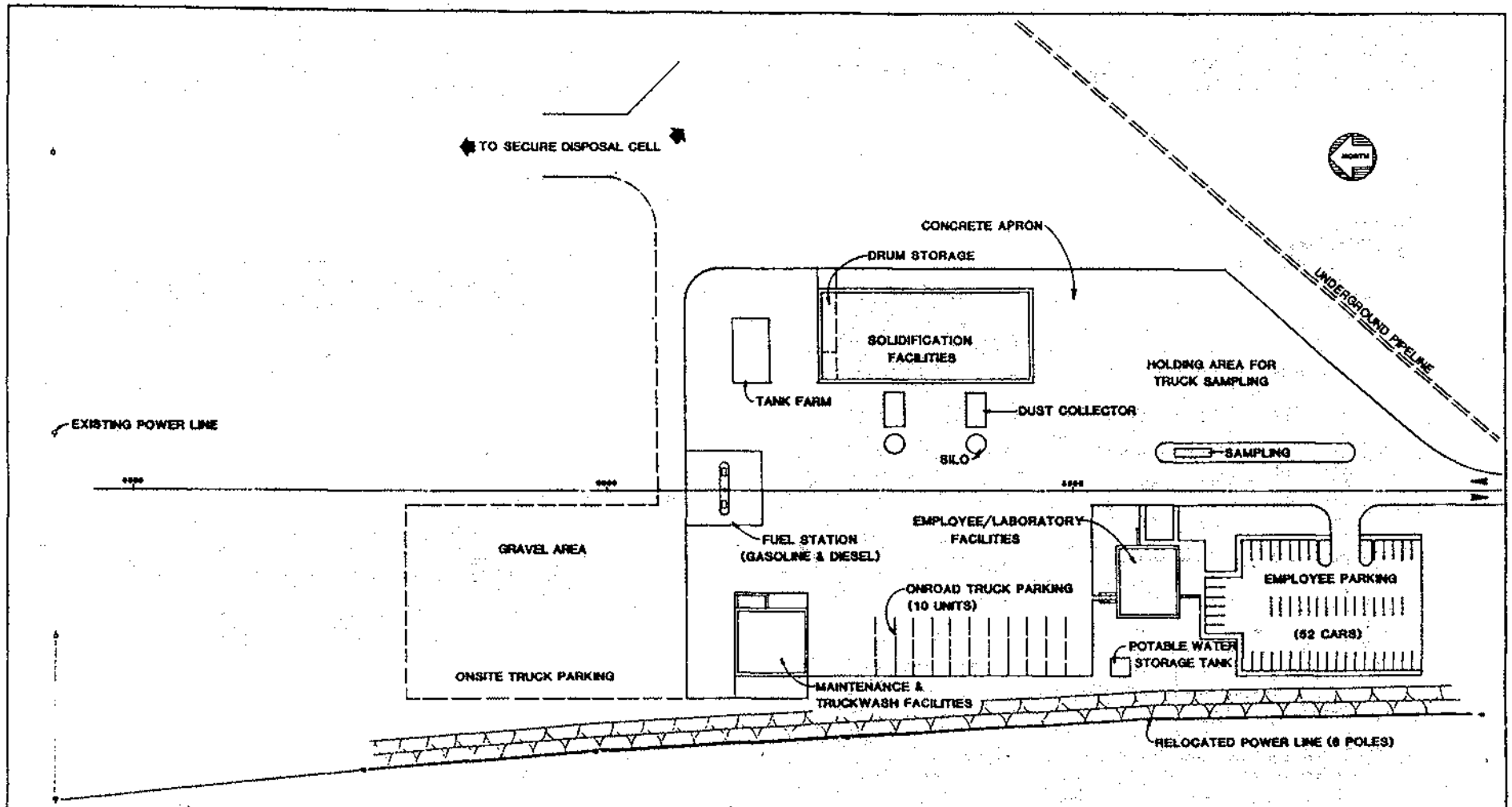
DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 15 MAR 81

BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
ADMINISTRATION BLDG. & GUARD HOUSE
ELEVATIONS

SHEET NO.
FIG 6.3.4
OF



PROCESSING AREA LAYOUT PLAN

PHASE II

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ ENGR
PROJ MGR
BY
DATE

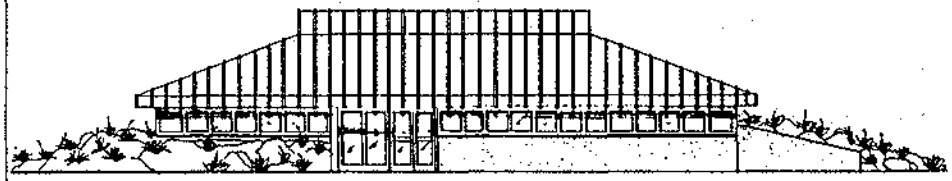
HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO. 4663-B-09
DATE

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
PROCESSING AREA LAYOUT PLAN

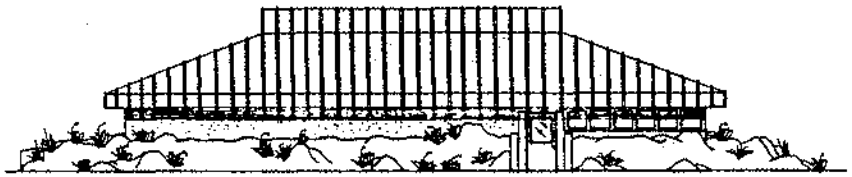
SHEET NO. FIG 6.3.5 OF

PRELIMINARY



SOUTH ELEVATION

SCALE IN FT. 0 2 4 8 12



NORTH ELEVATION

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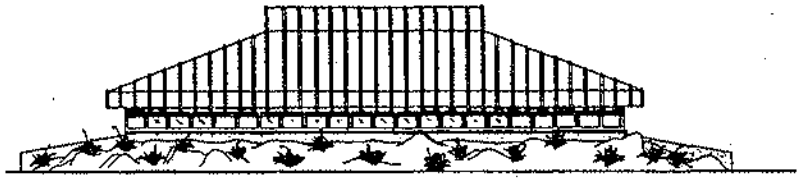
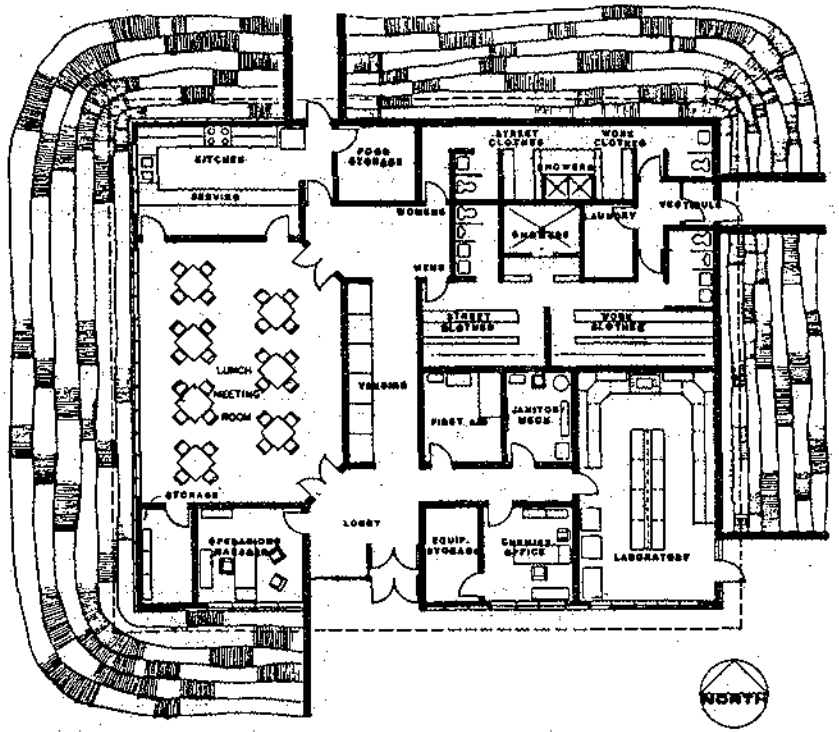


WEST ELEVATION

SCALE IN FT. 0 2 4 8 12



FLOOR PLAN
PHASE II

0 2 4 8 12

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

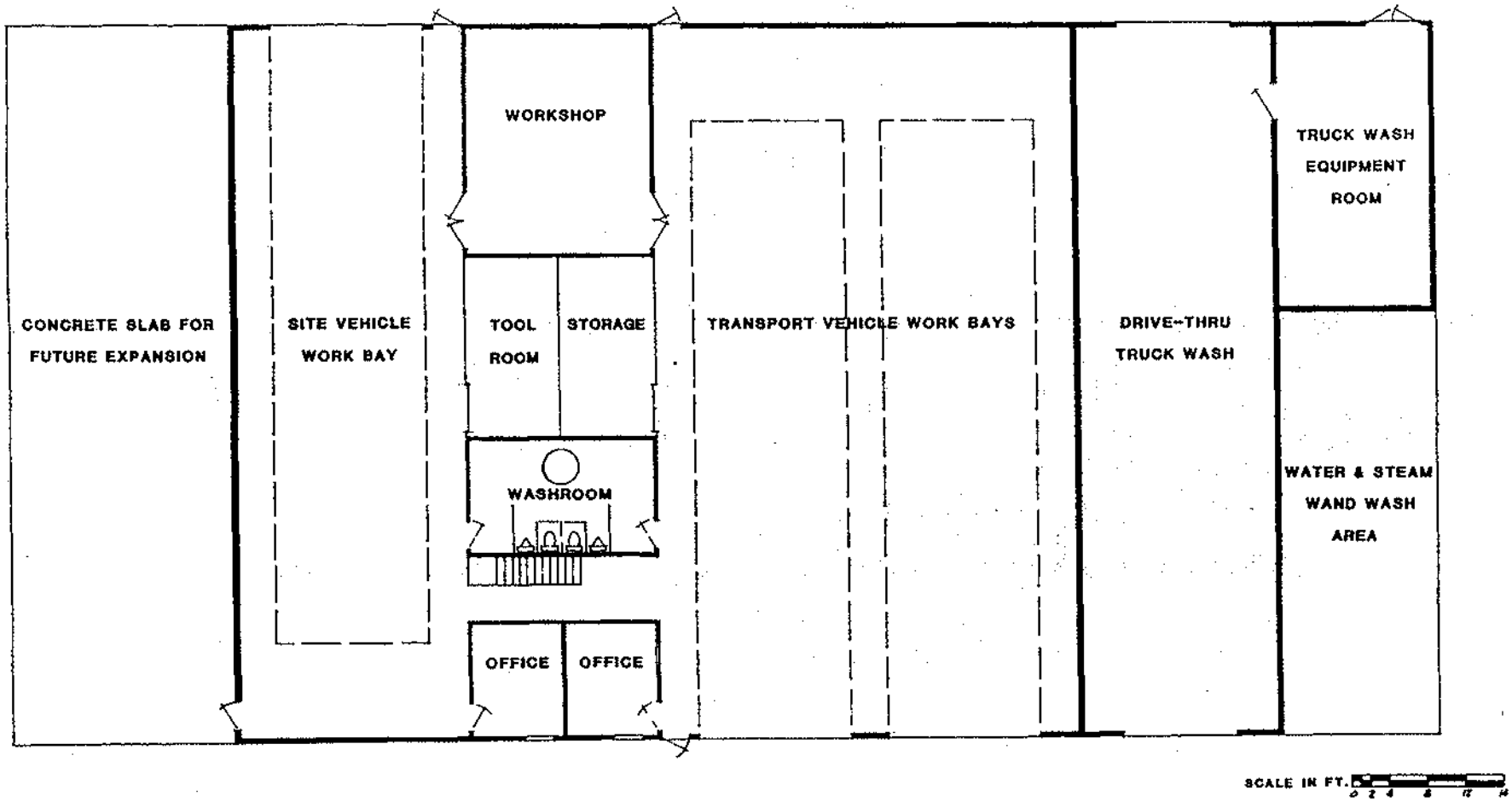
DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HOWARD NEEDLES TAMMEN & BERGENDOFF HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE (8 MAR 81)

BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
EMPLOYEE-LABORATORY BUILDING
FLOOR PLAN & ELEVATIONS

SHEET NO.
FIG 6.3.6
OF



MAINTENANCE BUILDING FLOOR PLAN

PHASE II

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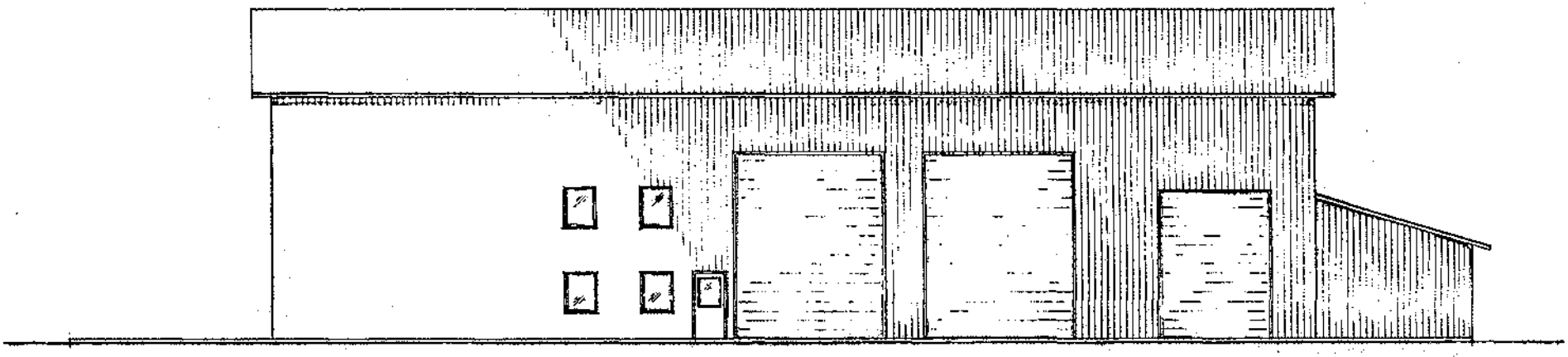
ARCHITECTS ENGINEERS PLANNERS

FIGURE 6.3.7

MAINTENANCE BUILDING PLAN

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

PRELIMINARY



SOUTH ELEVATION

PHASE II

SCALE IN FT. 0 2 4 8 12 16

FIGURE 6.3.8

MAINTENANCE BUILDING ELEVATIONS

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

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ARCHITECTS ENGINEERS PLANNERS

Thus for example, waste and reagents will be delivered to the west side of the treatment/solidification building and solidified product will exit that building from the east side. Further, site vehicles enter the maintenance building at the north side whereas waste transport vehicles enter that building at the south side.

6.3.4 Administration Building and Guardhouse

The Phase I administration facilities will be a trailer located at the turnoff from the county road (about one mile north of Highway 36) and the Phase I access road.

The Phase II administration building, as shown on Figures 6.3.3 and 6.3.4, will house offices for supervisory and clerical staff and a meeting room. Both the administration building and the guardhouse will be an aesthetically pleasing design.

6.3.5 Facility Security

The facility will be fenced, and the access road will be gated at the guardhouse (see Figures 6.3.1 and 6.3.2). Access to all buildings will be through lockable doors. Truck doors will be lockable. All exit doors in the Phase II processing building will be equipped with inside "crash" hardware, affording emergency exit to the outdoors but no entry from outdoors.

6.3.6 Employee and Laboratory Facilities

The employee and laboratory facilities, as shown in Figure 6.3.6 for Phase II, provide washrooms, showers, separate locker rooms for work clothes and street clothes, and a lunch room. The operations manager is provided an office in this area, and first aid and personal safety equipment will be kept in this location. A safety shower and eyewash will be

located in the laboratory. To provide adequate on-site control of the waste receipts, both the Phase I and Phase II laboratories will have the following minimum testing capability:

- pH (corrosivity)
- flash point (ignitability)
- acidity
- alkalinity
- cyanide
- sulfide
- ammonia
- chlorine
- settleable solids
- nitrate
- total solids
- suspended solids
- viscosity
- specific gravity or bulk density
- number of phases
- reactivity (water/air)
- radioactivity
- free liquids
- water solubility

The on-site laboratory will be equipped to determine flash points so as to identify wastes, such as paints and solvents, which present fire hazards due to being ignitable under routine storage and disposal, and wastes capable of severely exacerbating a fire once started. The ability to identify these wastes will facilitate the segregation and proper management of these types of materials. Figure 7.2.8, subsequently presented, further details the segregation and management practices for handling all the types of wastes to be received at the facilities.

During Phase I and Phase II, the laboratory will be furnished with the necessary equipment to perform the above listed tests including:

- pH meter
- fume hood
- centrifuge
- Pensky-Martin flash point tester
- oven (mechanical connection)
- geiger counter
- extraction apparatus
- refrigerator
- bunsen burner
- desiccator
- distilling apparatus
- hot plate/stirrer
- muffle furnace
- hydrometers

Laboratory wastewater will be segregated from the sanitary wastes in the building and will be collected, solidified, and then disposed of in the secure disposal cells.

6.3.7 Maintenance Facilities

A maintenance building and truck wash facility will also be provided for the Phase II level of operation, as illustrated in Figures 6.3.7 and 6.3.8. These will serve both the on-site vehicles and the transport vehicles. The effluent from the external truck wash will be collected and either reused as the first wash cycle for cleaning the interior of the transport trucks, or discharged to the contaminated water holding pond. Washing the interior of trucks will be conducted at the treatment/solidification building so that the washings are discharged directly to the appropriate solidification basin. In this manner, the washings will be solidified and then disposed of in a secure disposal cell.

6.3.8 Tank Farm

As illustrated in Figure 6.3.5, a tank farm will be provided during Phase II operations. As will be shown in Figure 6.4.2, it will consist of four 6,000 gallon tanks contained within a concrete basin. The tank farm will serve to store wastes for two purposes: (1) prior to solidification and/or use in the treatment process and (2) prior to trans-shipment of wastes to other hazardous waste management facilities for other types of processing, incineration, recycling, reuse, and/or disposal.

Storage of wastes requires at least four tanks to maintain waste compatibility precautions (see Section 7.2.6.2) and to store low volume waste streams until enough waste has been accumulated for subsequent treatment/solidification. It is expected that at least one tank should be available to handle each of four waste streams: acid sensitive, base sensitive, organic, and pH insensitive wastes. The exact assignment of tanks may vary according to facility needs, and additional tanks may be added

to provide operational flexibility and to maintain waste compatibility requirements. The precaution described in Section 7.2.6.2 will be adhered to when changing the waste type stored in a particular tank.

The tank capacity, 6,000 gallons, was chosen for two reasons: it is a standard size tank commercially available and it represents the nominal transport tanker truck volume. The tanks will be constructed with materials compatible with the type of liquids to be stored, such as cross-linked polyethylene material for storage of acid wastes. The tanks will be filled from a vacuum truck and emptied by a vacuum truck. To avoid mixing of incompatible material, no interconnecting piping between the tanks will be provided.

The concrete basin around the tanks serves as a back-up system, in the unlikely event that a tank should spill or rupture. As required by EPA regulations, BFI must meet the National Fire Protection Association design criteria for reactive liquids: the volume of a diked tank storage area must be able to contain the volume of the largest tank and have one foot freeboard with a minimum of five feet between the tank wall and dike. Each 6,000 gallon tank will be placed on a concrete pad, elevated so that the volume within the diked area below the level of the pads equals 6,000 gallons or more. This will permit the volume of one full tank to fill the space below the other tank bottoms.

The diked area will have a total capacity of at least 24,000 gallons (the total volume of four tanks) while leaving a one-foot margin for freeboard. This arrangement provides a safety factor well above the minimum standards.

6.3.9 Facility Staffing

BFI corporate staffing and typical regional staffing are illustrated in Figures 6.3.9 and 6.3.10, respectively. Facility staffing for Phase II is illustrated in Figure 6.3.11. As illustrated in Figure 6.3.11, the district manager will assume overall responsibility for the facility operation and personnel. The chief chemist and operations manager, both responsible to the district manager, will assure that daily operations are consistent with BFI policy and RCRA and state regulations as specified in the Facility Plan. It is also anticipated that local, state, and EPA officials will inspect the facility periodically to assure proper operation.

The staffing pattern for the facility reflects the anticipated requirements over the range of waste processing rates. Initially, no contracts for receipt of waste streams will be in effect, so that staffing will be substantially reduced from that shown in Figure 6.3.11. In all cases, however, BFI will maintain the number of personnel necessary to operate the facility in an environmentally sound manner. This will be dictated by the volume of waste processed and the hours of operation. At least one employee, a security guard, will be at the facility after normal working hours. The anticipated staff is consistent with other operations now receiving similar types of chemical wastes at other BFI facilities. Resumes of key personnel will be available to the state upon request. About 20 persons will be employed for the Phase I level of operation and about 34 people will be required for the peak Phase II level of operation. Key personnel are discussed below.

(1) The District Manager will have a combination of business and technical experience with special emphasis on operations management. He has overall responsibility for the facility operation and personnel.

BFI
CORPORATE STAFF

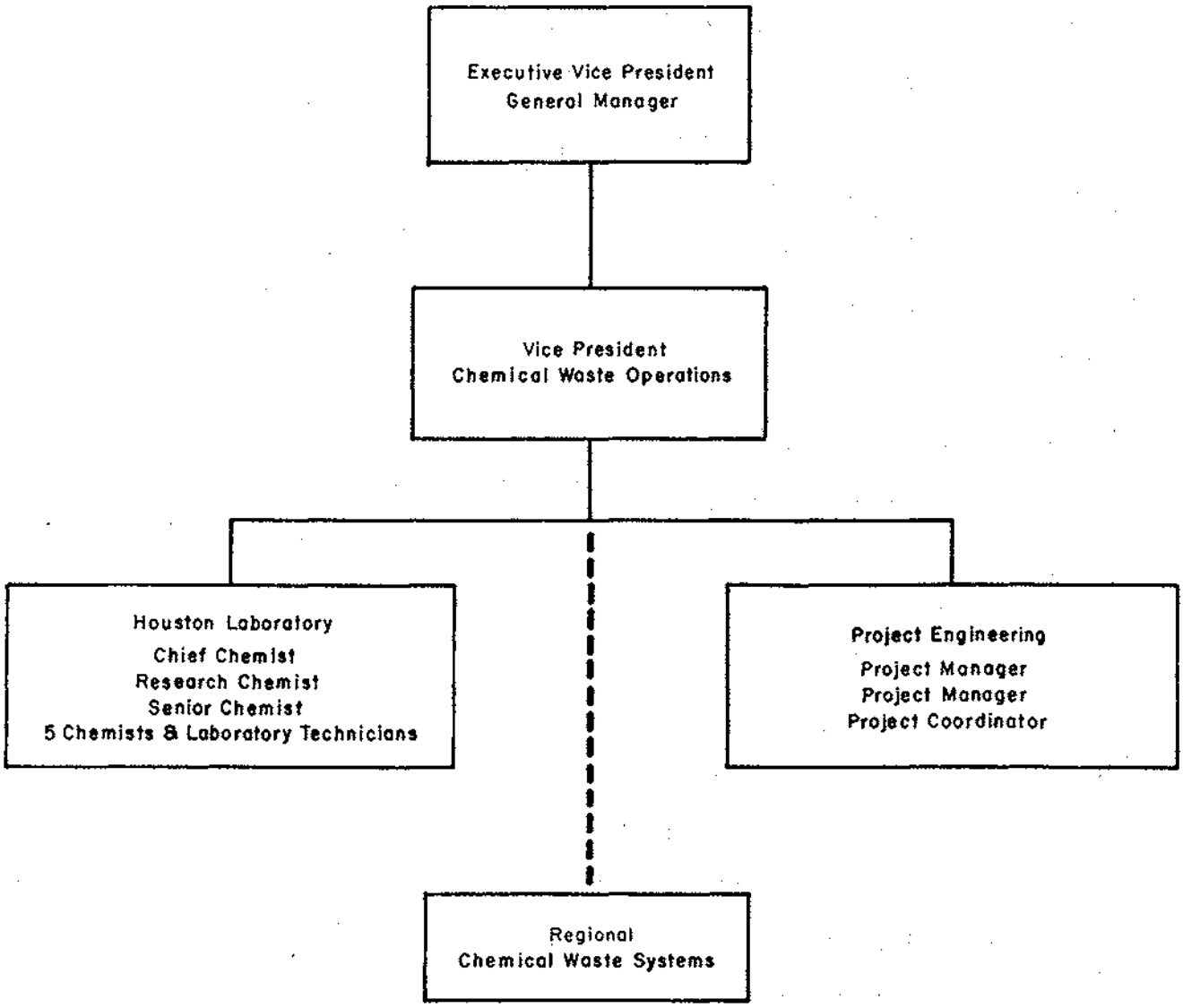

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FIGURE Nº 6.3.9
BFI CORPORATE STAFF

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TYPICAL REGIONAL CHEMICAL WASTE STAFF

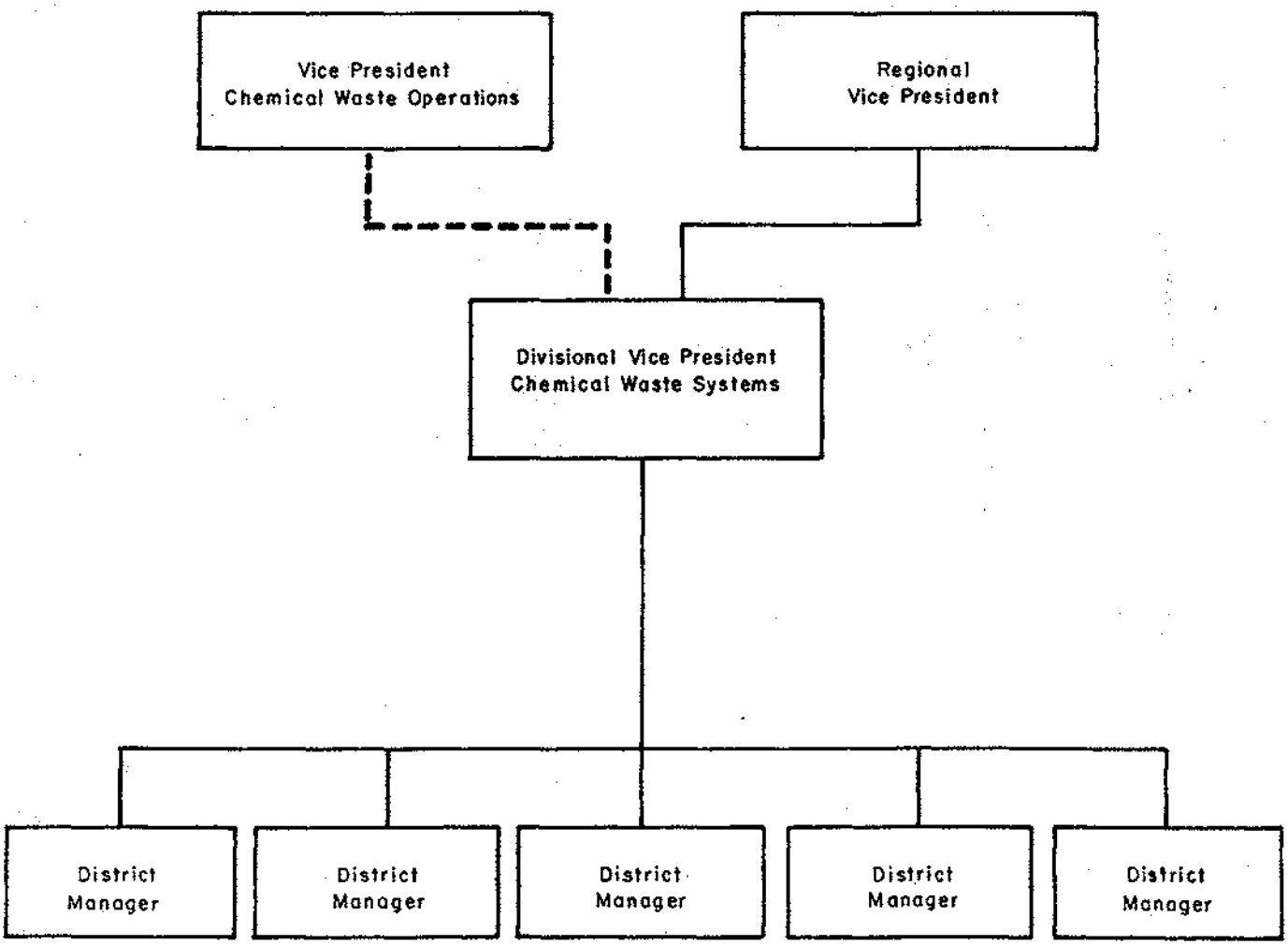

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FIGURE № 6.3.10
TYPICAL BFI REGIONAL STAFF
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

FACILITY STAFFING

PRELIMINARY

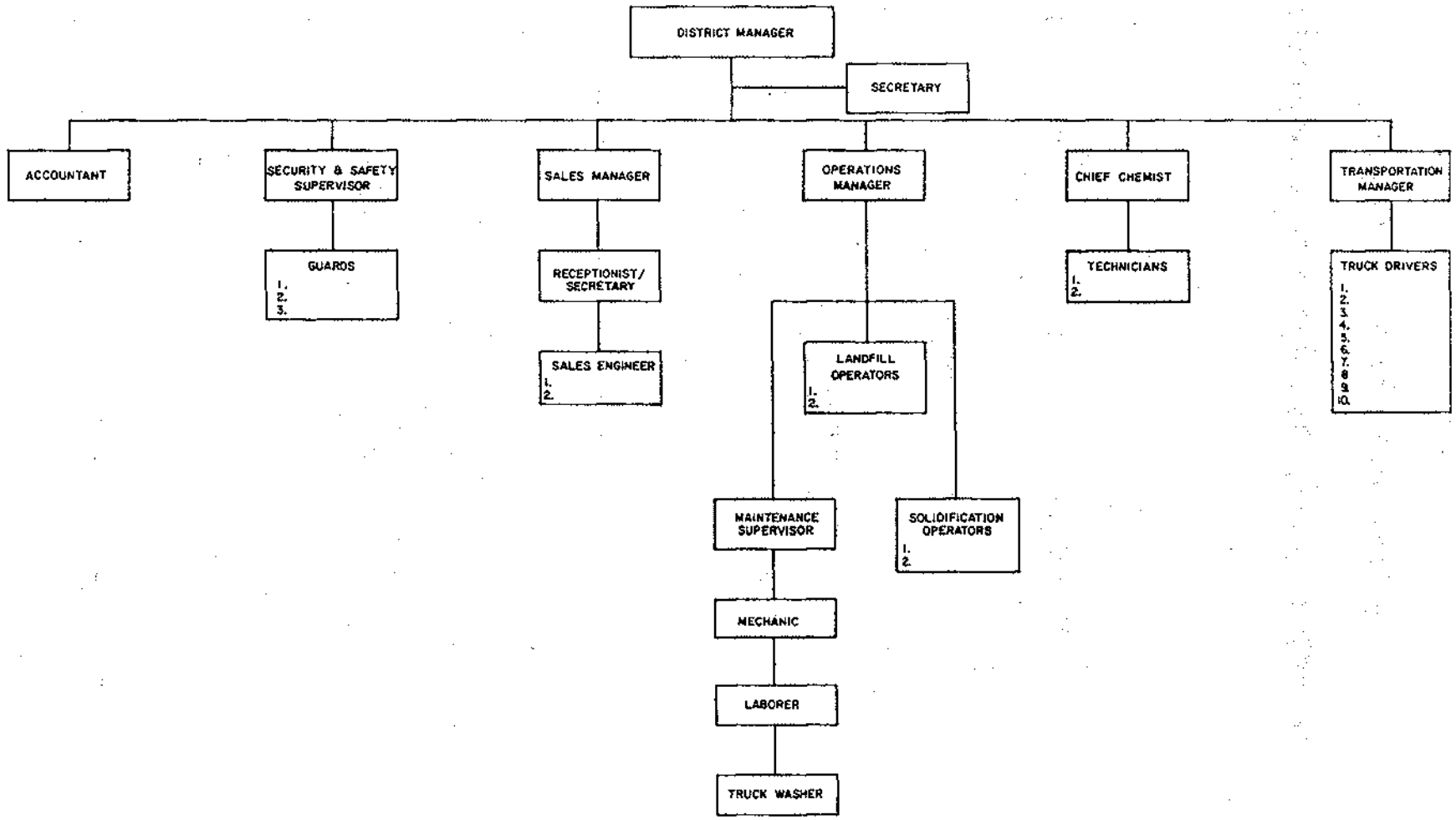

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FIGURE Nº 6.3.11

FACILITY STAFFING

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

(2) The Sales Manager will have experience in marketing with emphasis on chemical waste management service. He is responsible to the district manager.

(3) The Operations Manager will be familiar with the operation and use of heavy equipment and earth moving techniques and have experience demonstrating good supervisory capabilities. Also, it is desired that he be familiar with RCRA regulations and have a business degree or equivalent experience. He is responsible to the district manager and for coordinating all areas of facility operation, including equipment operations, maintenance, future planning, and daily scheduling.

(4) The Chief Chemist must have a degree in chemistry, be familiar with RCRA regulations and guidelines, and have at least one year of experience in proper laboratory procedures. At least one year of experience in chemical waste handling is desirable. A more detailed description of the chief chemist job is given in Table 6.3.1. He is responsible for the technicians. His functions are:

- establish and maintain a good rapport with customer's technical staff;
- be willing to help with any technical problems and/or questions on- or off-site;
- setup complete records, logs, and reports to proper agencies;
- make sure federal, state, local, and BFI rules and regulations are followed;
- setup and make sure the health program meets or exceeds industry and OSHA standards;
- supervise waste handling procedures on- and off-site to protect people and the environment;
- attend appropriate courses and seminars to ensure that BFI's programs are kept up-to-date;
- get involved with local and state chemical associations and with environmental community activities;
- establish and maintain a good rapport with federal, state, and local health department officials;
- help maintain a good BFI image in the area.

His normal duties include the following:

- receive, monitor, and control all incoming wastes;

I. RESPONSIBILITIES

A. Set-up and coordinate health and technical program for the District.

1. Health Program

The Chief Chemist will:

a. Prepare and supervise a written respiratory program, according to OSHA standards and guidelines.
b. Prepare, coordinate, and circulate safety data information sheets on all waste streams handled at this site to all appropriate personnel.
c. Make sure that all appropriate employees are informed of the proper chemical handling procedures for all waste streams handled at the site.
d. Supervise training sessions for employees on respirator, health, and chemical handling procedures.
e. To make regular, at least once a week, inspections of facilities, including but not limited to first aid station, safety equipment storage and conditions, safety showers and eyewashes, employee locker rooms, etc. He also shall maintain a permanent written record of all such inspections.
f. Monitor facility laboratory for proper safety and health techniques.
g. Coordinate with Security and Safety Supervisor as to the proper safety gear required for work on-site or in customer's plant.

2. Technical Program

The Chief Chemist will:

a. Coordinate between the Sales Engineers and the Houston Laboratory on the following for each waste stream:
   1. Waste Chacterization Data Sheets
   2. Sample of waste stream
   3. Disposal recommendation for waste stream
b. Be sure each waste stream has been approved by the Houston Laboratory for disposal and/or treatment. Check with the EPA to be sure the customer has proper ID number and Waste Code Number.
c. Communicate with customer's technical staff to help with problems and/or questions regarding treatment or disposal at the site.
d. Give approval for disposal, transfer, or shipping of waste to/from the site after the following criteria are met:
   1. Proper paperwork accompanies the waste
   2. Analysis of waste to assure identity
   3. Designation of proper safety gear and procedures
   4. Filling out a waste disposal or shipping authorization sheet

B. Record keeping and follow-up procedures

1. Record Keeping

The Chief Chemist will:

a. Set up monthly reporting to the State Health Department and Federal EPA to include:
   1. Waste received
   2. Waste code numbers
   3. Volumes
   4. Dates
   5. Treatment and disposal method
b. Report of analysis on monitoring wells, leachate detection wells, and air quality monitoring.
c. BFI internal weekly reports of waste handled, volumes, treatment and disposal method.

2. Follow-up Procedures

The Chief Chemist will:

a. Travel to and communicate with customer's technical staff about questions and problems regarding waste disposal at the site.
b. Help Sales Engineers and other BFI personnel with technical problems concerning waste registration or disposal.

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ARCHITECTS ENGINEERS PLANNERS

TABLE 6.3.1
CHIEF CHEMIST JOB DESCRIPTION
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

C. Hiring and Training

1. Hiring

The Chief Chemist will:

a. Interview and select possible candidates for chemist and technician positions.
b. Will select, with the approval of the District Manager, people to fill these positions.

2. Training

The Chief Chemist will:

a. Supervise the training of all appropriate personnel with regard to health and technical chemical handling procedures.
b. Will assist in the program selection for guest speakers at the monthly safety meetings.
c. Will prepare chemical handling demonstration for the monthly safety meetings.
d. Be responsible for training chemist and technicians as to the proper laboratory techniques and BFI policies.

II. AUTHORITY AND QUALIFICATIONS

A. Reporting and supervision of technical personnel

1. Reporting

The Chief Chemist will have a dual reporting responsibility to:

a. District Manager: for day-to-day activities and site specific duties
b. Vice-President of Technical Controls: for adhering to company procedures, etc.

2. Supervision

The Chief Chemist will:

a. Supervise chemist and technicians
b. Supervise waste handling procedures and personnel on-site
c. Recommend to the District Manager disciplinary action for people that do not adhere to these policies and procedures.
d. Will also be a member of the Safety Committee

B. Qualifications

1. Must have a degree in Chemistry
2. At least one year experience in proper laboratory procedures
3. One year experience in chemical waste handling desired
4. Familiar with RCRA Regulations and guidelines

III. COMPENSATION

A. This position will be salaried.

NOTE: The hiring, firing, and any raises must be approved by both the District Manager and the Vice-President of Technical Controls.

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ARCHITECTS ENGINEERS PLANNERS

TABLE 6.3.1 (CONTINUED)
CHIEF CHEMIST JOB DESCRIPTION
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

- maintenance of all records associated with hazardous waste receipts, treatment and disposal, including state manifest system;

- training program for technical personnel;

- groundwater, leachate, air and surface water monitoring systems;

(5) The Technicians perform routine technical tasks as assigned by the chief chemist. At least one technician (or the chief chemist) will be on duty during working hours. Their duties include:

- waste shipment inspection;
- lab analyses;
- ensure all vehicles have been cleared by lab and guard;
- ensure wastes are discharged in the proper locations;
- ensure compliance with safety rules;
- perform other routine duties as assigned.

(6) The Security & Safety Supervisor is responsible to the district manager. Depending on staffing needs, the chief chemist may serve as the security & safety supervisor. Duties and responsibilities include:

- emergency procedures and contingency plans;
- implementation and enforcement of site safety program;
- overall security of the facility including perimeter security control.

(7) The Guards are responsible to the security & safety supervisor, or to the chief chemist. Their purpose is to enforce security and safety rules and to assist with paperwork for incoming chemical wastes.

Their duties include the following:

- man guardhouse and act as site receptionist;

- restrict entry to authorized personnel and properly document vehicles;

- direct visitors to office;

- complete appropriate receiving records;

- check exiting trucks for leaks and open valves.

(8) The Maintenance Supervisor is responsible to the operations manager. The maintenance supervisor is responsible for maintaining all on-site and off-site vehicles and facilities.

6.4 DESIGN AND OPERATION OF TREATMENT/SOLIDIFICATION FACILITIES

6.4.1 Design Criteria

The main criteria used in establishing the design of the Phase I and Phase II treatment/solidification facilities are discussed in the following subsections.

6.4.1.1 Waste Load Capacity

On the basis of the waste inventory analyses presented in Chapter 3, the peak design capacity selected for the Phase I facility is 8,000,000 gallons of waste per year. This is equivalent to about 31,000 gallons per day (five day/week operation). The Phase II facilities are designed to accommodate a waste volume between 10,000,000 and 12,000,000 gallons per year. The selected long-term design average process rate for the Phase II facility of 10,000,000 gallons per year is equivalent to about 38,500 gallons of waste per day (five day/week operation).

6.4.1.2 Hours of Operation

Depending on the average rate at which wastes are received, the Phase I or Phase II treatment/solidification facilities would be operated from one to two shifts per day, and from five to seven days per week. At start-up, it is anticipated that the facility will be operating 12 hours per day from 7:00 A.M. to 7:00 P.M., five days per week. As the volume of waste increases, the hours of operation and the number of personnel will be increased, as needed. The Phase II treatment/solidification operation will be conducted within a totally enclosed, well lighted building. A guard will be on duty at all times, including non-operating hours.

6.4.1.3 Segregation of Reactive Wastes

Because of the often complex nature of the waste materials, an important part of any waste handling system is to ensure that only compatible waste streams are combined. Failure to effectively segregate wastes could result in reactions occurring with the associated hazards from generation of heat and/or potentially dangerous gases. The procedures for determining waste compatibility and an emergency response plan should non-compatible wastes be combined will be discussed subsequently in Chapter 7.

To ensure that only compatible waste streams are combined, the waste streams will be segregated into the following three categories with separate reception facilities:

- wastes which liberate gases when acidified; (acid sensitive wastes)
- wastes which liberate gases when the pH is raised; (base sensitive wastes)
- wastes which do not liberate gases when the pH is adjusted. (pH insensitive wastes)

For both the Phase I and Phase II treatment/solidification facilities, a minimum of four waste reception basins will be provided so that two basins will be available to accommodate the particular category of waste received most frequently.

6.4.1.4 Intermediate Storage Requirements

Ideally, the freshly solidified and cured product should be taken from the processing area and placed in the secure disposal area. The climatic conditions which might prevent the direct placement of freshly processed product in the product storage area are extreme wet weather, snow cover, or excessive winds. During these periods, intermediate storage of the solidified product and/or unprocessed wastes will be necessary.

Based on local climatological data, such conditions and their immediate after effects on site operations would not normally exist for periods of more than about one week. Although the access roads from the solidification facilities to the secure disposal cells will be graveled, maneuverability on the way to and in the secure disposal cell will be difficult during such periods. To provide a factor of safety, it is assumed that these conditions could last for ten consecutive days.

The Phase I mixing cells can accommodate up to eight days intermediate storage, assuming a waste load equivalent to 2,000,000 gallons per year, as might be expected during start-up of Phase I operations. This volume of storage is provided in the four Phase I mixing cells. These cells are clay lined and each can accommodate approximately 126 cubic yards, based on an effective depth of eight feet. To accommodate increased waste loadings as start-up progresses, the effective depth of the mixing cells will be increased to ten feet via a retaining wall so that each cell can accommodate approximately 247 cubic yards and/or additional cells will be constructed.

To provide increased flexibility and to ensure that the Phase II facility can accept wastes continuously, intermediate storage of product and/or unprocessed wastes is provided in the solidification building mixing cells and floor area to accommodate the equivalent of 6 to 8 operating days (or 8 to 10 consecutive days, including the weekend time period when no wastes would be processed) of waste volume at the Phase II design processing rate range. Solidified material stored on the floor in the solidification building has the consistency of soil and, as such, can be easily loaded into dump trucks and transferred to the secure cell during favorable operating conditions.

6.4.1.5 Reagent and Reagent Storage

As was indicated in Chapter 3, the volume of solidifying reagents required for the process will typically be two times the volume of wastes received, depending upon the reagents used and the waste streams. The most common reagent will likely be cement kiln dust, with a most probable waste to reagent volume ratio of 1:2. For those wastes which generate gases with the basic kiln dust, fly ash is the preferred solidifying reagent. In accordance with the selected design average processing rates for the Phase I and Phase II facilities, the volume of reagent required will typically be about 300 cubic yards per day and 380 cubic yards per day, respectively.

Waste cement kiln dust is produced at several Colorado cement plants. The operation of those plants is such that prolonged capacity shortages are expected to be rare. Nevertheless, production cutbacks due to maintenance requirements or market conditions could occur. Consequently, there should be enough on-site reagent storage capacity to accommodate irregularities in delivery so as to permit continuous, uninterrupted operation of the facility. In general, about three to four days of reagent storage capacity is desirable. In the event that cement kiln dust becomes unavailable, Portland cement can be used as an alternative solidification reagent. Also, depending on neutralization and chemical precipitation requirements, it may be necessary to provide on-site storage of quicklime, hydrated lime, or lime kiln dust. For the Phase I facility, temporary "Portabulk" containers will be used for reagent storage, whereas for the Phase II facility, storage silos will be provided. During Phase I, the reagents will be transferred from the port-a-bulk trailers to the mixing basins by a pneumatic feed system.

Of the two silos to be constructed on-site for Phase II, the following materials may be alternatively stored in them: kiln dust, fly ash, Portland cement, quicklime, hydrated lime, or lime kiln dust. Reagent will be fed from the silos to the concrete mixing tanks in the treatment/solidification building by means of a screw auger. The screw auger will move the reagent from the silo bottom to several ports in the appropriate mixing tank.

6.4.2 Design Concept

Several options were investigated for blending and mixing the liquid industrial wastes with the solidifying reagent(s). The two basic types of mixing considered were:

- mechanical mixers;
- mixing in concrete tanks.

Several types of mechanical mixers were investigated including paddle mixers, ribbon mixers, kneaders, pug mills and tumble mixers. The cement, tumble-type mixer was considered the most worthy of detailed investigation and the pug mill mixer somewhat less worthy.

After careful consideration, the use of tumble mixers was discarded. Withdrawal of the mixed product from the mixer would be problematical because of dryness and stickiness, and undesirable flushing water would be required. Also, the holding chambers for raw wastes would require considerable agitation to maintain fluidity which was considered a further disadvantage of the mechanical mixer option. The use of a pug mill mixer would also have this latter disadvantage. However, during preparation of the Phase II construction specifications, the use and integration of a pug mill mixer into the final design will be further evaluated.

The mixing tank concept has been used in at least three facilities in the United States. Several chambers are provided so as to allow one cell to be worked while another is being emptied. As mentioned previously, the tanks are segregated as to the type of raw waste they receive so as to prevent intermingling of mutually incompatible substances. During Phase II, four mixing basins will be provided. The basins will be designated as either acid sensitive, base sensitive, or pH insensitive. The fourth basin will be used to accommodate large quantities of a particular waste type. One of the basins will also be subdivided to provide two batch pretreatment tanks.

The method of mixing in the tank is simply to add the solidifying reagent to the tank either before or after the addition of the raw waste. Mixing is then done with a hydraulic hoe excavating machine equipped with a specially designed bucket. Details of the reagent storage and handling systems, and the dust control and ventilation systems are given in Section 6.4.3.

The tanks are emptied with the same equipment that is used for mixing. The product is left in the tanks for curing and may also be left in the tanks in the case where intermediate storage is required. For the majority of the operating time, the product will be removed from the tanks and loaded directly into dump trucks for hauling to the secure disposal cell area. To provide additional storage, floor space within the Phase II treatment/solidification building has been made available for intermediate storage of the solidified product.

One of the four tanks located within the Phase II treatment/solidification building will be compartmentalized to provide two 12,000 gallon waste detention compartments for pretreatment of specific wastes. The

pretreatment operations will be conducted on a batch basis and may include the following:

- Chemical oxidation, e.g., reduction of hexavalent chromium to trivalent chromium to reduce toxicity (note: chemical oxidation using chlorine is not anticipated at this facility).
- Chemical precipitation, e.g., recovery of precious and semi-precious metals from metal plating wastes.
- Neutralization, e.g., neutralization of waste acids to a neutral pH to prevent unfavorable chemical reactions with other wastes and with the clay liner material.
- Phase separation, e.g., acid cracking of oily wastes for recovery and reclamation of the oil by a properly permitted recycler.

The pretreatment tanks will be thoroughly cleaned before switching treatment schemes if the specific treatment operations are non-compatible.

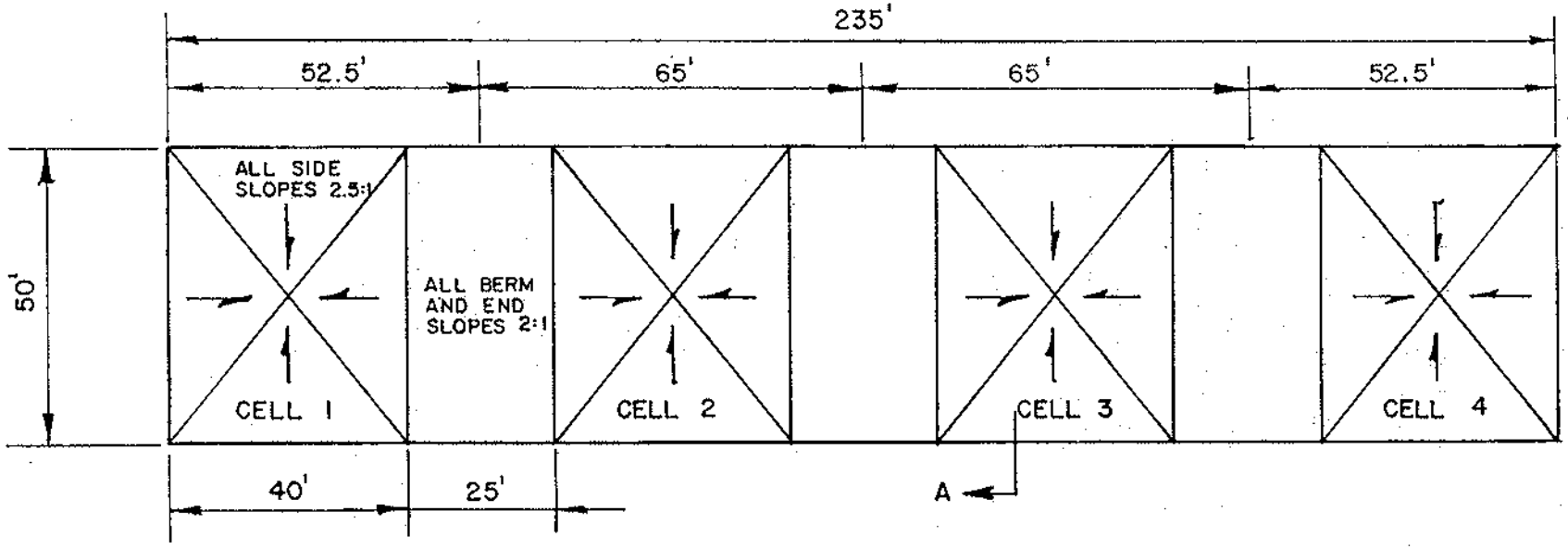
6.4.3. Details Of Processing Unit

6.4.3.1 Phase I Treatment/Solidification Facility

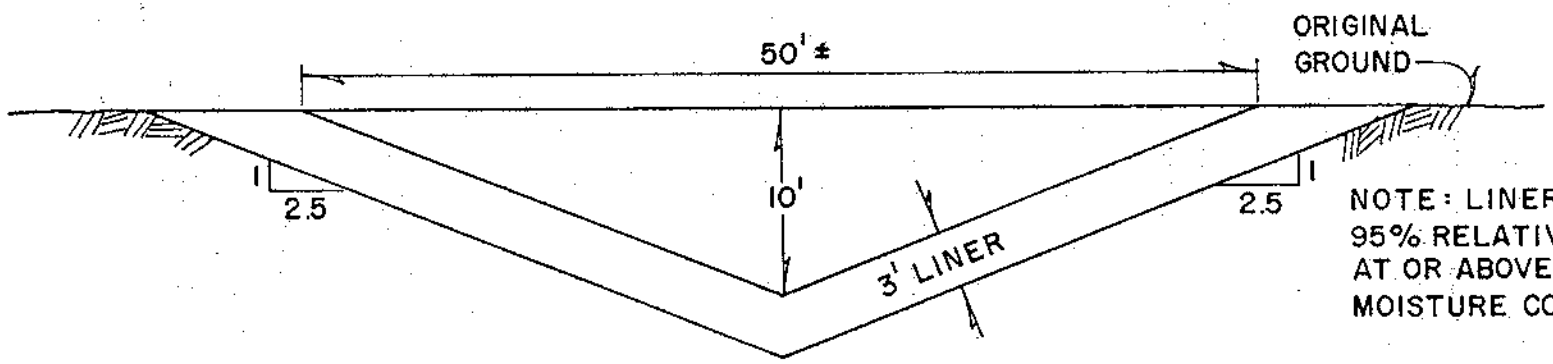
The Phase I solidification cells will be used until the Phase II treatment/solidification facility is operational. It is estimated that the Phase I facility will be used for 12 to 24 months.

The Phase I solidification facility consists of a rectangular earthen "V" bottom basin about 235 feet long by 50 feet wide with a maximum depth of about 10 feet. A minimum of two feet of freeboard will be maintained in the mixing basin. The basin is separated into four mixing cells by earthen cross dikes. The facility is provided with a compacted clay liner along the entire "V" bottom and ends. A plan and section of the facility is presented in Figure 6.4.1.

The side slopes of the "V" bottom are about 2.5:1 and the end slopes about 2:1 (horizontal to vertical). Both the bottom and end walls consist of three feet of compacted clay which constitutes the liner. The



PLAN
SCALE: 1" = 30'



NOTE: LINER COMPACTED TO 95% RELATIVE COMPACTION AT OR ABOVE OPTIMUM MOISTURE CONTENT.

SECTION A-A
SCALE: 1" = 10'

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FIGURE Nº 6.4.1
PHASE I
SOLIDIFICATION MIXING CELLS
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

liner was compacted to 95% relative compaction (ASTM 1557) which provides permeabilities on the order of 1×10^{-8} cm/sec. based on laboratory testing. The intermediate cross dikes used to form the mixing pits have side slopes of 2:1 and are constructed of clay-rich soil. Excluding two feet of freeboard, the volume of each cell is about 126 cubic yards.

Seepage analyses performed on the facility liner indicate that it will contain the wastes longer than the expected life of the facility. The liner will be periodically inspected for deterioration, and repaired if necessary.

A leachate collection system and monitoring wells will not be installed for the Phase I treatment/solidification cells. This decision was made following discussions with the state regarding monitoring requirements for these cells. It was felt that the monitoring system would not be required due to the safety factors included in the liner and mixing cell design combined with the fact that these cells will only be used for a maximum of 24 months. When the Phase II operations are initiated, the Phase I treatment/solidification cells and liners will be excavated and buried in a secure cell. Any contaminated material beneath the cell liners will also be excavated and buried in a secure cell. The excavated area will be filled with compacted clay to correspond with the surrounding topography.

Wastes from the transport vehicles will be discharged directly to the solidification cells along with reagents and then mixed. Site lab personnel will supervise the truck drivers on the discharge of all wastes. Protective equipment will be used depending upon the type of waste and the hazards involved, as required by BFI and OSHA. Examples of the personnel protective equipment to be used are hard hats, safety glasses/

goggles, face shields, protective footwear, protective clothing, gloves, and respiratory protection devices. Chapter 7 describes safety equipment in more detail.

The integrity of the clay liner will be protected during unloading of waste materials by placing a concrete splash pad on the side slope of the mixing cell. A backhoe will be used for mixing and removal of the materials into off-highway dump trucks for transportation to the secure disposal cells. The possibility of liner disruption by waste handling equipment was taken into consideration during the design of the mixing cell; and, as a result, a thickness of three feet was decided upon. This thickness will provide adequate protection, even in the unlikely event of minor degradation.

During the mixing and removal of the solidified waste, disturbance of the clay liner will be prevented by:

- Removing the backhoe bucket teeth and installing a smooth edge.
- Always leaving a minimum of one foot of solidified material in the bottom of the mixing basin. This will allow an ample buffer zone during mixing and prevent any contact with the liner.
- The implementation of a stringent operator control program to prevent operator neglect during mixing and removal.
- Placing an indicator above the clay liner, such as gravel or some other obvious visual indicator, to alert the backhoe operator when he has contacted the liner.

These four safeguards, in addition to the thickness of the clay liner and routine daily inspections, will adequately protect the integrity of the clay liner.

In the event that minor degradation or accidental removal of some of the liner is noted during the routine inspections, the liner will be repaired and a three foot thickness maintained.

When the Phase II solidification facility becomes operational, the Phase I facility will be closed. All contaminated materials, including the liner, will be excavated and placed in a secure disposal cell in accordance with the closure plan presented in Section 7.7.

Provisions have been made to receive drummed wastes, as shown in Figure 6.3.1 and discussed in Section 7.9.1. After inspection, the drums will be emptied into appropriate tanks using of a drum handler attachment for the front-end loader or a fork lift. Drums containing flammable solids will be directed to the secure disposal cell following inspection. Drummed solid ignitables will not be treated and will be segregated from incompatible wastes during storage. During disposal, they will be segregated by compacted clay barriers on all sides from incompatible wastes when placed in the secure disposal cell. Empty drums will be crushed or shredded and then buried in the secure disposal cell. No drums will be added to or crushed in the mixing cells.

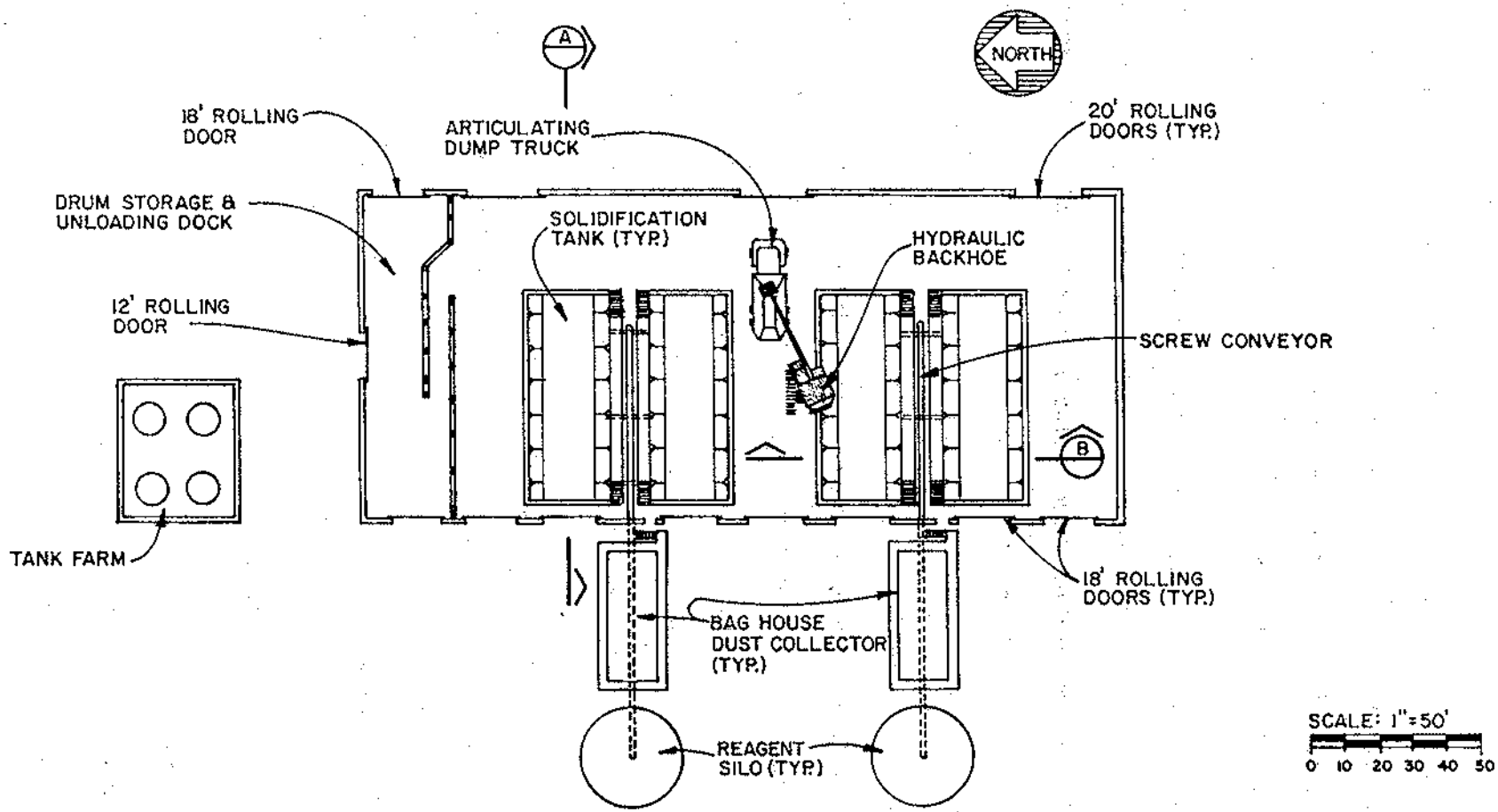
6.4.3.2 Phase II Treatment/Solidification Facility

The overall layout of the Phase II processing area was shown in Figure 6.3.5. Conceptual drawings of the treatment/solidification building are presented in Figures 6.4.2, 6.4.3, and 6.4.4. It is estimated that approximately 8 to 12 months will be required for construction of the Phase II processing facilities.

6.4.3.2.1 Mixing Tanks

The primary purpose of the mixing tanks in both Phases I and II is for mixing of liquids and semi-liquids with reagents to produce a cured, solidified product with minimal leaching characteristic for placement within a secure disposal cell. Liquids and semi-liquids will never be placed within the secure cell without first being solidified and cured.

PRELIMINARY



PLAN

FIGURE Nº 6.4.2
PHASE II
TREATMENT / SOLIDIFICATION BUILDING
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

HNTB
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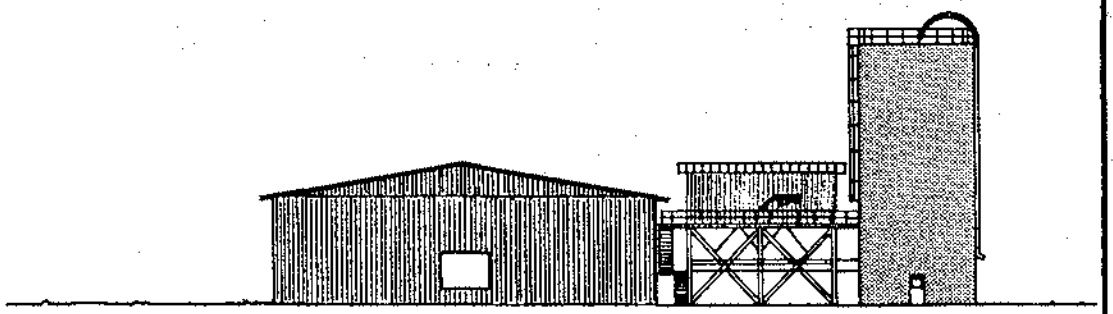
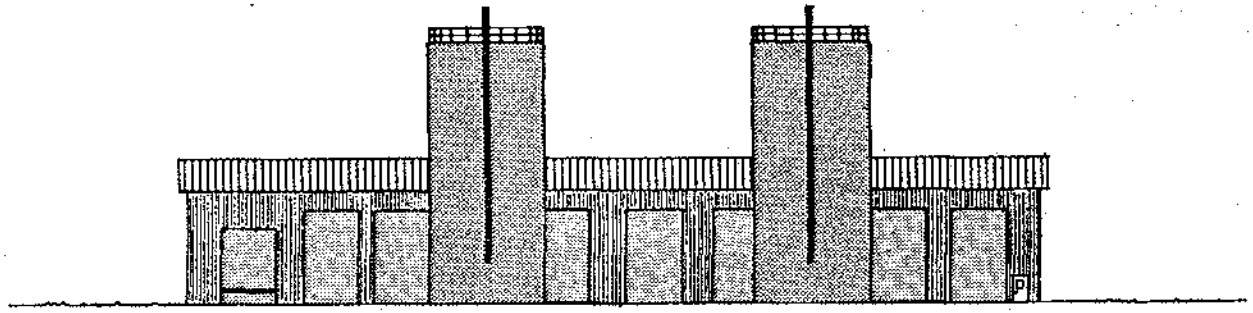
ARCHITECTS ENGINEERS PLANNERS

PRELIMINARY



NORTH ELEVATION



WEST ELEVATION

SCALE: 1" = 50'

0 10 20 30 40 50

HNTB

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FIGURE Nº 6.4.3

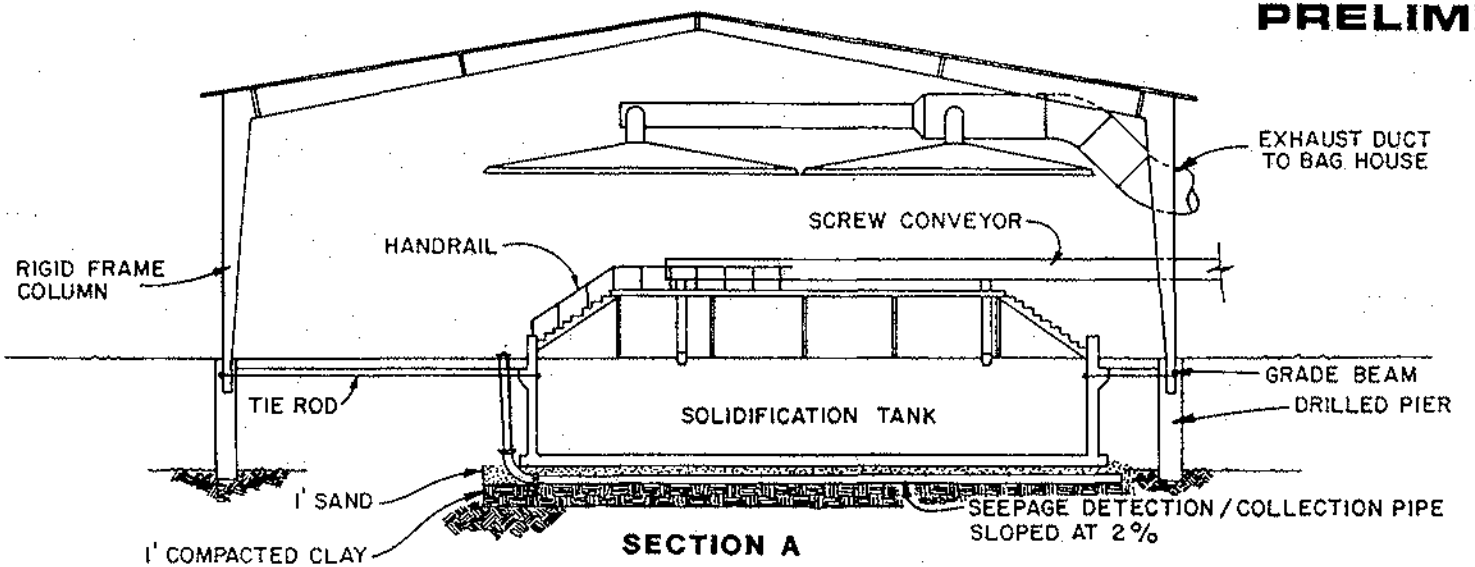
PHASE II

TREATMENT / SOLIDIFICATION BUILDING

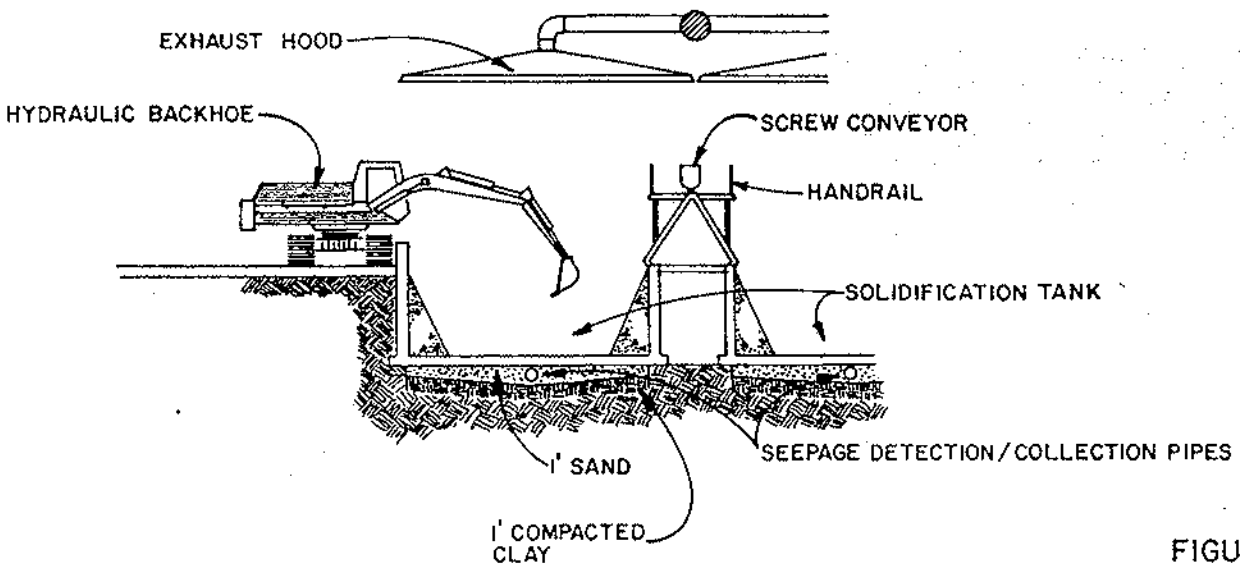
HIGHWAY 36 LAND DEVELOPMENT CO.

ADAMS CO., COLORADO

PRELIMINARY



SECTION A



SECTION B

SCALE: 1" = 20'

0 5 10 15 20

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS

FIGURE Nº 6.4.4
PHASE II
TREATMENT / SOLIDIFICATION BUILDING
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

In Phase II, each of the treatment/solidification tanks will be approximately 60 feet long and 10 feet deep (excluding freeboard) and will have a volume of about 13,000 cubic feet. The depth and cross sectional area of the mixing tanks are determined by the capabilities of the hoe excavator to be used for mixing. The length of the tanks and the number of tanks then become mainly a function of the quantities of the various categories of wastes and the holding period desired in the tanks.

For increased flexibility, four to five days of storage (calculated as solidified product) is provided in the mixing tanks for the Phase II processing rate range. This will provide for the majority of the intermediate product storage when access to the secure disposal cell area might be limited. In addition, however, approximately 6,000 square feet of floor space in the building have been provided for product storage. This provides an additional two to three days of product intermediate storage, if needed. The configuration shown is optimal with respect to minimizing equipment movements as well as reagent addition and dust collection.

All the tanks will be constructed of reinforced concrete to suit the loadings intended. Protective coatings, if necessary, will be applied to the inside of the tanks to protect the integrity of the concrete. Past experience has indicated that through careful engineering and construction, the reinforced concrete walls can withstand the rigors of this type of operation. Close monitoring of tank construction will insure that all engineering specifications are met and that the appropriate materials are used. The operating floors between tanks will be of reinforced concrete with surface hardening to provide a good wearing surface. Tanks will

have perimeter bumper guards to prevent equipment or trucks from slipping off the operating floor. A waterproofing system will be used for the tank walls and floors.

The mixing tanks will be routinely inspected and immediately repaired, if needed. Potential seepage from the concrete mixing tanks in the Phase II solidification building will be monitored and collected by the following means. Directly under each tank will be a one foot sand layer sloped 2% towards a discharge pipe for seepage detection/collection. The sandy layer will be underlain by two feet of compacted clay. Each tank will be served by an individual seepage detection/collection system in order to allow any leaks, should they develop, to be isolated in the appropriate tank. Should a leak develop, the leakage that is collected will be solidified and disposed of in a secure disposal cell.

The delivery of raw wastes to the tanks will be either by vacuum type tank trucks or sludge boxes ("roll-off" containers). The contents of the sludge boxes will be dumped directly into the head ends of the tanks; tankers will either discharge directly into the tanks or from outside the building via hose connections. Provisions have been made to receieve drummed wastes at the north end of the building (refer to Section 7.9.1). After inspection, the drums will be emptied into the appropriate tanks from the floor by hand or by use of a drum handler attachment for the front end loader equipment or fork-lift truck. Drums containing solids will be directed to the secure disposal cell following inspection. Drummed ignitables will be handled as discussed in Section 7.9.1. Empty drums will be crushed or shredded and then buried in the secure disposal cell as in Phase I.

6.4.3.2.2 Mixing and Product Transportation Equipment

Mixing will be achieved using a diesel powered hydraulic hoe excavator machine. The machine will be fitted with a specially designed bucket suitable for both mixing and loading of product into transportation trucks.

Trucks used to haul the solidified product from the processing building to the secure disposal cells will be heavy duty diesel powered dump haulers (e.g., articulated dump trucks). Two haulers will be sufficient to transport the product. Turn around time for trucks (loading, hauling, dumping, and returning) is estimated to be 20-30 minutes depending upon site conditions.

For those times when storage is required on the floor, two extra product handling steps will be involved: placing product on the floor and loading product from the floor to the hauler. During these infrequent situations, a diesel powered front end loader will be transferred from outdoor operations for use inside the building in order to build the piles and subsequently load trucks from the piles.

For working comfort, the cabs of all equipment working inside the building will be equipped with filtered fresh air intakes.

6.4.3.2.3 Process Building

The process building, including the mixing tanks, will be designed to accommodate the harsh conditions, heavy vehicular traffic, and to provide a safe working environment. A concern was raised during public review of the Facility Plan in regard to the proximity of the site (15 miles) to Explosive Fabricators, Inc., a metal bonding plant. Explosions occurring

at Explosive Fabricators are above ground using a maximum of 5,000 pounds of ammonium nitrate fuel blasting explosive. Given the distance involved, no effects on structures are anticipated. In addition, Arapahoe County officials have not felt vibrations from the blasting facility at the nearest ranch to the blasting facility, although the blast could be heard.

The building housing the mixing tanks and floor storage will be of steel frame design with prefabricated metal panel siding and a mechanically seamed metal panel roof. The overhead doors will be heavy commercial industrial grade with manually actuated electric motor operators.

The entire concrete floor area will be curbed with concrete to 12-18 inches above floor level with vehicle access ramps at the doors. The floors will be sloped slightly towards the chambers to facilitate the clean up of any spilled materials within the building.

The building will have electric infrared heating above the floor area between the cells and at the cell tipping ends. This will eliminate ice in maneuvering areas and will generally keep frost out of the building. The electric heating will be guarded as an ignition source.

Workers in the building will normally be in heated vehicular cabs, except for emergency maintenance for which portable heaters could be used if necessary.

The electrical classification in the building will be Class II, Division 2 (accumulations of dust that interfere with the safe dissipation of heat from electrical equipment). Therefore, all electrical equipment, heaters, outlets, conduits, etc., and the incandescent lighting system in the

building will have to comply with the requirements of this classification (dustproof). Electrical service to the building will be 3 phase, 480 volts (to air exhaust fans, conveyor motors, heaters, etc.). The remainder of the power for lighting will be 110 volt, three phase, mainly for lighting. The electrical panels will be located adjacent to the processing building.

The reagent storage and handling system and the building dust collection and ventilation system are discussed under separate headings.

There will be a fire protection system within the Phase II building as there is a possibility for flammable materials within this building (i.e., solid flammables in drums). Solvents, oils, paint vehicles, etc., can and will be accepted since many waste streams contaminated with the above organics are above the RCRA 140°F flash point limit and others can be treated during solidification to raise the flash point above this 140°F limitation.

The on-site laboratory will be equipped to determine flash points so as to identify wastes which present fire hazards due to being ignitable under routine storage and disposal and wastes capable of severely exacerbating a fire once started. The ability to identify these wastes will facilitate the segregation and proper management of these types of materials. Also, hand held dry powder fire extinguishers will be provided for equipment. These extinguishers will be strategically located around the building. All rolling stock will be equipped with dry powder fire extinguishers on board. Further details on safety precautions are given in Chapter 7.

6.4.3.2.4 Reagent Storage and Handling

As noted previously, the primary reagents to be used will be cement kiln dust or fly ash. Vertical cylindrical silos with conical bottoms are suitable to handle either reagent. Two silos, approximately 30 feet in diameter and 70 feet total height, will provide sufficient reagent storage (five to six day storage capacity at the maximum design rate). The silos and the building will be finished to appear much like an agricultural installation. An elevation view of the processing facility was shown in Figure 6.4.3.

The silos will receive the reagent from pneumatically off-loaded delivery trucks. Each silo will be equipped with its own baghouse dust collector to handle offloading exhaust air. These collectors will be automatically shaken into the silos after deliveries. Each silo will also be equipped with high and low level alarms and intermediate level indicators.

The bottom rotary valve feeders will be interlocked with the reagent conveyors serving a pair of chambers. The reagent conveyors will be the screw type with three draw off gates at 15 foot centers. The gates will be actuated by the plant operator. Conveyor maintenance can be carried out from the walkway provided (see Figure 6.4.4).

Only two chambers will be mixed at any one time at design capacity. One baghouse type dust collector per pair of mixing chambers will be provided, as shown in Figure 6.4.2.

6.4.3.2.5 Dust Collection and Ventilation Systems

The dust collection system will utilize hoods over each basin whereby a 75 ft./min. capture velocity across the face of the mixing chambers will

be achieved. Separate headers will serve each pair of adjacent chambers and will be connected to a single baghouse type dust collector. Each header will have its own separate damper. Header velocity will be high so as to prevent dust fallout and subsequent plugging in the ducts. A velocity of 5,000 ft./min. or higher will be provided.

Each chamber, when being worked, will require approximately 55,000 cu.ft./min. of air for dust collection. The baghouse air-to-cloth ratio will be approximately eight. The removal efficiency of the baghouse is anticipated to be greater than 99%. Dust will be collected off the filter cloth media in a hopper beneath the bag-house collector, which will be emptied by gravity to the same conveyor system utilized for the silo reagent feed system.

In the event of an exhaust hood failure, operations in the respective mixing tank will be suspended until the hood is repaired. Operations in other mixing tanks with functional hoods will continue.

In addition, none of the reagents that are proposed have explosive dust mixtures. Both kiln dust and fly ash come from high temperature devices, such as a furnace or incinerator. There will not be any explosive vapors present. The main reason for suspending operation in case of failure is for internal dust control.

Adequate fresh air will be brought into the building via gravity louvers at the front of the building to maintain all air contaminants in the building to below their threshold limit values (TLVs). A large volume of air will be exhausted from the building by the dust collectors. Further dilution, however, will be required to meet the appropriate air standards, as discussed below.

The most critical source of air contaminants will be the diesel exhaust from the equipment and the trucks working in the building. The parameter which determines the dilution rate required for the diesel exhaust was found to be oxides of nitrogen which can run as high as 1,000 ppm in the exhaust gas while their TLV is 5 ppm (as NO_2). In addition, for workers' comfort and safety, the vehicles (typically four) operated within the process building will be equipped with filtered fresh air intakes and a carbon monoxide badge which changes colors if the carbon monoxide concentration reaches dangerous levels.

The air movement created by two dust collection systems, each rated at 55,000 cu.ft./min., will provide slightly less than half the required dilution of the engine exhaust gases assuming prolonged periods of maximum operation. To provide the additional air movement required, five 50,000 cu.ft./min. exhaust fans (including one spare) will be provided in the ceiling. The resulting air change will be approximately 15 air changes per hour, considering the entire building volume.

The large air change provided by the ventilation system in the solidification building will result in the air temperature inside the building being close to the ambient air temperature. The ambient air temperature can vary considerably from summer to winter. The annual fluctuation in air temperatures and, thus, solidification building temperature will have no effect on the ultimate solidification of waste in the building. The time required for curing (solidification) is a function of temperature, type of waste, and type of reagent used. The solidification process is supervised by on-site laboratory personnel who have the responsibility to

ensure that the waste has cured and is completely solidified before placement in a secure cell. No waste will be placed into a secure cell in a liquid or semi-liquid form.

6.5 DESIGN AND OPERATION OF THE SECURE DISPOSAL CELLS

The solidified wastes will be buried in secure disposal cells located adjacent to the Phase I and Phase II solidification facilities. The design of these cells incorporates proven engineering criteria in addition to the naturally favorable geologic conditions at the project site. The combination of suitable geology and sound engineering design will provide a facility that will meet or exceed all applicable regulatory requirements. These two key facets of the secure disposal cells are discussed below.

6.5.1 Site Geological Conditions

The detailed geological and hydrogeological site characterization was presented in Section 5.4. There it was concluded that the site is geotechnically suitable for the facility, as summarized below.

6.5.1.1 Subsurface Soils

The characterization showed that the site is located on top of a geologic unit known as the Pierre shale which is about 4,300 feet thick. Table 5.4.1 (presented in Section 5.4) indicated that this is the most suitable geological formation in the Denver Basin for developing a safe waste disposal facility. The Pierre shale at the site has weathered to varying degrees. For discussion purposes, the subsoils have been divided into three major soil groups:

Group I

Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The uppermost soil (top six inches) is generally a very silty clayey soil, slightly sandy medium stiff to very stiff (increasingly stiff with depth), dry to slightly moist, light brown (CL-ML). The clay content, moisture content, and dry density generally increase with depth, and in most borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec; pH values ranged from 7.9 to 8.2. Based on the cation exchange capacity values (see Appendix G) and the geologic environment, the clay appears to be an illite. No x-ray diffraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec. range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1×10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it will meet or exceed the requirement as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface except in test holes G1, G2, and G3, which are outside the processing/disposal

area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4×10^{-7} cm/sec. and a low of "completely impervious" (no flow could be induced).

6.5.1.2 Groundwater

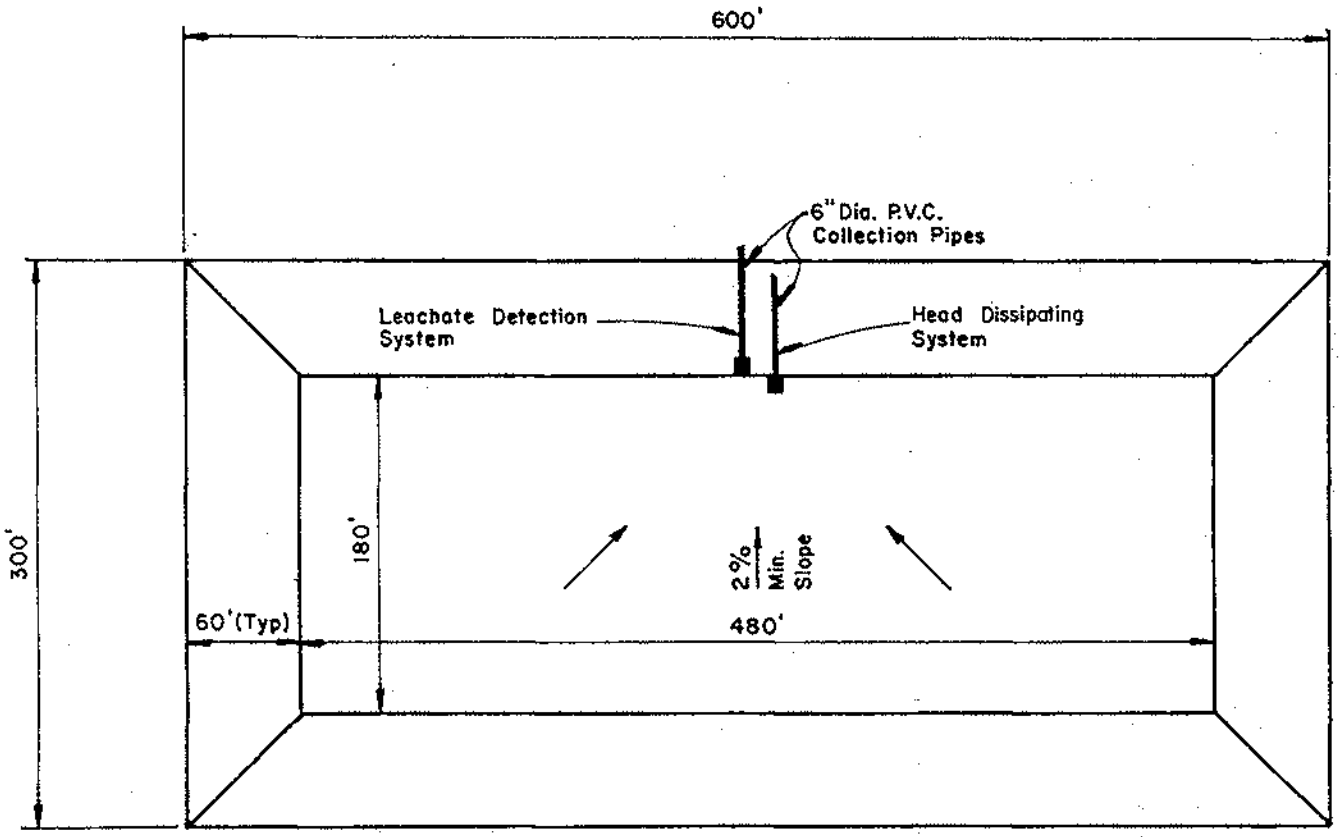
No major groundwater aquifers underlie the site, nor are any exposed at the surface. However, due to the very low permeability of the Pierre shale, perched water tables typically occur in the alluvial fill drainages. Groundwater of this type was encountered in the drainage swales outside the perimeter of the secure disposal cell area at depths ranging from 35 to 45 feet. Recharge to these areas comes from vertical infiltration in the immediate drainage area.

A minor amount of deep groundwater exists at the site in the Pierre shale bedrock. Recharge probably comes from horizontal flow through the small fracture networks. Groundwater of this type was encountered in two deep borings at depths of 182 feet and 99 feet, both corresponding to an elevation of about 4,700 feet. Pump tests indicated virtually dry well conditions, i.e., 0.16 gallons per minute.

6.5.2 Secure Disposal Cells

6.5.2.1 Description

Presented in Figures 6.5.1 and 6.5.2 are plan and section views, respectively, of the standard size secure disposal cell. As can be seen there, typical cells will have surface dimensions of 600 feet by 300 feet and will be about 30 feet deep. The cell bottom will be excavated into weathered shale bedrock. The cell bottom will consist of six feet of compacted clay liner with two sand recovery systems. The lower recovery system, the leachate detection/collection system, will be used to monitor



NOTE:
See Section
Fig. 6.5.2

PLAN

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
ARCHITECTS ENGINEERS PLANNERS
INDIANAPOLIS, INDIANA

FIGURE Nº 6.5.1

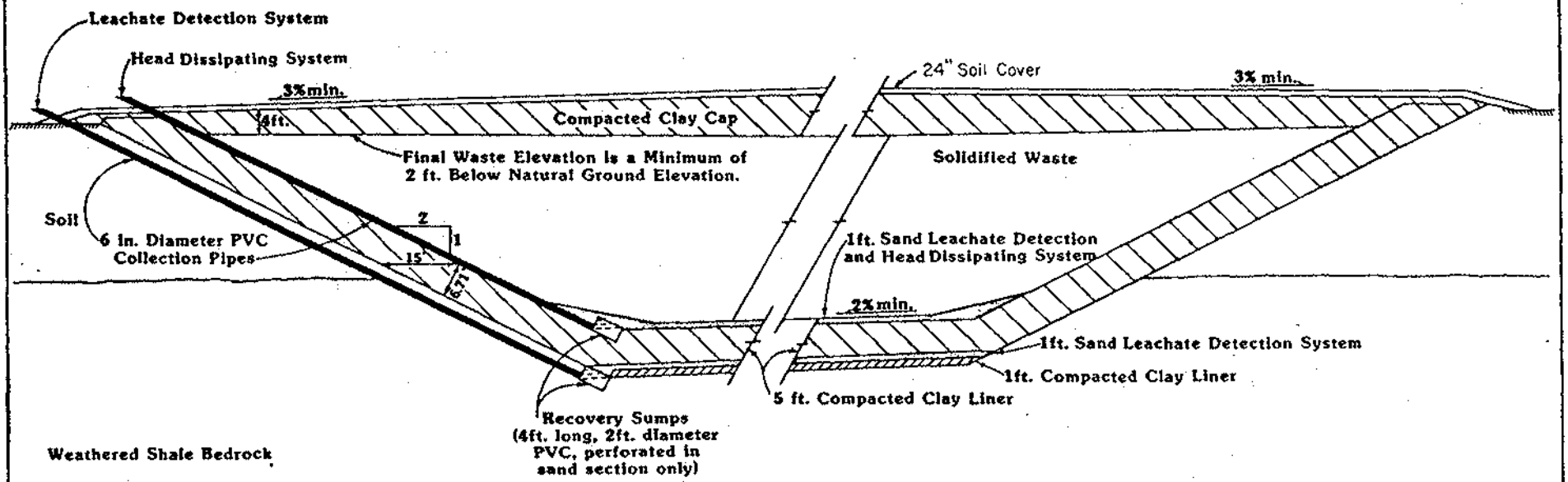
TYPICAL SECURE DISPOSAL CELL

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

TYPICAL SECURE DISPOSAL CELL

TYPICAL

Cell Length - 600 feet
Cell Width - 300 feet
Cell Depth - 30 feet
Cell Volume - 125,000 cu. yds.



Shale Bedrock

General Notes:

1) Cell excavations should be inspected by a qualified soils engineer prior to any fill placement to insure that the cell is bottomed in weathered shale.
2) Clay liners and cap should be compacted to 95% of ASTM D-1557 at 0 to plus 3% of optimum moisture content.
3) Clays for liner material must meet material specification of:
   a) more than 80% passing the No. 200 Sieve
   b) Liquid Limit greater than or equal to 30
   c) Plasticity Index greater than or equal to 7
4) All fill placement should be monitored by a qualified soils technician under the supervision of a registered professional engineer.

0 10 20 30ft.

TYPICAL SECURE DISPOSAL CELL

FOX Consulting Engineers and Geologists

Date: 10/12/81
Drawn By: DRG
Reviewed By: [illegible]
Job No: I-2543-3233

FIG. 6.5.2

the performance of the cell across the entire cell bottom. The upper system, the head dissipating system, will be used to ensure that no fluid head is allowed to develop on top of the clay liner. Each system will be sloped at 2% to a sump located in the center of the cell length on one side of the cell. The sumps will be accessed via a six-inch diameter collection pipe.

The cell side wall liners will be constructed with a horizontal dimension of 15 feet. This will provide a liner thickness normal to the cell wall of 6.7 feet. Five feet of liner thickness is the design thickness. The additional 1.7 feet of material will be installed to ensure the moisture content changes in the liner are minimized.

The integrity of the clay liners will be maintained through appropriate maintenance and management practices. A ramp or roadway will be constructed over the clay liner to allow direct access to the working face of the disposal area by the solidified waste delivery vehicles.

Only one secure disposal cell will be available for use at any given time. The solidified wastes will be placed in the cells in lifts of varying thicknesses (four to eight feet) and compacted with a bulldozer. The lifts can be thought of as subsections of the disposal cell. The actual placement of solidified wastes in each lift of the disposal cell will likely be performed in layers only a few inches thick. The surface of each lift will be covered with six inches of clay on a daily basis. Wastes placed within any given layer may be separated, depending on their compatibility, by clay partitions two feet wide. The two-foot clay partitions, placed entirely around the waste, have from past experience proven sufficient to inhibit mixing of incompatible wastes.

This procedure will be repeated until the cell is filled to within two feet of the ground surface. When the capacity of a cell is exhausted, a four-foot compacted clay cover (cap) will be placed on the cell and graded for drainage. A minimum of two feet of native topsoil will then be placed over the cap which has been provided with a 3% slope for drainage, to allow revegetation to aid in erosion control. During the operation of a secure disposal cell, berms will be constructed around the cell to divert surface runoff from outside the area to the non-contaminated surface water collection ponds.

Post-closure care of the vegetation cover will include weed control to remove seedlings of deep rooted plants. Weed control, combined with the sheer thickness and density of the cap, will effectively eliminate any problems of root penetration.

Some important statistics for the standard sized cell are summarized in Table 6.5.1.

6.5.2.2 Liner

The clay liners in the secure disposal cell will consist of one one-foot and one five foot layer of clay compacted at or above optimum moisture content to 95% of Modified Procter maximum dry density per the ASTM D1557 test method with a one foot leachate detection/collection system in between. In-place liner material will not be allowed to dry, thereby preventing shrinkage cracks from developing. Liner at the bottom of the cells will be covered with solidified waste material immediately after construction of the head dissipating system which is above the five foot thick clay liner.

TABLE 6.5.1

STATISTICS OF STANDARD SIZED SECURE DISPOSAL CELL

DESCRIPTION

1. 300' wide x 600' long x 30' deep (with liner in place)
2. Side walls sloped at 2:1 (horizontal to vertical)
3. 6.71' thick wall liner (15' horizontal thickness)
4. Cell depth from original grade to top of first sand layer is 30'
5. Final waste elevation is 2' below natural ground elevation
6. 1' thick sand - head dissipating system
7. 5' thick clay - floor liner
8. 1' thick sand - leachate detection system
9. 1' thick clay - bottom liner
10. 48" per lift, including 6" intermediate cover (alternatively, 96")
11. 4' thick cap (minimum) + 3% slope
12. 2' thick soil over cap

VOLUME STATISTICS

Total Excavation Volume (including overcut for liners) - 199,800 cu.yds.

Empty Volume (with floor and wall liners in place) - 144,900 cu.yds.

Volume of Non-waste Materials Installed Below Grade

a.	2' thick clay cap*	13,100
b.	Clay wall liner	33,000
c.	Intermed. cover (6" per 48" lift)	14,000
d.	1' sand - head dissipation system	3,200
e.	5' thick clay floor liner	14,400
f.	1' thick - leachate detection sand layer	2,500
g.	1' thick clay bottom liner	2,500
	Total	82,700

Volume Available for Solidified Waste (@ 48"/lift) 117,100 cu.yds.
(199,800 - 82,700 = 117,100)

Volume of Non-waste Materials Installed Above Grade

a.	2' thick soil cover	15,800 cu.yds.
b.	2' thick clay cap (incl. 3% slope)*	39,900 cu.yds.

Net Volume of Overburden 67,100 cu.yds.

*The combined 2' thick clay caps above and below grade represent the 4' thick total clay cap thickness. They have been separated to more easily account for overburden generation.

Liner thickness on the sides of the cell will be a minimum of 6.7 feet to maintain at least five feet of liner integrity even if cracks develop. The on-site clays meeting the following criteria are suitable for liner construction: greater than 80% passing the No. 200 Sieve, the Liquid Limit greater than or equal to 30, and the Plasticity Index greater than or equal to 7. Laboratory test results from on-site clays compacted to the above compaction criteria indicate the liners will have a permeability on the order of 1×10^{-8} cm/sec.

In order to evaluate the performance of the liner, a seepage analysis was conducted using the method of McWhorter and Nelson, of Colorado State University, as presented in their paper "Unsaturated Flow Beneath Tailing Impoundments" (in U.M.T.M., Vol. I, Proceedings of Symp., Nov. 20, 1978). Their procedure was developed for analyzing flow through partially saturated porous media. It is to be emphasized that the head dissipating system prevents the formation of a fluid head, in the unlikely event that leachate should occur. Without a fluid head, no seepage can possibly occur. Consequently, in order to perform the seepage analysis, three unrealistic assumptions were necessary: (1) that leachate would occur; (2) that the head dissipating system would fail; and (3) that a one foot fluid head existed over the bottom liner for a six-month period. Using the measured liner permeability of 1×10^{-8} cm/sec, the analysis indicated that for these conditions the equilibration of the narrow saturated zone created by the artificial placement of a fluid head on the liner would result in a six-foot zone of clay liner material containing that seepage. This seepage alone would <u>not</u> result in the formation of leachate because the clays would not be saturated and, therefore, would not allow the flow of liquids in this case.

Many of the on-site permeability tests were conducted at depths below the anticipated cell bottom elevation to ensure that lower permeability material exists below the cell elevations throughout the site. At the time of the field and laboratory programs, it was realized that clayey sands did exist in localized areas at the interface between the weathered shale bedrock and the surficial clays. It was, therefore, determined that compacted clay liners would be required, and that the actual permeabilities of the localized sandy lenses were not as critical as the actual grain size distribution of the material. The grain size distribution is a critical factor in determining which materials would be suitable for compacted clay liners. For this reason, more classification type testing than actual permeability testing was conducted in these sandy areas. F. M. Fox & Associates has, however, drilled six additional borings at the site. Of these six borings, one encountered a sandy lense that had a permeability of 4.6×10^{-6} cm/sec. It should be noted, however, that the majority of the site subsoil materials are of a lower permeability and that the clayey sands are discontinuous across the site.

The disposal cell excavations will be inspected by a qualified geotechnical engineering firm. The sidewalls of the disposal cell will be lined with a minimum 6.7 foot thickness of recompacted clay, and monitor wells will be constructed in any clayey sands that are encountered in the excavation of the cells.

A qualified field soils engineer will be retained to inspect and test the liner material to assure that it meets both the material and compaction specifications during construction. However, BFI is ultimately responsible to see that the disposal cells are constructed properly and to design specifications.

6.5.2.3 Cap

The top of each secure disposal cell will receive a four foot minimum clay cover (cap) sloped at 3% and compacted to 95% relative compaction which will achieve permeabilities similar to the liner. The overburden taken from the excavation of a new cell will be used for construction of the four-foot compacted clay cap. The four-foot thickness was considered the maximum cap thickness that would isolate the cells without significantly altering the site topography. Excess overburden will be placed outside the active site area to reduce topographical impacts. If all the overburden were used to cover the secure cells, the site topography would be severely altered. Native topsoils will be placed over the cap. The top will be planted with suitable vegetation to minimize erosion. Rainfall run-off from the surface of the capped cells will be collected in the non-contaminated surface water collection ponds.

6.5.2.4 Leachate Detection/Collection

Since the original Facility Plan submittal, several modifications to the disposal cell were made. The bottom liner construction has been changed, as previously described. The bottom most layer will be a one-foot thick layer of compacted clay with a one-foot layer of sand/gravel to act as a leachate detection/collection system. Over this will be the main liner of five feet of compacted clay. The head dissipating system (the uppermost layer of the four-layered bottom liner) will be a minimum of one-foot thick with a 2% slope directed to a collection point for liquid removal. Figure 6.5.2 illustrated a section view of the liner design. The initial waste layer will be distributed over the bottom, in an approximately four-foot lift, working from the high end to the lower end. The landfill equipment will then be working on top of the lift of waste and not on top of the head dissipating system.

The design of the disposal cell virtually precludes the formation of leachate within the disposal cell. In the unlikely event that leachate is generated in the disposal cells, the flow capacity of the head dissipating system sump, and weekly removal of the liquid from the sump, will prevent any significant hydrostatic head from building up anywhere in the disposal cell. With the permeability of the drain gravel being approximately 1,000,000 times greater than the liner, the leachate would move preferentially through the collection system to the sump, rather than into the liner.

The location of the collection sump has been changed. The new collection point will be in the center of the 600-foot dimension of the cell, at the bottom outside edge of the cell. With this design, the maximum distance that leachate must travel has been cut by half from that in the original design.

One parameter that influences the potential for leachate formation within the disposal cell is the degree of compaction of the solidified waste. No compaction and proctor tests have been performed on the specific solidified wastes to be handled at this site because representative samples are difficult to obtain due to the varied concentrations of any one type of waste over a period of time. However, Chapter 3 presented typical characteristics of solidified wastes from other BFI facilities. Although no optimum density will be specified for the solidified product, it is anticipated that the compaction effort that will be realized during waste placement will be sufficient to minimize long-term settlement within the disposal cell. In the event that minor amounts of liquids are generated, they will be collected in the head dissipating system to

ensure that no seepage can occur through the cell liner. A testing program will be conducted to ensure that long-term consolidation is not occurring to any significant extent in the solidified material. This program will consist of collecting in-place solidified waste samples within one year after placement and at two-year intervals in the first cell constructed. The analyses for these samples will include permeability testing, moisture content, and density testing. Records of moisture content of the solidified waste before placement in the disposal cell will be kept for comparison.

It is anticipated that generation of free liquids will be unlikely and not of any consequence due to (1) their small quantity, (2) the head dissipating system incorporated in the secure disposal cell, and (3) their overall low potential for leachate formation. If any liquids were formed, they would be collected in the head dissipating system, removed, solidified, and placed in a secure disposal cell.

6.5.2.5 Construction and Operating Plan

The following steps will be employed during construction and filling of a typical secure disposal cell:

1. The area will be stripped of usable topsoil. This soil will be stockpiled for future use on completed cells.

2. The cell will be excavated to the required depth and width, with overburden placed in predesignated areas.

3. The one foot thick bottom liner will then be constructed.

4. The sand leachate detection/collection system will be installed on top of the bottom liner, including the recovery sump and piping.

5. The five foot thick bottom and side liners will be constructed.

6. The head dissipating system will be installed, one foot depth at 2% minimum slope. Recovery sump and piping will be installed.

7. The necessary surface drainage control facilities will be constructed concurrent with the above items.

8. The wastes will be placed at the high end and worked toward the low end. The wastes will be deposited from dump trucks and spread with a dozer.

9. A six-inch thick layer of clay will be maintained over the top of the waste surface. It will be shaped and compacted with a dozer. This process will be repeated as the cell is filled.

10. The top of the cell will have a four-foot thick compacted clay cap graded to form a crown with 3% slopes. Additional topsoil (two feet) will be placed over the cap to promote surface drainage.

11. The final crowned surface will be vegetated to resist erosion.

As the filling of one secure disposal cell progresses, excavation of the next cell will begin so that space is available for solidified wastes at all times.

6.6 DESIGN OF SURFACE DRAINAGE COLLECTION FACILITIES

Surface drainage has been separated into three categories: non-contaminated, contaminated, and potentially contaminated. The collection ponds for the non-contaminated surface runoff were discussed in Sections 6.2.3 and 6.2.7.2.2. They will be constructed to the same specifications as the standard sized secure disposal cells except that a head dissipating system will not be employed. The designs for the contaminated water holding pond and the potentially contaminated holding water collection pond are discussed below.

6.6.1 Contaminated Water Holding Pond

The location of the holding and evaporation pond for contaminated water was illustrated earlier in Figures 6.2.3 and 6.3.2. This pond is under construction and will be utilized for both the Phase I and Phase II levels of operation. It is approximately 250 feet by 150 feet and 10

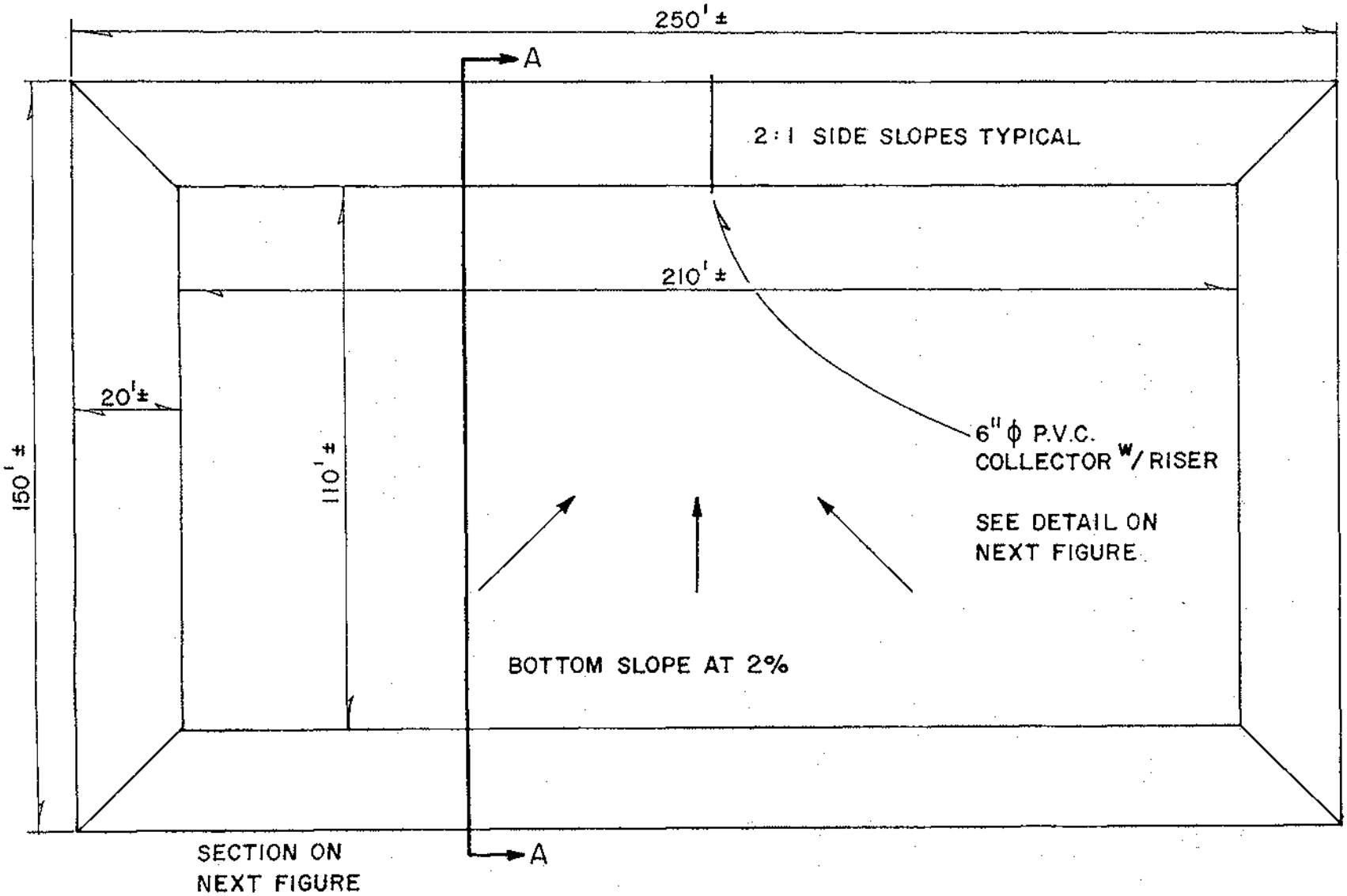
feet deep (available storage volume of about 2.2 million gallons). A plan view is presented in Figure 6.6.1, and a section view, with leachate collection detail, is presented in Figure 6.6.2. The liner system employed in the secure cells will be used in the contaminated water holding pond with two modifications: (1) no head dissipating system will be installed and (2) the floor liner system will be extended up the side walls of the pond.

Two feet of freeboard is provided for the pond. In the unlikely event that the level of the pond gets too high, liquid will be drawn off, treated at the solidification facility, and the solidified product placed in a secure disposal cell.

The water conveyed to the contaminated water holding pond will consist of the following:

- runoff from the secure cell being operated (only one secure disposal cell will be operated at any one time);
- runoff from the area immediately adjacent to the secure disposal cell in use (which will be surrounded by an earth berm);
- leachate collected from the head dissipating system of the closed secure disposal cells (should leachate occur), the potentially contaminated holding pond, and the contaminated holding pond;
- runoff from access routes to secure disposal cells;
- external truck wash water, when required.

The contaminated water holding pond has been designed to completely contain and evaporate all potentially contaminated rainfall runoff from the entire active site. This pond was sized to accommodate potentially contaminated runoff resulting from a 100-year, 24-hour maximum rainfall event, and to evaporate all of the annual potentially contaminated rainfall runoff collected from the active area.



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ARCHITECTS ENGINEERS PLANNERS

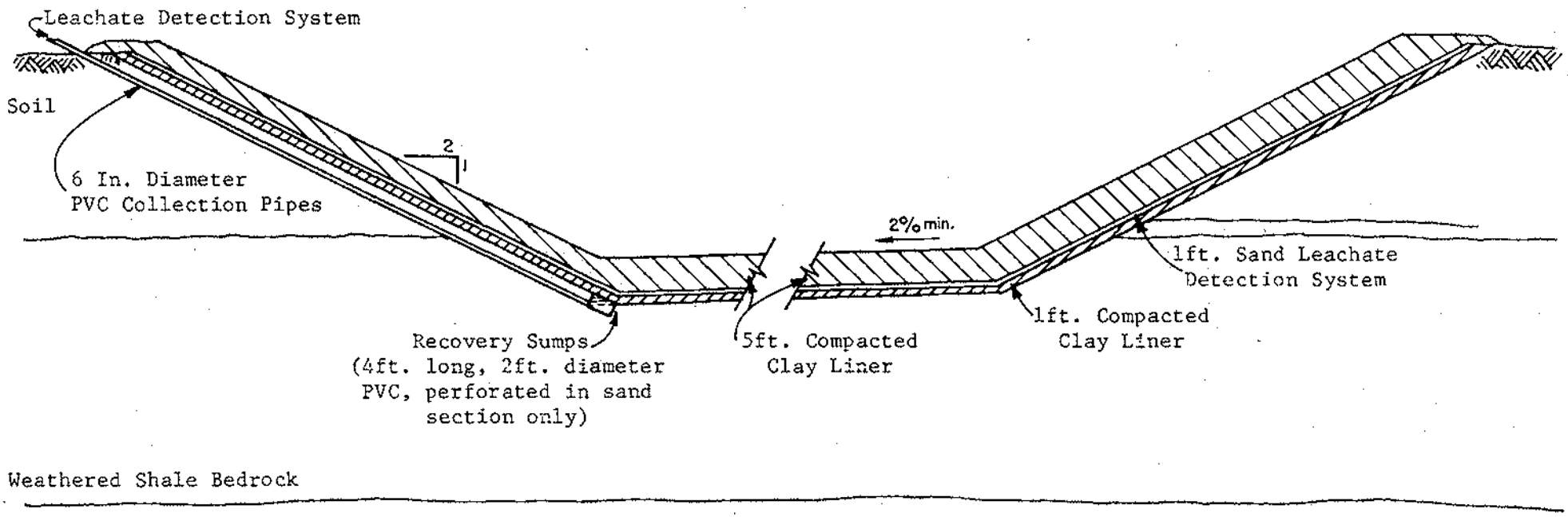
SCALE: 1" = 30'
0 10 20 30 60

FIGURE № 6.6.1
CONTAMINATED WATER HOLDING
POND PLAN

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

PRELIMINARY

CONTAMINATED WATER HOLDING POND - SECTION



General Notes:

1) Cell excavations should be inspected by a qualified soils engineer prior to any fill placement to insure that the cell is bottomed in weathered shake.

2) Clay liners and cap should be compacted to 95% of ASTM D-1557 at 0 to plus 3% of optimum moisture content.

3) Clays for liner material must meet material specification of:
   a) more than 80% passing the No. 200 Sieve
   b) Liquid Limit greater than or equal to 30
   c) Plasticity index greater than or equal to 7

4) All fill placement should be monitored by a qualified soils technician under the supervision of a registered professional engineer.

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ARCHITECTS ENGINEERS PLANNERS

FIGURE №6.6.2

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

to $2.00 per gallon; and prices for disposal in secure landfills ranged from $0.08 to $1.52 per gallon. It is noted that these prices are in terms of 1980 dollars and exclude transportation costs. The anticipated disposal fees in 1983 dollars are from $0.06 to $1.00 per gallon, with the average between $0.20 and $0.60 per gallon.

CHAPTER 7

OPERATIONAL CONTROLS AND MONITORING

7.1 INTRODUCTION

The implementation of the Resource Conservation and Recovery Act, or RCRA, (Public Law 94-580) resulted in the promulgation of numerous requirements governing the operation of hazardous waste treatment, storage, and disposal (TSD) facilities. The majority of these requirements were published in the Federal Register, Vol. 45-No. 98, on May 19, 1980. Various additional requirements, and modifications to those previously published have been presented in other issues of the Federal Register.

At the present time, the applicable requirements for the operation of this facility are the interim status standards for owners and operators of hazardous waste treatment, storage and disposal facilities. These standards are contained in Chapter 40 of the Code of Federal Regulations, Part 265, Subparts A through R (40 CFR 265.1-265.430) and are included in Appendix H as promulgated through February 20, 1981. As specified in the recently promulgated RCRA regulations, interim status standards are applicable to all TSD facilities (meeting certain requirements) until administrative action is taken on the individual facility's application for a final permit by the United States Environmental Protection Agency (EPA).

The purpose of this chapter is to describe the proposed operation of this facility and to demonstrate how the facility will conform to the interim status standards. To do this, various plans and procedures are

presented. For the convenience of reviewers of this chapter, this presentation is arranged in the same sequence and with the same headings as the published standards. Because each of the chapter sections must be written to stand on its own, some of the material has been presented several times, as required, to make each major section essentially a complete and separate document.

The interim status standards do not apply to certain specific hazardous waste disposal activities such as ocean disposal, underground injection, treatment at a publicly-owned treatment works, waste reclamation, generator storage for less than 90 days and several others. None of these exemptions is relevant to this facility. The only other exemption to the interim status standards is for facilities located in a state which has a RCRA hazardous waste program authorized by EPA to operate in lieu of the federal program. Since Colorado does not presently have an authorized program, this exemption does not apply.

7.2 GENERAL FACILITY STANDARDS

The general facility standards are contained in 40 CFR 265.10 to 265.17. These standards cover a series of requirements, including facility identification number, general waste analysis, security, general inspection requirements, personnel training, and general requirements for ignitable, reactive, or incompatible wastes. Compliance procedures for these standards are contained in the following subsections.

7.2.1 Identification Number

The owner or operator of every hazardous waste treatment, storage, or disposal facility must apply to EPA for a permanent EPA identification number. This identification number must be used in all subsequent permit

applications and related correspondence, annual reporting functions, and hazardous waste shipping documents.

A notification of hazardous waste activity (EPA Form 8700-12) was completed by the Highway 36 Land Development Company and submitted to EPA, in accordance with Section 3010 of RCRA and is contained in Appendix B. This notification resulted in issuance of EPA Identification Number COD 991300484 to this facility (Appendix C).

7.2.2 General Waste Analysis

The district manager will establish a program to determine the specific physical and chemical properties of hazardous wastes destined for treatment, storage, or disposal at this facility. The purpose of this waste analysis program is to:

- o verify the identity of incoming wastes;
- o promote safe storage and handling of the wastes; and
- o permit proper treatment and disposal in accordance with all pertinent regulations.

The following elements constitute the waste analysis program. Figure 1.4, previously presented, illustrated this plan schematically.

1. Prequalification of Waste Streams

   All waste streams proposed for treatment, storage or disposal at this facility will first undergo a preliminary screening process by BFI to determine that the characteristics of candidate waste streams are compatible with the capabilities of the facility. This prescreening process will involve laboratory analysis of a representative sample of the waste at BFI's laboratory in Houston, Texas or submission of independent laboratory analyses by the generator, and when appropriate, could include review of chemical manufacturer's specifications or published data on these or similar wastes. This review aids BFI's Houston lab in determining if the analyses are correct and made on the representative material to be discarded.

2. Waste Characterization by Generator

   The generator will be required to submit a completed BFI waste characterization data sheet as shown in Figure 7.2.1.

FIGURE 7.2.1

BROWNING-FERRIS INDUSTRIES
CHEMICAL WASTE SYSTEMS

BFI Waste Code No. _____

EPA Generator Id. No. _____

WASTE CHARACTERIZATION DATA

General Directions: In order for us to determine whether we can lawfully and safely transport, treat, and dispose of your waste material, we must obtain certain information about the chemical and physical properties of the waste and its chemical composition. Please be complete in your answers; if your response is "none" or "not available", so indicate. Answers must be printed in ink or typewritten and the completed form must be signed. Please make a copy of this form for your records. PLEASE PRESS HARD, THIS IS A FIVE PART NCR FORM.

(1.) Generator Name: _____ Date _____
(2.) Generating Facility Complete Address _____
(3.) Authorized Company Representative: _____ Title: _____
(4.) Phone Number: _____

(5.) Emergency Contact _____ Title _____ Phone Number: _____
(6.) General Description of The Waste: _____

(7.) Process Generating Waste: _____

(8.) Anticipated volume _____ [ ] Gallons [ ] Tons [ ] Cubic Yards [ ] Drums, or [ ] Other _____
Per: [ ] Day [ ] Week [ ] Month [ ] Year, or [ ] Other _____
(9.) Waste Properties:
(a.) Vapor pressure (in mm of Hg @ 25°C) _____
(b.) Flash Point _____ [ ] °F [ ] °C [ ] Closed Cup [ ] Open Cup
(c.) Phases/layers: [ ] Single [ ] Bilayered [ ] Multilayer
(d.) Physical State @ 20 °C: [ ] Solid [ ] Liquid [ ] Semi-Solid [ ] Powder [ ] Other _____
(e.) Solubility (g/100g H_2O) @ 20 °C: _____ (f.) pH _____
(g.) Density: _____ [ ] lb./ft.^{3} [ ] lb./yd.^{3} [ ] lb./gal. [ ] g/cc
(h.) Odor: [ ] Strong [ ] Mild [ ] None
(i.) Reactivity:
Hydrophoric [ ] Yes [ ] No Autopolymerizable [ ] Yes [ ] No Shock Sensitive [ ] Yes [ ] No
Pyrophoric [ ] Yes [ ] No Thermally Sensitive [ ] Yes [ ] No Explosive [ ] Yes [ ] No

(10.) Complete waste composition (with ranges – indicate % or ppm.) Attach Additional Pages If Necessary
ORGANIC INORGANIC
_____
_____
_____
_____

(11.) Sample Included [ ]
(12.) Manifest Information

Proper USDOT Shipping Name	USDOT Hazard Class	UN or NA No.	USEPA Haz. Code	USEPA Haz. Waste No. (Type)

(13.) This waste contains:
Biological Materials [ ] Yes [ ] No Pathogens [ ] Yes [ ] No Etiological Agents [ ] Yes [ ] No
Radioactive Materials [ ] Yes [ ] No PCB's [ ] Yes [ ] No Dioxin [ ] Yes [ ] No
If yes, specify type (if applicable) and concentration _____
(14.) Have you obtained toxicity studies of this waste material? _____ If so, please attach a copy of the results.
(15.) Required personnel protective equipment & procedures _____
_____

I hereby certify that the above and attached description is complete and accurate to the best of my knowledge and ability to determine, that no deliberate or willful omissions of composition or properties exists, and that all known or suspected hazards have been disclosed.

Generator's Authorized Signatory

_____ Title _____ Date _____

Confidentiality Agreement: As consideration for the Generator's release of the above information and any other supplemental data, the undersigned agrees to treat such information as confidential property and will not disclose such information to others except as is required by law, and in such circumstances only after first giving notice to the Generator.

By _____ Name BFI Representative _____ Title

BFI Houston Lab Distributes:
DISPOSAL SITE - white copy TRANSPORTATION - green copy LAB - pink copy REGIONAL OFFICE - yellow copy SALES OFFICE - gold copy

By _____ Name BFI Representative _____ Title

BFI Houston Lab Distributes:
DISPOSAL SITE - white copy TRANSPORTATION - green copy LAB - pink copy REGIONAL OFFICE - yellow copy SALES OFFICE - gold copy

By _____ Name BFI Representative _____ Title

BFI Houston Lab Distributes:
DISPOSAL SITE - white copy TRANSPORTATION - green copy LAB - pink copy REGIONAL OFFICE - yellow copy SALES OFFICE - gold copy

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By _____ Name BFI Representative _____ Title

BFI Houston Lab Distributes:
DISPOSAL SITE - white copy TRANSPORTATION - green copy LAB - pink copy REGIONAL OFFICE - yellow copy SALES OFFICE - gold copy

3. Decision to Accept or Reject Candidate Waste Stream

A recommendation to accept or reject a candidate waste stream will be made by BFI's technical staff. This recommendation will be based on the facility's capabilities, following review of the data obtained by the procedure outlined in #1 and #2 above. Any problems with the fixation of wastes will be assessed during the initial screening. Kiln dust volume to volume or weight to weight ratios along with volume increases are noted by the Houston lab. If a waste stream is found to be acceptable for receipt at this facility, the generator will be notified and a laboratory pretreatment and disposal recommendation form, as shown in Figure 7.2.2., will be prepared. The generator will also be notified as to any specific pretreatment or packaging requirements which may be applicable for the particular waste. Typical contractual agreements for waste treatment/solidification and disposal are given in Appendix M.

4. Facility Notification

Copies of laboratory data, forms and correspondence indicated above will be transmitted to this facility for use by the facility management and technical personnel when the waste stream is subsequently shipped to the facility.

5. Verification of Waste Identity

Upon arrival of a waste stream at the facility, its identity will be verified by comparing its physical and chemical characteristics to those described in the documents on file (see #4 above) and by comparing results of laboratory analysis of a representative sample of the waste as received to those results previously obtained during the prequalification process. The facility laboratory will be equipped to perform the necessary analyses on incoming wastes.

Due to the variances typically encountered in liquid, semi-solid, and solid wastes' physical and chemical states and the range of container types available, no single type of sampler can be used to collect a representative sample of all types of wastes. Table 7.2.1 from "Test Methods for Evaluating Solid Waste" (EPA SW-646-1980) will be used in the selection of the proper sampling equipment depending upon the sampling point and waste types. Lab personnel will wear full safety gear while obtaining and testing the waste samples.

On-site analysis of a representative sample will (a) verify conformity with manifest and generator's waste characterization data and (b) provide technical support for decisions on management of the waste. Conflicting data will be resolved to the satisfaction of both an authorized representative of the waste generator and the site chief chemist prior to disposal of that waste. This includes obtaining a new waste characterization data sheet and performing new lab analysis if necessary. The

FIGURE 7.2.2

Browning-Ferris Industries
HOUSTON LABORATORY

Date _____

PRETREATMENT AND DISPOSAL RECOMMENDATION

BFI _____ Source _____

1. Sample Description: Liquid _____ Sludge _____ Solid _____ Mix _____

Number of Phases (% v/v of each) _____ Color _____ Odor _____

pH _____ Density _____ (lb/gal) (lb/cu. ft.) Flash Point _____°F Total Solids _____ % w/w Ash _____ % w/w

Comments:

2 Pretreatment:

_____ A. Phase Separation _____ C. Oxidation/Reduction

_____ B. pH Adjustment _____ D. Other _____

Comments:

3. Disposal Recommendation:

_____ A. Solidification: Volume percent of Original Waste _____

1. Kiln Dust _____ Fly Ash _____

a. Ratio of Absorbent to Waste _____ c. Volume Increase _____ times original

b. Reaction upon mixing _____ d. Final Disposal: See attached leachate data _____

(1) Sanitary Landfill _____

(2) Secure Landfill _____

Cell Type _____

2. Liq-Wa-Con® _____

a. Reagent Ratio _____ c. Volume Increase _____ times original

b. Reaction upon Mixing _____ d. Final Disposal: See attached leachate data _____

(1) Sanitary Landfill _____

(2) Secure Landfill _____

Cell Type _____

_____ B. Deep Well Disposal: Volume percent of Original Waste _____

1. Calcasieu _____ 3. Chaparral _____

2. Sonics _____ _____ See attached Deep Well Analysis

_____ C. Incineration: Volume percent of Original Waste _____

_____ D. Other:

Comments:

The above is a recommendation of the BFI Houston Laboratory Group. It must be understood that local regulations (if more stringent) regarding disposal of specific wastes takes precedence over the laboratory's recommendations.

_____

TABLE 7.2.1

SAMPLING EQUIPMENT FOR PARTICULAR WASTE TYPES

Sampling Point / Waste Type	Drum	Sacks and Bags	Open Bed Truck	Closed Bed Truck	Storage Tanks or Bins	Waste Piles	Ponds, Lagoons & Pits	Conveyor Belt	Pipe
Free Flowing Liquids and Slurries	Coliwasa	N/A	N/A	Coliwasa	Weighted Bottle	N/A	Dipper	N/A	Dipper
Sludges	Trier	N/A	Trier	Trier	Trier	N/A		N/A	N/A
Moist Powders or Granules	Trier	Trier	Trier	Trier	Trier	Trier	Trier	Shovel	
Dry Powders or Granules	Thief	Thief	Thief	Thief	Thief	Thief	Thief	Shovel	
Sand or Packed Powders and Granules	Auger	Auger	Auger	Auger				N/A	
Large Grained Solids	Large Trier	Large Trier	Large Trier	Large Trier	Large Trier	Large Trier	Large Trier	Large Trier	

N/A = Not Applicable

waste can be stored on the truck at the disposal site during this procedure. Any waste found to be unacceptable for disposal will not be returned to the generator until, at a minimum, the following conditions have been met:

- o Approval by either site chief chemist or district manager.
- o Notification to the following:
  - Colorado Department of Health
  - Generator
  - Appropriate BFI salesman

The following procedures are planned for the implementation of the waste analysis plan at this facility:

1. The vehicle carrying the hazardous waste shipment will be stopped at the guardhouse at the site entrance. The security guard will obtain a bill of lading and check the hazardous waste manifest (See Figure 7.2.3 for an example) from the driver.

2. The vehicle driver will present the bill of lading and the hazardous waste manifest to the chief chemist or his designee.

3. A technician under the direction of the chief chemist will check the bill of lading and the generator and transporter portions of the manifest for completeness and consistency with data in site files, then verify that a waste characterization data sheet and a laboratory pretreatment and disposal recommendation form are on file for the waste, and that the shipment is scheduled for receipt.

4. A technician under the direction of the chief chemist will then obtain a representative sample of the waste shipment for on-site analysis to determine that the material contained in the shipment conforms to the waste described on the hazardous waste manifest accompanying the shipment and to the waste characterization data sheet for that waste. The specific tests necessary for any particular waste will be determined by BFI's laboratories (Houston) or BFI's chief chemist and will be sufficient for comparison purposes.

   The observations and analyses which may be performed at the facility on incoming wastes are listed below. Each drum of any drummed waste shipment will be sampled. There are no cases when a truck load of waste would not be sampled and analyzed on-site before it is accepted for disposal.

   - o Flash point
   - o Threshold Odor
   - o Color
   - o Ammonia
   - o Settleable Solids
   - o Acidity
   - o Alkalinity

FIGURE 7.2.3

Browning-Ferris Industries

HAZARDOUS WASTE SHIPPING MANIFEST

(SEE BACK FOR OTHER PROVISIONS/INSTRUCTIONS)

Manifest Document No. 80-00301

BFI WASTE CODE ____ / ____ / ____ / ____

DESTINATION'S EPA IDENTIFICATION NO ____

GENERATOR'S EPA IDENTIFICATION NO ____

GENERATOR'S EMERGENCY PHONE NO ____

TRANSPORTER'S EPA IDENTIFICATION NO ____

NATIONAL EMERGENCY RESPONSE CENTER PHONE NUMBER 800 - 424 8802

SECTION I — GENERATOR INFORMATION

SUBSECTION A. — GENERAL INFORMATION

COMPANY NAME ____ BUSINESS PHONE NO. ____

ADDRESS ____ EMERGENCY PHONE NO. ____

____ EPA IDENTIFICATION NO. ____

COMPANY REPRESENTATIVE ____ TITLE ____

SUBSECTION B. — WASTE IDENTIFICATION

DESCRIPTION OF WASTE/PROCESS SOURCE BY PROPER EPA AND DOT SHIPPING NAME	DOT HAZARD CLASS	EPA/STATE HAZARDOUS WASTE NO.	AMOUNT OF WASTE	UNIT OF MEASURE	TYPE/NO. OF CONTAINER(S)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

SUBSECTION C. — CERTIFICATION

As the duly authorized representative of the above identified generator, I hereby certify that:

(i) I have personally examined and am familiar with the information contained in this shipping manifest and in all attached documents, and

(ii) The information contained in this shipping manifest is true, accurate, and complete; and

(iii) The named hazardous waste/materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to applicable regulations of the U.S. Department of Transportation, the U.S. Environmental Protection Agency, and all applicable state and local authorities; and

(iv) The designated destination for the hazardous waste/materials is in compliance with all permit requirements for the storage, treatment and disposal of hazardous waste/materials.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

GENERATOR'S AUTHORIZED REPRESENTATIVE SIGNATURE ____ TITLE ____ DATE OF SHIPMENT ____

SECTION II — TRANSPORTER INFORMATION

SUBSECTION A. — GENERAL INFORMATION

COMPANY NAME ____ BUSINESS PHONE NO. ____

ADDRESS ____ EMERGENCY PHONE NO. ____

____ EPA IDENTIFICATION NO. ____

COMPANY REPRESENTATIVE ____ TITLE ____

SUBSECTION B. — CERTIFICATION

As the duly authorized representative of the above identified transporter, I hereby certify that I have reviewed the information contained in this manifest and agree to comply with all applicable instructions. In the event that I cannot comply with those instructions, for any reason, I will immediately contact the above identified generator's appropriate representative at the emergency phone number listed herein.

By executing this manifest, I acknowledge that the above identified transporter is solely responsible for notifying all appropriate authorities (including the U.S. Department of Transportation: Phone Number 800 - 424-8802) and the required clean-up with respect to the spillage or discharge of any materials transported under this shipping manifest.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

TRANSPORTER'S AUTHORIZED REPRESENTATIVE SIGNATURE ____ TITLE ____ DATE OF RECEIPT ____

SECTION III — DESTINATION INFORMATION

SUBSECTION A. — DESTINATION DESIGNATION

Primary Shipment Destination. (Note: All facilities designated by the generator to receive hazardous waste must be in compliance with all federal, state and local permit requirements, including but not limited to those requirements contained in 40 CFR Parts 122, 123, 124, 129 and 265.)

FACILITY NAME ____ EPA IDENTIFICATION NO. ____

ADDRESS ____ FACILITY OPERATOR'S EMERGENCY PHONE NO. ____

FACILITY OPERATOR'S NAME (ie. COMPANY NAME) ____ FACILITY OPERATOR'S BUSINESS PHONE NO. ____

ADDRESS ____

Secondary Shipment Destination.

FACILITY NAME ____ EPA IDENTIFICATION NUMBER ____

ADDRESS ____ FACILITY OPERATOR'S EMERGENCY PHONE NO. ____

FACILITY OPERATOR'S NAME (ie. COMPANY NAME) ____ FACILITY OPERATOR'S BUSINESS PHONE NO. ____

ADDRESS ____

SUBSECTION B. — CERTIFICATION

I hereby certify that I have inspected and/or analyzed the hazardous wastes accompanying this shipment in accordance with the requirements of 40 CFR § 265.13 and that to the best of my knowledge, the quantity and quality of the hazardous wastes received substantially conform to the hazardous wastes identified and listed herein.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

DESTINATION'S AUTHORIZED REPRESENTATIVE SIGNATURE ____ TITLE ____ DATE OF RECEIPT ____

© BROWNING-FERRIS INDUSTRIES, INC. 1980

ORIGINAL—SEND TO GENERATOR AFTER FULLY DELIVERED

REPRESENTATIVE SIGNATURE ____ TITLE ____ DATE OF RECEIPT ____

© BROWNING-FERRIS INDUSTRIES, INC. 1980

SECOND PART—GENERATOR COPY

REPRESENTATIVE SIGNATURE ____ TITLE ____ DATE OF RECEIPT ____

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THIRD PART—TRANSPORTER COPY

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FOURTH PART—DESTINATION COPY

- No. of phases & percentage (liquid/solid content)
- Viscosity
- Specific gravity or bulk density
- Reactivity (water/air)
- pH (corrosivity)
- Cyanide
- Sulfide
- Chlorine
- Nitrate
- Total Solids
- Suspended Solids
- Radioactivity
- Free Liquids
- Water Solubility

In addition to the above tests, if the waste is destined for solidification followed by burial in a secure disposal cell, the following analyses may have to be performed to determine the compatibility of the incoming waste with site operations:

- Reaction or evolution of gases resulting from the addition of hydrochloric acid to a portion of the sample until the pH of the mixture is less than one.

- Reaction or evolution of gases resulting from addition of sodium hydroxide to a portion of the sample until the pH of the mixture is greater than 13.

These analyses are required to ensure that wastes can be combined without the formation of gases hazardous to facility personnel.

5. The above analytical data will be entered in a bound laboratory notebook under a heading identifying the origin of the sample along with other data identifying the shipment, and the quantity of waste received. Calculations associated with the generation of analytical data will be shown in the laboratory notebook.

6. A shipment will be detained for any of the following reasons until all discrepancies are resolved to the satisfaction of the facility chief chemist:

   - if the hazardous waste manifest is incomplete or incorrect;

   - if the required forms are not on file for the waste material;

   - if the shipment has not been previously scheduled;

   - if the on-site analysis shows the shipment to differ substantially from the waste described, the hazardous waste manifest or the waste characterization data sheet.

If no resolution is possible, the shipment will be returned to the generator after conditions noted earlier in "Verification of Waste Identity" have been met.

If all of the above requirements are met, the designated facility technical personnel under the direction of the operations

manager, using the results of onsite analysis and information obtained from the pretreatment and disposal recommendation sheet, will prepare a shipment/receipt/transfer form shown in Figure 7.2.4 for the shipment, indicating a waste receipt into the site. This form will contain detailed instructions regarding the location at which the material is to be off-loaded and any special procedures and safety equipment to be utilized during off-loading.

7. The facility technical personnel will then complete and sign the facility portion of the hazardous waste manifest, retaining one copy for facility files, and forwarding the remaining copies as instructed on the manifest.

8. The shipment/receipt/transfer form will be read and signed by the vehicle driver and the facility personnel under the direction of the operations manager responsible for off-loading the shipment. By signing the form, the driver and facility operations personnel signify that they have read and understood the instructions contained on the form and, further, that they are capable of executing the off-loading in accordance with those procedures.

9. The shipment will then be off-loaded by technicians in coordination with the solidification supervisor in accordance with the instructions on the shipment/receipt/transfer form, observing all safety precautions and wearing all required protective equipment. <u>BFI policy is that any variation from the instructions stated on that form without the written authorization of the district manager or failure to wear all required personnel protective equipment and observe all safety procedures, constitutes grounds for disciplinary action, including dismissal.</u>

10. If required, the vehicle which contained the waste shipment will be internally/externally washed out or decontaminated in accordance with instructions listed on the shipment/receipt/transfer form. Upon completion of off-loading and truck washout, the shipment/receipt/transfer form will be returned to the site chief chemist or his designee indicating that the shipment was properly received.

11. To ensure that the proper mixture of reagent to waste were obtained, BFI will have an independent laboratory determine a specific retention value for each solidification reagent. These values will be used as specifications for each mixing basin. On a routine basis, representative samples of solidified waste will be tested for moisture content. If the moisture content is below the required specific retention value, the waste will be transferred to the disposal cell. If the moisture content is above the specific retention, additional reagent will be added prior to disposal until the specified moisture content is obtained. Records of moisture content data will be maintained on-site for review by regulatory personnel.

FIGURE 7.2.4

Browning-Ferris Industries, Inc.

SHIPMENT/RECEIPT/TRANSFER FORM

DATE_____
BFI WASTE CODE_____
TDWR TICKET #_____
TDWR WASTE CODE_____
VOLUME_____UNITS_____

TRUCK #_____ SHIPMENT/RECEIPT/TRANSFER (circle one)
JOB #_____ SHIPMENT/RECEIPT/TRANSFER TANK OR LAGOON #_____
GENERATOR_____

SPECIAL SAFETY INSTRUCTIONS_____

HANDLING/SEGREGATION_____

TRUCK WASHOUT_____

SIGNATURES (read before signing)

CHEMIST_____ TIME_____

COORDINATOR_____ TIME_____

DRIVER_____ TIME_____

TANK FARM PERSONNEL_____ TIME_____

COORDINATOR_____ TIME_____

7.2.3 Security Plan

The security plan regulations outlined in 40 CFR 265.14 have a two-fold purpose:

- to set general performance standards which prevent the unknowing entry of people onto the active portion of the site;
- to minimize the potential for the unauthorized entry of people, livestock, or other animals onto the active portion of the site.

The security system proposed for this site provides for positive control and monitoring of all entry onto the active portion of the site. The structures and security personnel at the access points will prevent the direct entry of unauthorized personnel onto the site and the fence and signs surrounding the site will prevent the unknowing entry of people, livestock, or other animals onto the active portion of the site. The required warning signs will indicate that only authorized personnel are allowed within the active portion of the site and that entry may be dangerous. The warning signs will be in the English language because the demographic characteristics in the surrounding area are such that there are not significant non-English speaking population groups.

To satisfy the requirements of Section 40 CFR 265.14 of RCRA, the district manager will implement the following security system to prevent the unknowing and unauthorized entry of people, livestock, or other animals onto the active portion of the facility:

- A chain link perimeter security fence will surround the active portion of the site (see Figure 6.2.1). The fence will be of sufficient height to meet the intentions of the regulations.
- Security personnel will be stationed in a guard house at the operating access point onto the active portion of the site at all times. All other gates used occasionally for maintenance, inspections, etc., will stay closed and secured. They will be opened only by security personnel during maintenance and inspections and will be monitored by the security personnel while open during these activities.

- Gates onto the active portion of the site will be controlled manually or electro-mechanically by security personnel during site operating hours and closed and secured during non-operating hours.

- A sign will be posted at each access point onto the active portion of the site. It will have the following legend, "DANGER - Unauthorized Personnel Keep Out", and will be legible from a distance of at least 25 feet.

- Signs will be posted along the periphery of the site at approximately 200 foot intervals having the legend, "DANGER - Unauthorized Personnel Keep Out", to warn unknowing people that entering onto the active portion is potentially dangerous.

- A daily survey will be conducted to inspect the perimeter security fence for damage from vandalism or weather. The results of the perimeter security fence survey will be recorded in the site operational log and any damage found will be corrected.

- Entry to the active portion of the site will be restricted to site personnel and properly identified persons whose entry is authorized by the site management. Authorized visitors will only be allowed near the active area of the site when accompanied by a site representative designated for that purpose by the district manager.

- The entry gate, guard house, and immediate surroundings will be well lighted during periods of darkness.

7.2.4 General Inspection Plan

The general inspection plan for this facility has been developed in four interrelated parts, which correspond to the four sub-sections in 40 CFR 265.15. These parts are the statement of need, written inspection schedule, response to incidents, and inspection records.

7.2.4.1 Statement of Need

BFI recognizes the need for periodic inspection of the facility components and equipment, as an intrinsic part of an overall personnel safety and environmental security program. Therefore, the district manager will establish and adhere to an on-going general inspection plan which is intended to identify and correct problems before they result in harm to health or the environment.

The on-going BFI corporate maintenance scheduling program will be used at the site to assure reliable and effective equipment availability. This program will be expanded, as required, to meet the specific needs of the Adams County site.

7.2.4.2 Written Inspection Schedule

A complete facility inspection will be conducted daily on normal operating days by trained and technically qualified personnel assigned to this duty by the operations manager. Some items, such as tanks, drainage ditches, and concrete structures, require periodic inspection, but are not subject to sudden failure or deterioration. These items will be inspected on a weekly basis, in conjunction with the routine daily inspection. In addition, mechanical equipment requires periodic service and preventive maintenance procedures to ensure proper functioning and reliability. These procedures, and their frequency, vary. The district manager will develop an equipment service and maintenance schedule coordinated with existing BFI maintenance programs in accordance with the specific recommendations of the manufacturer of the various items of equipment which are used at this facility.

Each daily and weekly inspection will be documented by an inspection report form, which will be completed, signed, and dated by the person assigned to perform the inspection under the direction of the operations manager. The inspection report form will indicate the items inspected and will note any deficiencies observed during the inspection, including, if appropriate, a comment on the severity of the condition. Examples of typical daily and weekly inspection report forms are shown in Figures 7.2.5 and 7.2.6, respectively.

FIGURE 7.2.5
SAMPLE DAILY SITE INSPECTION REPORT

General Facility Conditions

Security fencing-gates-locks
Unauthorized entry
Liquid discharges-odor
Perimeter drainage facilities
Wind-blown wastes-debris
Emergency response equipment
Spilled material within facility
Condition of non-all-weather roads - Dust, ruts
"No Smoking" regulations obeyed

Solidification Facilities

Observe freeboard levels in tanks
Personnel protective equipment used
Decontamination equipment accessible
Emergency equipment in place
Spillage-discharge from facility
Security barriers
Unusual odor
Dust collection & ventilation system gauges

Secure Landfill

Free liquids in landfill
Personnel protective equipment used
Decontamination equipment accessible
Emergency equipment in place
Integrity of leachate standpipes
Area drainage facilities
Unusual odors-other emissions
Presence of fugitive material
Integrity of monitoring wells
Operating guidelines/procedures

Containers

Leakage or spillage
Placement-segregation of containers
Identification of contents
Damage to containers
Accessibility within facility
Emergency equipment in place

Tanks

Personnel protective equipment used
Decontamination equipment accessible
Emergency equipment in place
Discharge control equipment
Operating guidelines/procedures
Unusual odors-other emissions
Spillage-discharge from tanks

Impoundments

Freeboard level (2 feet or greater)
Unusual odors-other emissions

OBSERVATIONS AND COMMENTS

Date: _____ Signature: _____

FIGURE 7.2.6
SAMPLE WEEKLY SITE INSPECTION REPORT

General Facility Conditions

Perimeter drainage facilities
Condition of hard surfaced roads
Operability of emergency equipment
Remote monitoring well condition

Solidification Facilities

Condition of mechanical equipment
Operability of decontamination equipment
Operability of emergency equipment

Secure Landfill

Operability of decontamination equipment
Operability of emergency equipment
Condition of drainage systems
Degree of cover over wastes
Damage to closed portions
Escape of leachate-closed portions

Containers

Container corrosion/deterioration
Operability of emergency equipment
Condition of storage pad
Condition of protective barriers

Tanks

Operability of decontamination equipment
Operability of emergency equipment
Evidence of corrosion
Structural integrity of tanks-supporting structures
Erosion or damage in the area

Impoundments

Condition of embankments, erosion
Evidence of leakage
Condition of vegetation-other cover

OBSERVATIONS AND COMMENTS

Date: _____ Signature: _____

Inspection reports will be directed to the district manager or his designee, who will be responsible for noting the deficiencies and implementing the appropriate corrective action. Inspection reports will be incorporated into the daily operating record of the facility.

On days the facility is not operating, such as weekends and holidays, site security personnel will conduct tours of the facility to check for unusual conditions or breaches of security.

The following items will be included in the daily facility inspection: (See Figure 7.2.5)

- o <u>General Facility Conditions:</u>
  - Integrity of security fencing, gate(s), and locks;
  - Evidence of unauthorized entry;
  - Evidence of unauthorized liquid discharges or unusual odor;
  - Functioning of perimeter drainage control berms;
  - Presence of wind-blown wastes or debris;
  - Presence of spilled, dropped or leaked material along access roads, transportation routes within the facility, and waste loading/unloading areas;
  - Condition of non-all-weather surface roads as to dust or ruts;
  - Adherence to "No Smoking" regulations, where applicable;
  - Presence of emergency response equipment.
- o <u>Solidification Facilities:</u>
  - Observation of freeboard levels in all receiving basins;
  - Utilization of required personnel protective equipment by operating personnel and visitors;
  - Accessibility of personnel decontamination equipment;
  - Presence of emergency response equipment;
  - Evidence of spillage or discharge around or from the facility;
  - Condition of security barriers;
  - Unusual odors;
  - Observation of dust collection and ventilation system gauges for proper flow pressures.
- o <u>Secure Disposal Cells</u>
  - Presence of free liquids in the secure disposal cell;
  - Utilization of required personnel protective equipment by operating personnel and visitors;
  - Accessibility to personnel decontamination equipment;
  - Presence of emergency response equipment;
  - Integrity of leachate collection standpipes;
  - Operation of area drainage facilities;
  - Presence of unusual odors, vapors, or other emissions;
  - Observance of operating guidelines and procedures;
  - Presence of any fugitive wastes or debris;
  - Evidence of escape of leachate;
  - Integrity of monitoring wells adjacent to active areas.

- o Containers:
  - Evidence of leakage or spillage;
  - Proper placement, storage or segregation of containers;
  - Container contents identified;
  - Damage to containers;
  - Accessibility throughout the storage facility;
  - Presence of emergency response equipment.

- o Tanks:
  - Utilization of required personnel protective equipment by operating personnel and visitors;
  - Presence of personnel decontamination equipment;
  - Presence of emergency response equipment;
  - Evidence of leakage, spillage, or discharge in, around, or from the facility;
  - Observance of required operating guidelines and procedures;
  - Unusual odors, vapors or other emissions;
  - Level of tank contents;
  - Condition of discharge control equipment (waste feed cut-off systems, by-pass systems, etc.).

- o Impoundments:
  - Observe freeboard level to be two feet or greater;
  - Check for unusual odors, vapors or other emissions.

The following items will be included in the weekly facility inspection (see Figure 7.2.6):

- o General Facility Conditions:
  - Condition of perimeter drainage facilities;
  - Condition of all-weather surface roads;
  - Condition of emergency response equipment;
  - Surface condition of remote monitoring wells.

- o Solidification Facilities:
  - Condition of tanks, pumps, and other mechanical equipment;
  - Operability of personnel decontamination equipment;
  - Condition of emergency response equipment.

- o Secure Disposal Cells:
  - Operability of personnel decontamination equipment;
  - Condition of emergency response equipment;
  - Condition of area drainage facilities;
  - Degree of cover over buried wastes;
  - Evidence of erosion, differential settlement, ponding, or cap damage on closed portions of the landfill;
  - Evidence of escape of leachate from closed portions on the landfill.

- o Containers:
  - Evidence of corrosion or deterioration of containers;
  - Operability of emergency response equipment;
  - Condition of storage pad;
  - Condition of protective barriers.

- o Tanks:
  - Operability of personnel decontamination equipment;
  - Operability of emergency response equipment;
  - Evidence of corrosion;
  - Structural integrity of tanks and supporting structures;
  - Evidence of erosion or damage within the area.

- o Impoundments:
  - Condition of embankments, erosion;
  - Evidence of leakage;
  - Condition of vegetation or other cover.

The head dissipating systems in closed secure disposal cells will be inspected for the presence of liquid on a monthly basis. The contaminated water holding ponds will be sampled after each significant precipitation, but no less than once a month.

7.2.4.3 Response to Incidents

The facility employee assigned to perform the site inspections will record his observations on the appropriate inspection report, utilizing a system similar to placing a checkmark along side an inspection item that was observed to be satisfactory, and an "X" along side an item that was found not to be in compliance. When appropriate, a notation would be made on the report as to the severity of an item requiring corrective action, to assist facility management in taking a timely and appropriate course of action. Any items found not to be in compliance, but which are corrected at the time of the inspection, will be marked as being non-compliant, but with a notation that appropriate corrective action was taken.

Upon completion of each inspection, the person performing the inspection will sign and date the inspection report, to acknowledge that the inspection was complete, was personally performed, and that the inspection report accurately reflects the conditions actually observed.

BFI management will require prompt and on-the-spot correction, whenever possible, of any non-compliant conditions.

Any situation or condition encountered during the inspection which constitutes an actual or potential threat to health, safety or the environment, and cannot be remedied on the spot, will be immediately reported to the district manager, operations manager, or other responsible person who has authority and responsibility to immediately initiate whatever remedial action is appropriate.

The facility will be visited by an industrial hygienist for the purpose of evaluating personnel exposure. This will include noise, particulate, and vapor sampling. A review of the facility's respiratory protection, change facilities, personnel protective equipment, and record keeping will be conducted.

Based upon the results of the exposure evaluation, a program will be developed for the selection and use of personnel protective equipment. This system will involve a cross-reference system for the waste characterization data sheets to the necessary personnel protective equipment and change facilities. In addition, an industrial physician will be employed on a consulting basis to work with the industrial hygienist to develop a medical surveillance program. Included will be pre-employment and routine physicals, alleged exposure investigation procedures, and other medical requirements as deemed appropriate by the doctor.

Following establishment of the necessary monitoring practices and personnel protection equipment, special training in respiratory protection will be provided at the site by the industrial hygienist.

7.2.4.4 Inspection Records

The facility operations manager will maintain a record of all inspections by entering the originals of the inspection reports into the site operating log system with the reports arranged in chronological order. These reports will remain on file for a minimum of three years.

An integrated record or log system will be maintained to show the corrective action taken with respect to items found during inspections which require subsequent corrective action. This system will reflect each condition requiring correction, the date it was discovered, the corrective action taken, and the date of the corrective action. This system will consist of either a summary log, or chronologically organized copies of those inspection reports which show items requiring correction, upon which the date and the corrective action taken would be entered.

7.2.5 Personnel Training Program

BFI will assure that the operation of the facility will not endanger the health or safety of its personnel and visitors, or threaten the environment. Thorough training of facility personnel is recognized as being an important step toward these goals. Consequently, a comprehensive personnel training program, which has already been used in training other BFI personnel, will be developed (as appropriate for the site) and employed throughout the operating life of the facility.

The two major objectives of the personnel training program will be:

- to thoroughly train all employees in the proper performance of their individual job duties;
- to ensure that all appropriate employees are capable of effectively implementing the proper emergency procedures, should the need arise.

It is felt that accidents and emergency situations can be avoided, or at least minimized, by having a work force which is trained to perform jobs properly, using adequate precautions. If an emergency does occur, its consequences can be minimized through rapid and effective emergency response.

To accomplish this, the district manager will initiate a comprehensive personnel training program directed by a person having appropriate training in hazardous waste management and related environmental health sciences. Instruction in hazardous waste management procedures, safety, emergency procedures, legal requirements, and facility operational procedures, and similar related subjects will be provided by that individual or other persons who are technically qualified to provide such instruction. Training manuals, other types of training aids, technical seminars, and formal classroom education will be utilized in training activities.

Personnel will receive training appropriate to their personal needs as well as to their job duties and responsibilities, including their responsibilities for emergency response. BFI personnel will have first aid training with CPR certification and spill control/cleaning training. Local fire departments, sheriffs, and EOC personnel will be invited to attend BFI's training sessions. Successful completion of the appropriate training activities will be a condition of filling a technical or operating position or of transfer or promotion to a new position which requires additional training.

On-the-job training will be provided to all employees on an individual basis. This training will be specific to the duties, tasks and responsibilities of the employee's particular position. Experienced employees or supervisors who are knowledgeable of the requirements for satisfactory performance of the job will provide this training and monitor its progress. On-the-job training will be progressive in nature, beginning with demonstration and followed by closely supervised practice. When the employee has shown his ability to understand and perform his job and the basic safety and emergency response functions related to it, his supervisor will formally acknowledge the satisfactory completion of the employee's on-the-job training, in that employee's training file.

The training policy of BFI requires that all new employees must successfully complete their specific training within six months of their employment or assignment to the facility. Upon transfer or promotion of an existing employee to a new position with training requirements that differ from those for the previous position, that employee shall complete the required additional training within six months.

Pending satisfactory completion of the specific training required for a particular job, an employee will receive intensive supervision to assure that the job is performed properly and safely.

On-going continuing education and training will be provided to employees by the operator of the facility. The frequency of continuing education and training activities will vary according to the type of job.

Figure 7.2.7 presents an outline of the proposed personnel training program along with the schedule for conducting the training and the personnel who would be scheduled to participate. The frequency of formal training activities varies from monthly for emergency response and contingency plan functions, to annually for training which does not relate directly to emergency situations. By scheduling training functions at six month intervals or less, new employees will be able to receive all necessary training within six months of their employment.

7.2.5.1 Training Records

Documentation of training will be provided by three record systems and files which will be maintained at the facility.

The first record system will be a listing of job titles for every position at the facility, along with the name of the person who occupies each position. This list will be revised as this becomes necessary. Each list will be dated, and copies of each previous list will remain on file at the facility for a minimum of three years.

The second record system relating to training will be a written job description for each position at the facility (previously given in Section 6.3.3). Included in the job description will be any required education and experience or equivalent, the training required both initially and on an ongoing basis, and the job duties and responsibilities including those during emergency response, if any. Generally, the training requirements for various categories of jobs are displayed in Figure 7.2.7. The specific descriptions of the type and amount of introductory and ongoing training to be given will be incorporated into the written job descriptions.

FIGURE 7.2.7

PERSONNEL TRAINING PROGRAM - FORMAL TRAINING ACTIVITIES

Activity Description	Frequency	Personnel
I. Hazardous Waste Management Overview		
A. Synopsis of Federal/State Regs.	Annually	All Facility Pers.
B. Definition of Hazardous Waste	"	"
C. Manifest System and Records	"	"
D. Generator Requirements	"	"
E. Transporter Requirements	"	"
F. TSD Facility Requirements	"	"
II. Facility Policies and Procedures		
A. Waste Approval	"	"
B. Site Security	"	"
C. Facility Inspection, General	"	"
D. Preparedness and Prevention	"	"
E. Industrial Hygiene	"	Appro. Tech. Pers.
F. Inspection and Maintenance of Emergency, Monitoring, Alarm, and Communication Systems	Quarterly	"
G. Response to Fires or Explosions	Monthly	"
H. Response to Spills, Ground Water Contamination, or Air Emissions	"	"
III. Waste Receipt, Inspection, Sampling and Verification Procedures		
A. General overview	Annually	All Facility Pers.
B. Specific Procedures	"	Lab and Security
IV. Safety in Handling Hazardous Wastes		
A. Chemical reactions and chemistry	Annually	All Pers. Except Accounting, Sales and Clerical
B. Personal protective equipment	Semi-Annually	All Personnel
C. Truck loading, unloading, and washout	"	All Pers. Except Accounting, Sales and Clerical
D. Use of Shipment/Receipt/ Transfer Forms	"	"
E. Contingency Plan and Emergency Procedures	"	All Personnel
F. First Aid	Semi-annually	All Personnel
G. Safe Handling of Specific Wastes	Monthly	Approp. Tech. & Oper. Pers.
V. Solidification Facilities, Tank Farm and Containers		
A. Waste Ident. and Segregation	Semi-annually	Approp. Oper. Pers.
B. Care in Handling Wastes	"	"
C. Operation and Monitoring	"	"
D. Use and Care of Emergency Systems	Monthly	"
E. Waste Feed Cut-off Systems	"	"
F. Emergency Shutdown	"	"
VI. Secure Landfill and Impoundments		
A. Design Considerations	Semi-annually	"
B. Waste Ident. and Segregation	"	"
C. Operation and Controls	"	"
D. Monitoring	"	"
E. Use and Care of Emergency Systems	Monthly	"
F. Emergency Response	"	"

Records of training given to facility personnel will constitute the third method of training documentation. These records will consist of both a general facility training file and inclusion of a record of his or her training in each employee's personnel file. The general facility training file will contain a description of each formal training activity, the date(s), the personnel who attended, and an indication of satisfactory accomplishment of the goals of the training activity by each person. The same or similar information will be included in the personnel file maintained at the facility for each employee.

At least twice a year, facility management will review each employee's personnel file against that person's job description training requirements, to verify that the frequency and type of training required for that job is being provided. This semi-annual review will also demonstrate that the facility's training objectives are being met.

Training records will be retained for a minimum of three years or until completion of closure of the facility. In the event an employee transfers to another facility and his personnel file is transferred with him, the general facility training file will be used to document the training he was provided during his employment at the facility.

7.2.6 General Requirements For Ignitable, Reactive, or Incompatible Wastes

7.2.6.1 Identification of Ignitable, Reactive, or Incompatible Wastes

The chief chemist of this facility will implement precautions to prevent accidental ignition of ignitable wastes, or chemical reaction of reactive or incompatible wastes.

The precautions which will be implemented include prescreening of candidate wastes to determine if particular waste streams proposed for treatment or disposal at this facility can be safely handled at the facility, or if special handling techniques and/or pretreatment are required. Those wastes which cannot be safely handled even with special techniques or pretreatment will be strictly excluded from the facility. Those which can be accepted only with special handling or pretreatment will have those particular requirements stated on the pretreatment and disposal recommendation form (see Section 7.2.2), a copy of which will be on file at the facility along with all other forms from wastes which have been approved for treatment and/or disposal.

Upon arrival of a waste shipment at the facility, the waste will be examined and sampled, and these results will be compared to the shipping documents and manifest accompanying the waste, as well as the data in the facility files concerning the waste. After these procedures have demonstrated that the waste characteristics are known, the waste shipment will be accepted by the facility for treatment or disposal. Additional details of these procedures were described in the general waste analysis plan, in Section 7.2.2.

The special precautions for ignitable, reactive or incompatible wastes will be implemented for wastes which meet the definitions of "ignitability" and "reactivity" contained in EPA regulations 40 CFR 261.21 and 40 CFR 261.23, respectively. A description and examples of incompatible wastes are also presented in the following discussion.

The characteristic of ignitability from 40 CFR 261.21 is as follows:

"A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

(1) It is a liquid, other than an aqueous solution containing less than 24% alcohol by volume, and has a flash point less than 60°C (140°F), as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D-93-79, or a Setaflash Closed Cup Tester, using the test method specified in ASTM standard D-3278-78, or as determined by an equivalent test method approved by the Administrator under the procedures set forth in 40 CFR 260.20 and 260.21.

(2) It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

(3) It is an ignitable compressed gas as defined in 49 CFR 173.300 and as determined by the test methods described in that regulation or equivalent test methods approved by the Administrator under 260.20 and 260.21.

(4) It is an oxidizer as defined in 49 CFR 173.151." (DOT regulations)

The characteristic of reactivity, from 40 CFR 261.23, is as follows:

"A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

(1) It is normally unstable and readily undergoes violent change without detonating.

(2) It reacts violently with water.

(3) It forms potentially explosive mixtures with water.

(4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

(7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

(8) It is a forbidden explosive as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88." (DOT regulations)

Incompatible wastes are not as explicitly defined as those which are ignitable or reactive. Generally, incompatible wastes are those which may produce adverse chemical reactions when brought into contact with certain other wastes. Incompatible wastes, when mixed with other waste or materials at a hazardous waste facility, can produce effects which are harmful to human health and the environment, such as:

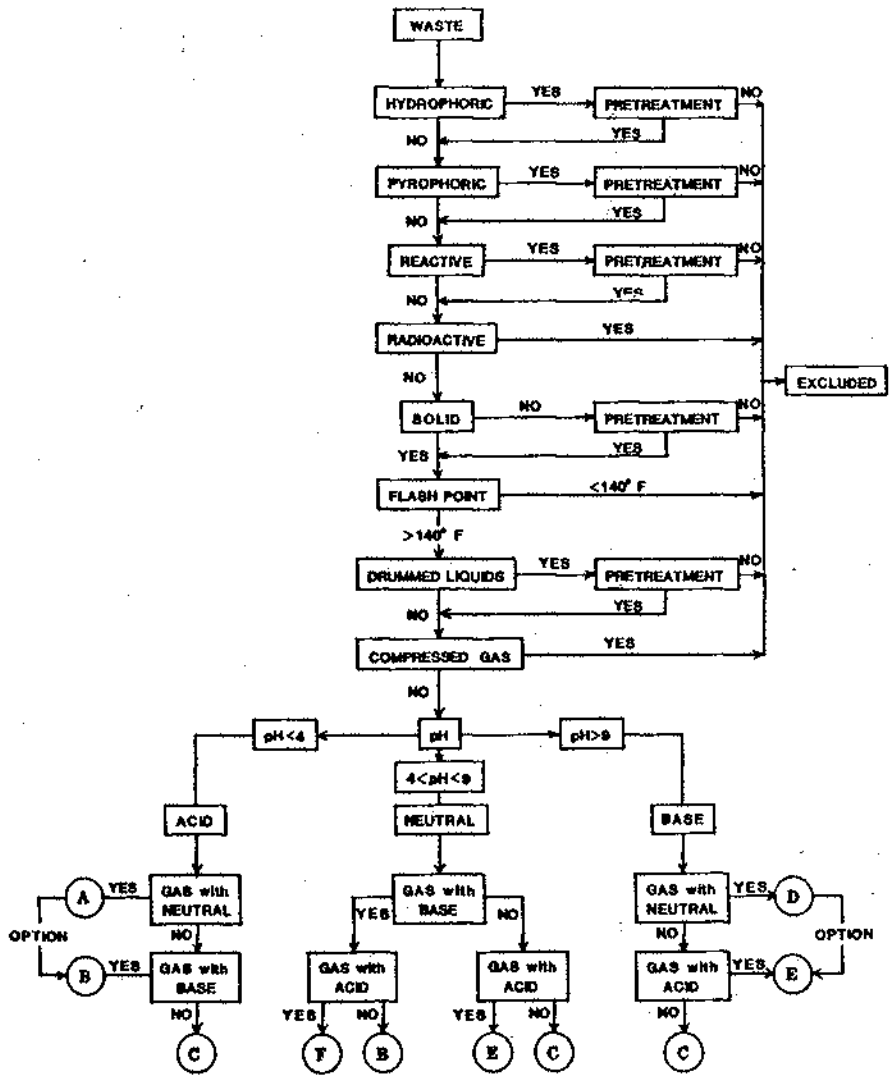
- excessive heat or pressure;
- fire or explosion;
- violent reaction;
- toxic dusts, mists, fumes, or gases; or
- flammable fumes or gases.

It is possible for potentially incompatible wastes to be mixed in a way that precludes a reaction (e.g., adding acid to water rather that water to acid) or that neutralizes them (e.g., strong acid mixed with a strong base), or that controls substances produced (e.g., by generating flammable gases in a closed tank equipped so that ignition cannot occur, and burning the gases in an incinerator).

The decision tree shown on Figure 7.2.8 will be used by technical personnel to avoid mixing incompatible wastes.

7.2.6.2 Precautions to be Taken With Ignitable, Reactive or Incompatible Wastes

Ignitable, reactive or incompatible wastes will be handled, stored, treated, solidified, and/or disposed utilizing due precautions to prevent accidental or spontaneous ignition, or chemical reaction. These wastes



LEGEND

TYPE A - Acid materials which liberate gas when neutralized.

TYPE B - (1) Acids which liberate gas when mixed with bases; (2) neutral materials which liberate gas when mixed with bases, but do not liberate gas when mixed with acids.

TYPE C - (1) Acids which do not liberate gas when mixed with basic material; (2) neutral materials which do not liberate gas when mixed with acids or bases; (3) basic materials which do not liberate gas when mixed with acids.

TYPE D - Basic material which liberate gas when neutralized.

TYPE E - (1) Basic materials which liberate gas when mixed with acids; (2) neutral materials which liberate gas when mixed with acids, but do not liberate gas when mixed with bases.

TYPE F - Neutral materials which liberate gas when mixed with either acids or bases.

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FIGURE Nº. 7.2.8

CHEMICAL COMPATABILITIES

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will be identified before and during receipt and adequately separated or isolated from sources of ignition or reaction during handling, storage, processing and disposal.

The first of several specific precautions to be taken with ignitable, reactive or incompatible wastes will be the special pretreatment or handling requirements that will be communicated to the generator. This is to assure proper handling, packaging or protection, and labeling of wastes prior to commencing transport to the facility.

The second precaution will be that upon arrival of any ignitable, reactive or incompatible wastes at the facility, the waste identification process described in Section 7.2.2 and previously in this section will be used to verify the nature and identity of the waste. The specific instructions in the pretreatment and disposal form will be implemented. Facility technical personnel will prepare a shipment/receipt/transfer form, which indicates receipt of the waste at the site. This form is also used to designate the specific location within the facility where the waste is to go for off-loading, as well as all of the procedures and safety requirements which must be explicitly followed during the off-loading procedure.

These precautions will ensure that accidental ignition or reaction of wastes does not occur as a result of incorrect handling or placement of wastes. Potential causes of accidental ignition or reaction, such as exposure to adverse environmental conditions or contact with other incompatible wastes or waste residues, will be eliminated by strict adherence to the handling, storage, treatment, solidification, and disposal requirements specified in the pretreatment and disposal recommendation

form. It should be emphasized that the instructions contained on that form will be explicit, and will be prepared by BFI's staff of qualified chemists, and will represent considerable corporate knowledge and experience in proper management of hazardous wastes.

The third specific precaution to be incorporated into the management of ignitable, reactive and incompatible wastes will be the use of separate areas and separate facilities for these wastes, to prevent accidental ignition or reaction on a long term basis.

Incompatible drummed wastes will be segregated to minimize reaction in the event of concurrent spills, or damage to other containers from a spill of a reactive waste.

Within the secure disposal cells, isolation of ignitable, reactive or incompatible wastes will be provided by means of interior isolation barriers of compacted clay. It should be emphasized that the facility does not anticipate receiving significant quantities of waste materials of this type to be disposed of directly without first having undergone pretreatment or solidification processing in order to minimize or eliminate their ignitability, reactivity or incompatibility.

Other specific precautions to be taken include isolating ignitable or reactive wastes from open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, or mechanical), spontaneous ignition (e.g., from heat-producing chemical reactions), and radiant heat.

During the operating life of the facility, smoking and open flame will be confined to specially designated locations. "No Smoking" signs will be conspicuously placed wherever there is a hazard from ignitable or reactive waste.

The treatment, storage, solidification, or disposal of ignitable or reactive waste, and the mixture or commingling of incompatible wastes, or incompatible wastes and materials, will be conducted so that it does not:

- generate extreme heat or pressure, fire or explosion, or violent reaction;
- produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health;
- produce uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions;
- damage the structural integrity of the device or facility containing the waste; or
- through other like means threaten human health or the environment.

7.3 PREPAREDNESS AND PREVENTION

7.3.1 Introduction

The preparedness and prevention measures required by the hazardous waste regulations (40 CFR Part 265) have been developed for the purpose of minimizing accidents and emergency situations which could threaten human health or the environment.

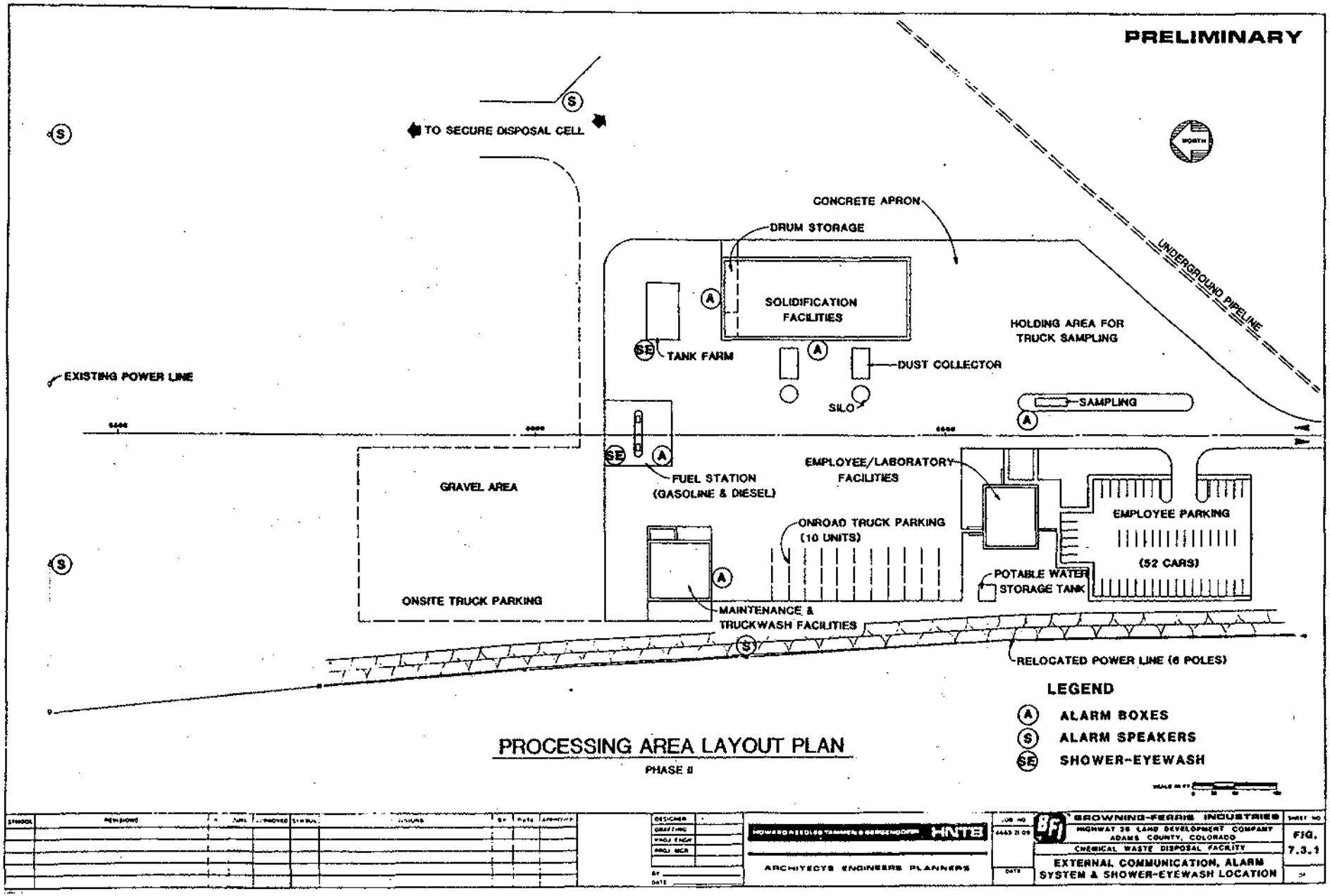
The regulations address the preparedness and prevention measures as a separate subpart because they contain relatively explicit facility standards which are independent of the contingency plans (presented in Section 7.4). It is appropriate to design preparedness and prevention measures into facility operations before discussing planning for and response to emergencies.

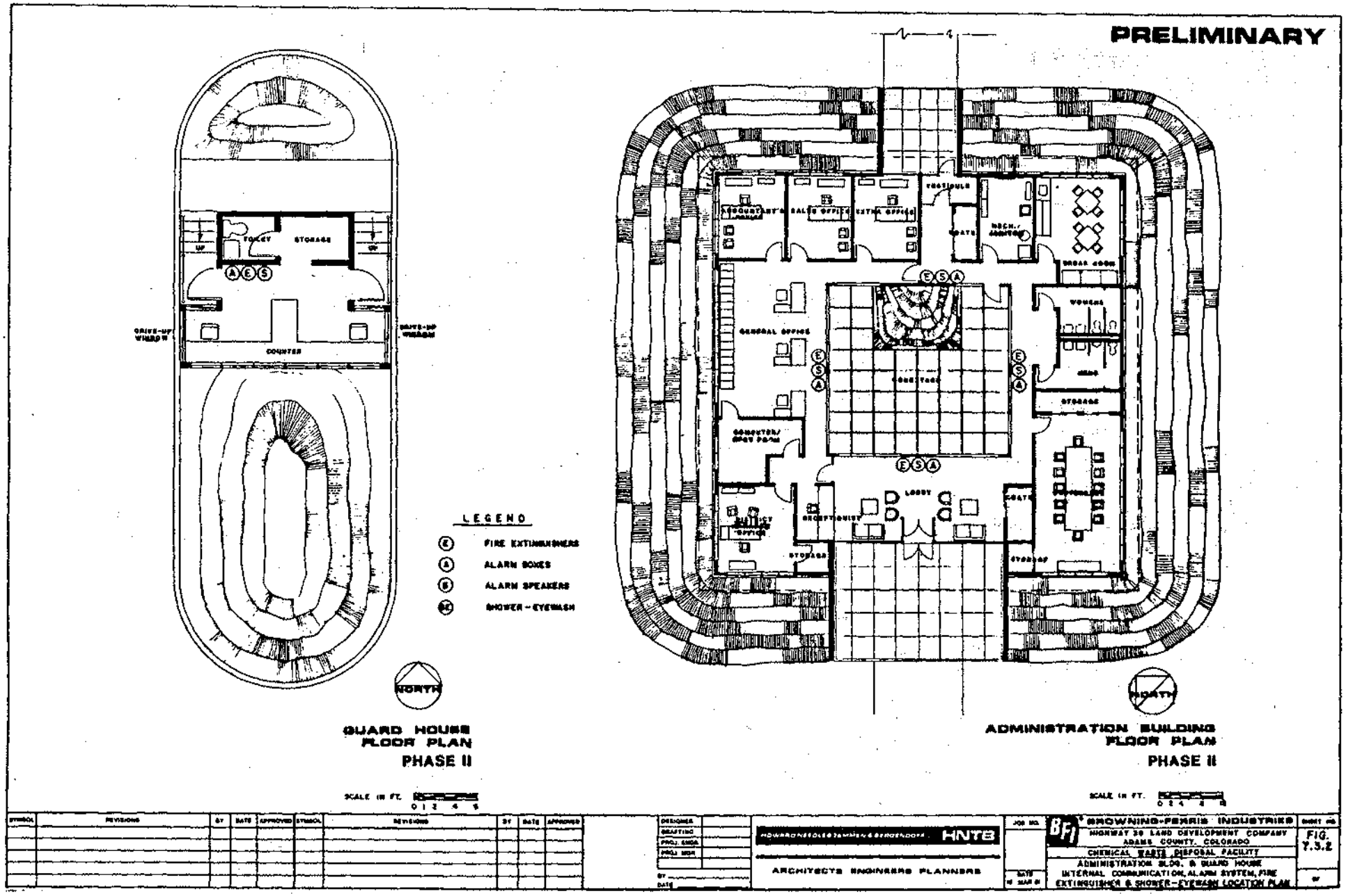
These measures have been designed into each operational unit of the facility to minimize or prevent the occurrence of a fire, explosion, or release of a hazardous waste, to alert personnel required, and to contain the emergency situation.

7.3.2 General Measures

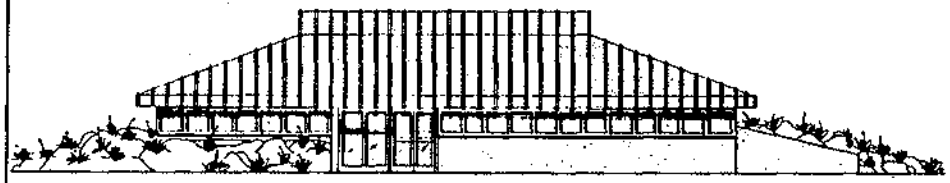
The following measures are applicable to the facility in general, or are common to all operations involving handling, treatment, storage, solidification, or disposal of hazardous waste. To avoid repetition, these measures are presented in the following section with the understanding that they are considered to be incorporated into the specific facility preparedness and prevention measures that follow. Typical safety equipment and arrangements are shown on Figures 7.3.1 through 7.3.9.

- Alarm stations will be appropriately located to ensure immediate access in the event of an emergency. Specific emergency procedures will be developed for facility personnel in the event of fire, explosion or release of a hazardous waste.
- The emergency life support equipment will be located to ensure quick access by facility personnel in the event of an emergency.
- Arrangements will be made to familiarize area clinics and hospitals as to the possible types of injuries or illnesses which could result from fires, explosions or releases at the facility.
- The layout of the facility and placement of equipment will allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment.
- Signs prohibiting smoking will be posted where visible to all employees, vehicle operators, and visitors and in all areas where wastes are received, handled, treated, stored, or disposed.
- Procedures will be devised for testing and maintaining facility communications and alarm systems, fire fighting equipment, spill control equipment, and personnel decontamination station equipment located at the site.
- Fire extinguishers, spill control equipment, and decontamination equipment will be located in adequate numbers and locations throughout the facility to ensure expedient access in the event of an emergency.


PRELIMINARY
TO SECURE DISPOSAL CELL
NORTH
CONCRETE APRON
DRUM STORAGE
UNDERGROUND PIPELINE
SOLIDIFICATION FACILITIES
HOLDING AREA FOR TRUCK SAMPLING
TANK FARM
DUST COLLECTOR
EXISTING POWER LINE
SILO
SAMPLING
GRAVEL AREA
FUEL STATION (GASOLINE & DIESEL)
EMPLOYEE/LABORATORY FACILITIES
ONROAD TRUCK PARKING (10 UNITS)
EMPLOYEE PARKING
(52 CARS)
POTABLE WATER STORAGE TANK
ONSITE TRUCK PARKING
MAINTENANCE & TRUCKWASH FACILITIES
RELOCATED POWER LINE (6 POLES)
LEGEND
ALARM BOXES
ALARM SPEAKERS
SHOWER-EYEWASH
PROCESSING AREA LAYOUT PLAN
PHASE II
HINTZ
ARCHITECTS ENGINEERS PLANNERS
BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
EXTERNAL COMMUNICATION, ALARM SYSTEM & SHOWER-EYEWASH LOCATION
FIG. 7.3.1


PRELIMINARY
TOILET
STORAGE
UP
UP
DRIVE-UP WINDOW
DRIVE-UP WINDOW
COUNTER
LEGEND
FIRE EXTINGUISHERS
ALARM BOXES
ALARM SPEAKERS
SHOWER - EYEWASH
NORTH
GUARD HOUSE
FLOOR PLAN
PHASE II
SCALE IN FT.
0 1 2 4 6
NORTH
ADMINISTRATION BUILDING
FLOOR PLAN
PHASE II
SCALE IN FT.
0 2 4 8 16
SYMBOL
REVISIONS
BY
DATE
APPROVED
DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE
HOWARD NEEDLES TAMMEN & BERGENDOFF
HNTB
ARCHITECTS ENGINEERS PLANNERS
JOB NO.
DATE
BF
BROWNING-FERRIS INDUSTRIES
HIGHWAY 30 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
ADMINISTRATION BLDG. & GUARD HOUSE
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE
EXTINGUISHER & SHOWER-EYEWASH LOCATION PLAN
SHEET NO.
FIG. 7.3.2

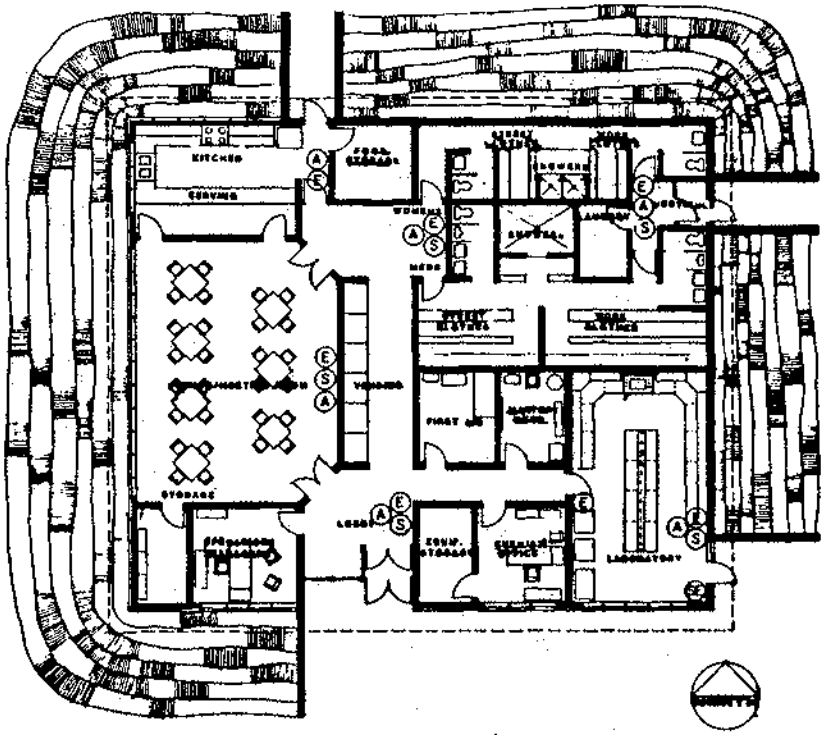
PRELIMINARY



SOUTH ELEVATION

NORTH ELEVATION

WEST ELEVATION



FLOOR PLAN

LEGEND

- (E) FIRE EXTINGUISHERS
- (A) ALARM BOXES
- (S) ALARM SPEAKERS
- (SE) SHOWER-EYEWASH

SCALE IN FT. 0 2 4 6 8

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

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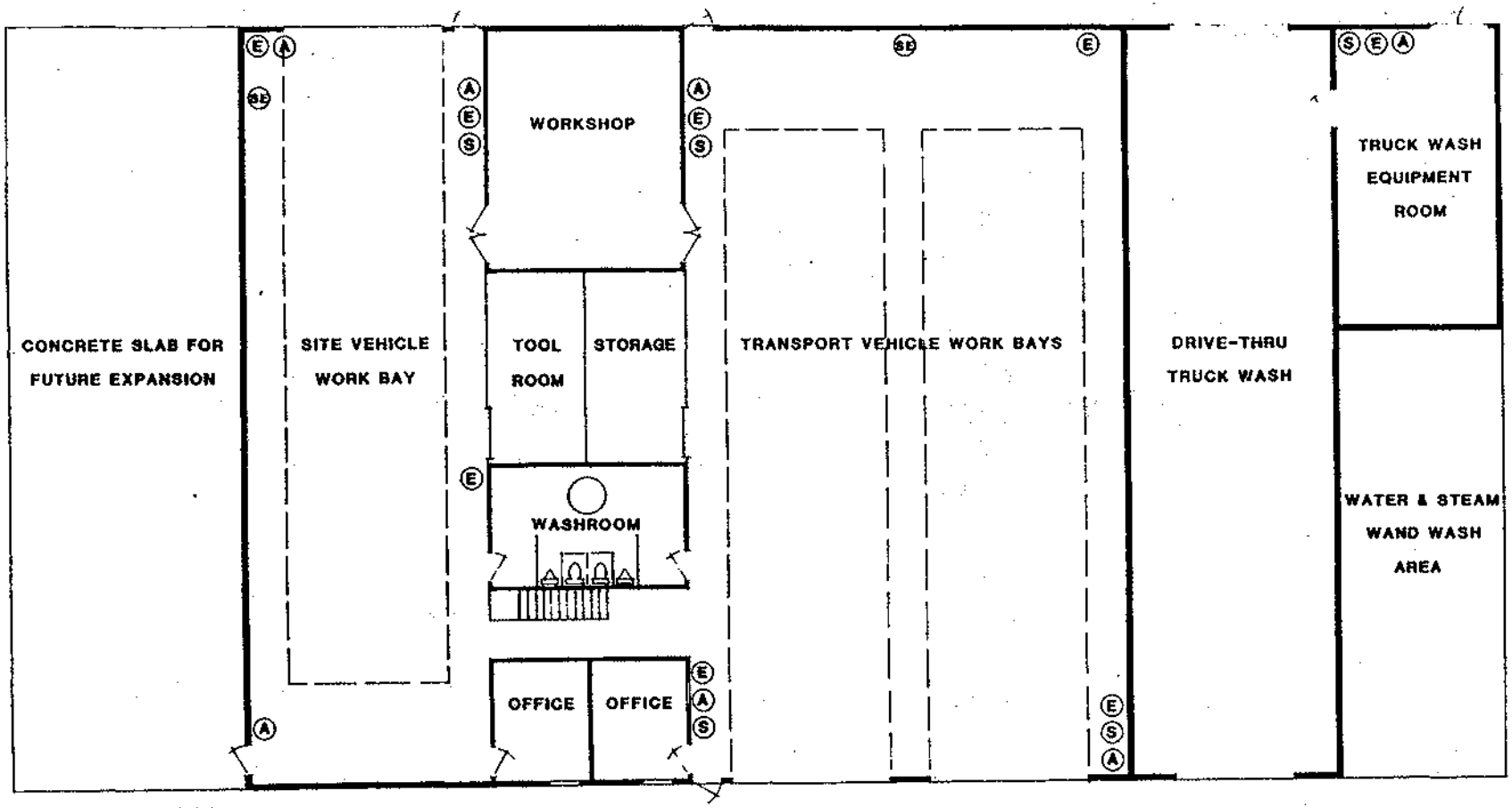
DATE 15 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
PHASE II EMPLOYEE/LABORATORY BLDG.
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE EXTINGUISHER & SHOWER-EYEWASH LOCATION PLAN

SHEET NO. FIG. 7.3.3 OF

PRELIMINARY



LEGEND

- (E) FIRE EXTINGUISHERS
- (A) ALARM BOXES
- (S) ALARM SPEAKERS
- (SE) SHOWER-EYEWASH

SCALE IN FT. 0 2 4 8 12 16

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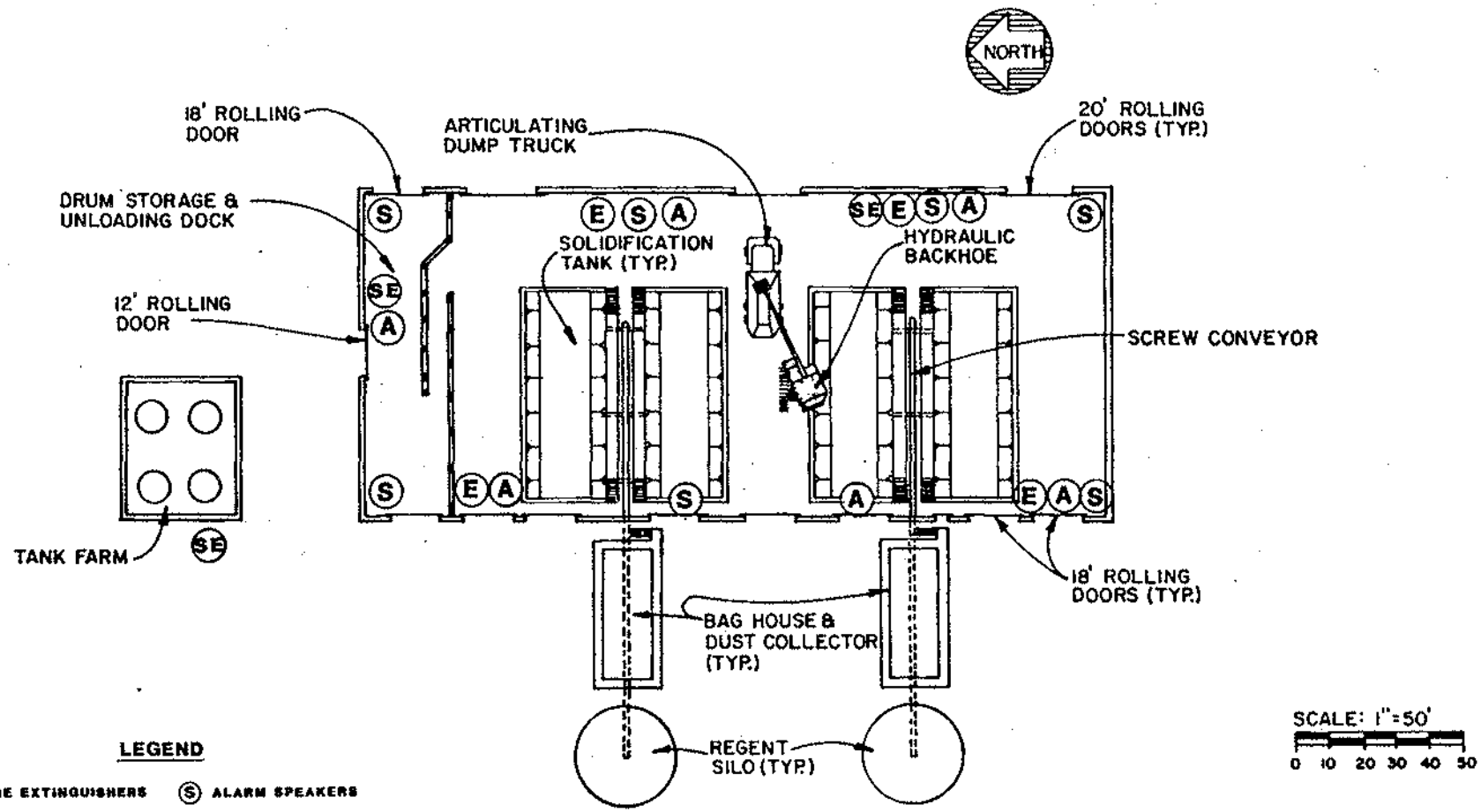
MAINTENANCE BUILDING FLOOR PLAN

PHASE II

FIGURE 7.3.4
MAINTENANCE AND TRUCKWASH FACILITIES
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE EXTINGUISHER & SHOWER- EYEWASH LOCATION PLAN
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

PRELIMINARY



LEGEND

- (E) FIRE EXTINGUISHERS
- (S) ALARM SPEAKERS
- (A) ALARM BOXES
- (SE) SHOWER-EYEWASH

PHASE II PLAN

FIGURE 7.3.5

TREATMENT / SOLIDIFICATION BUILDING
INTERNAL COMMUNICATION, ALARM SYSTEM, FIRE EXTINGUISHER & SHOWER - EYEWASH LOCATION PLAN
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

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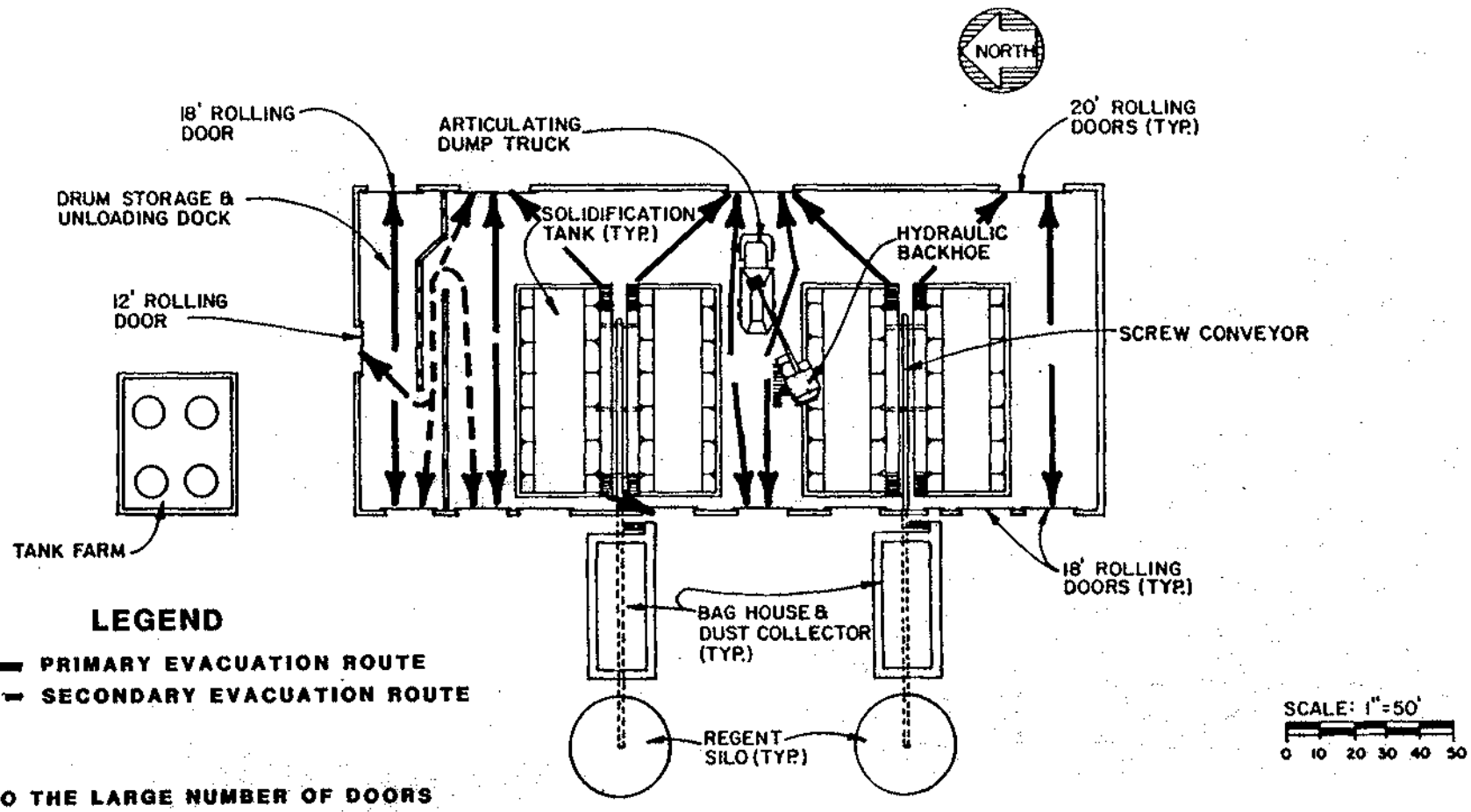
PRELIMINARY



LEGEND

PRIMARY EVACUATION ROUTE

SECONDARY EVACUATION ROUTE

NOTE:
DUE TO THE LARGE NUMBER OF DOORS AND FEW EMPLOYEES WORKING IN THE BUILDING, SECONDARY ROUTES ARE SHOWN ONLY FOR DRUM STORAGE AREA

PLAN
PHASE II

HNTB
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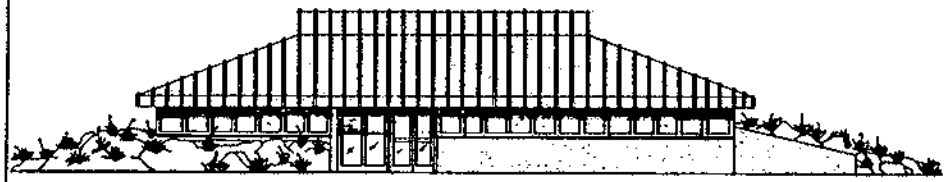
ARCHITECTS ENGINEERS PLANNERS

FIGURE 7.3.6

TREATMENT / SOLIDIFICATION BUILDING
PRIMARY & SECONDARY EVACUATION PLAN

HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

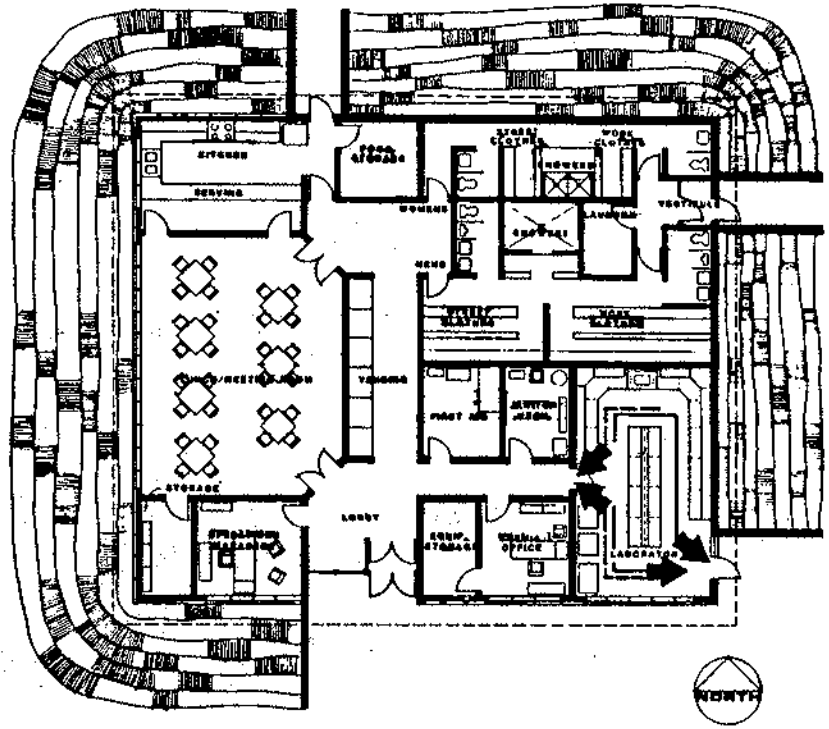
PRELIMINARY



SOUTH ELEVATION

NORTH ELEVATION

WEST ELEVATION



FLOOR PLAN

LEGEND

PRIMARY EVACUATION ROUTE

SECONDARY EVACUATION ROUTE

SCALE IN FT. 0 2 4 8 12

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ ENGR
PROJ MGR
BY
DATE

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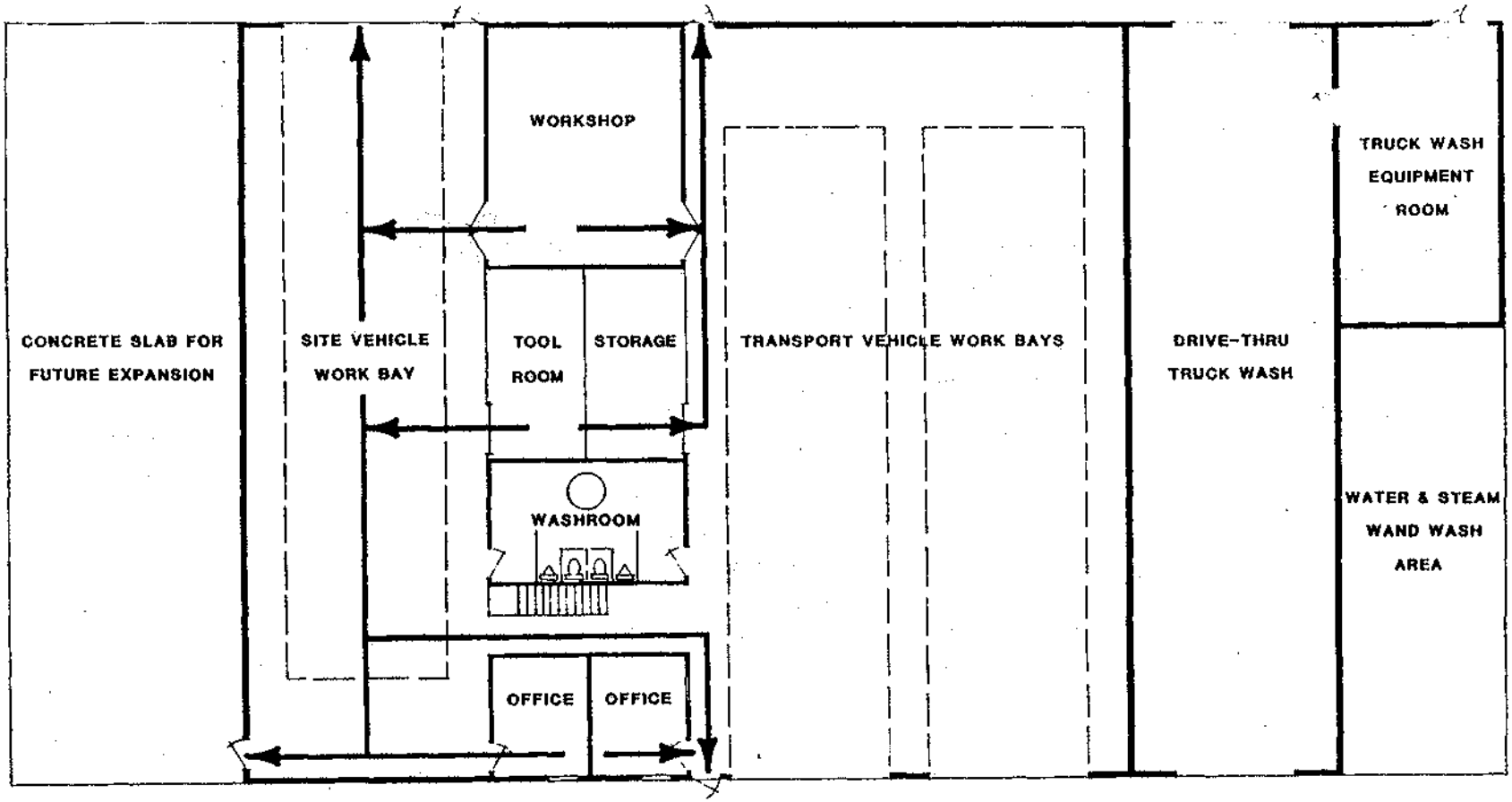
JOB NO.
DATE 10 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
PHASE II EMPLOYEE/LABORATORY BLDG.
PRIMARY AND SECONDARY
EVACUATION ROUTE

SHEET NO
FIG. 7.3.7

PRELIMINARY



NOTE:
DUE TO THE LARGE NUMBER OF DOORS AND FEW EMPLOYEES WORKING IN THE BUILDING, SECONDARY ROUTES ARE SHOWN ONLY FOR DRUM STORAGE AREA

LEGEND

PRIMARY EVACUATION ROUTE

SCALE IN FT. 0 2 4 8 12 16

MAINTENANCE BUILDING FLOOR PLAN

PHASE II

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FIGURE 7.3.8

PRIMARY EVACUATION ROUTES
MAINTENANCE AND TRUCKWASH FACILITIES
HIGHWAY 36 LAND DEVELOPMENT CO.
ADAMS CO., COLORADO

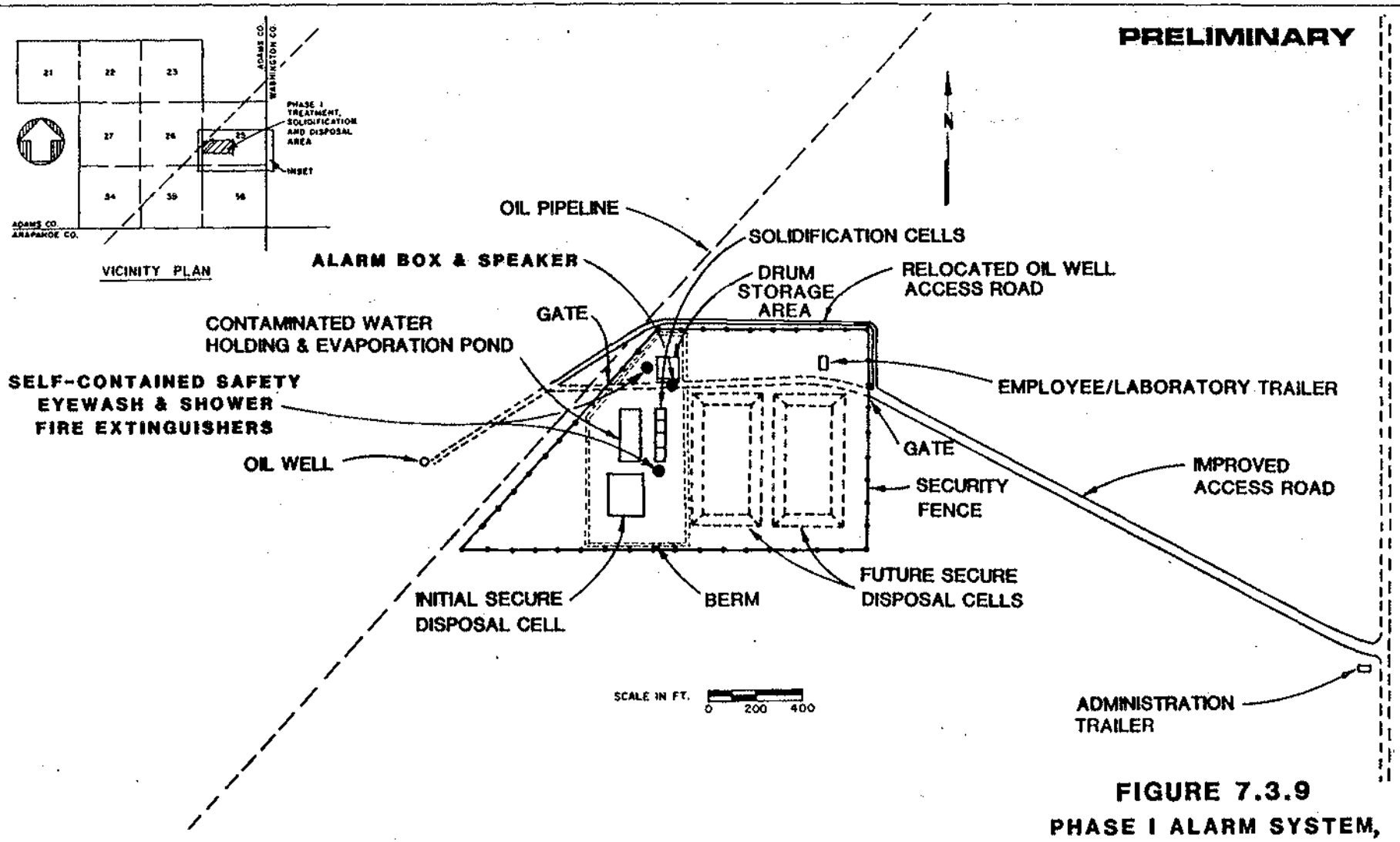

FIGURE 7.3.9

PHASE I ALARM SYSTEM, SHOWER / EYEWASH AND FIRE EXTINGUISHER LOCATION PLAN

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- Company and government emergency response personnel will be provided with the site and building layout and design, properties of wastes stored, location of personnel working at the facility and all internal roads and evacuation routes. Governmental emergency response personnel will be encouraged to visit the facility for greater familiarization with it.

- Arrangements will be made with any state and local emergency response teams, emergency response contractors and equipment suppliers as needed to minimize contamination.

- Facility personnel will be given a thorough physical examination by outside medical consultants before employment and follow-up as needed.

- All facilities will be furnished with proper types and number of fire fighting equipment, decontamination stations, fume vents, exhaust fans, and emergency evacuation equipment to insure compliance with local, state, and federal OSHA regulations (see Figures 7.3.1 through 7.3.9).

7.3.3 Laboratory

- The chief chemist or technician will review the manifest and other pertinent documents or data to determine the proper procedures and equipment required to safely obtain a representative sample of the incoming waste.

- All samples will be immediately labeled as to their health hazards and dangerous properties from information obtained from the manifest and other documents.

- Samples will be containerized, stored and handled in accordance with local, State, and Federal occupational safety and health regulations until the required analyses have been completed.

- Excess samples or portions of samples not used during analyses will be stored in compliance with local, State and Federal occupational safety and health regulations pending on-site disposal as hazardous waste.

7.3.4 Tank Farm

- Tanks and connections will be clearly identified to ensure that no incompatible wastes are commingled.

- Tank construction, pipes, valves, pumps, and other equipment will meet prescribed safety standards and will be designed and selected in accordance with good engineering practice.

- The tank farm will be diked to meet spill prevention control and countermeasure (SPCC) criteria. If flammable or reactive materials are received, they will be placed in tank(s) spaced to meet National Fire Prevention Association (NFPA) buffer zone requirements.

- Tanks will be constructed of materials and linings which will not be prematurely degraded by wastes stored in the tanks.

- Procedures will be utilized for testing and preventive maintenance at all components critical to the tank farm integrity and safety.

- Procedures (as shown in Figure 7.2.8) will be utilized to ensure that the waste previously stored in a tank is chemically compatible with incoming waste prior to transfer operations. If incompatibility exists, the tank will be properly cleaned prior to transfer of the incompatible waste into the tank.

- An inspection will be made daily of all discharge control equipment and the level of waste in each tank. Equipment and structural components of the tanks will be inspected in accordance with the general inspection plan in Section 7.2.4. Inspection results will be recorded on an inspection report form.

- An inspection will be made weekly of all discharge confinement structures to ensure no erosion or obvious signs of leakage. Inspection results will be recorded on an inspection report form.

- All damages and sub-specification conditions will be recorded and replaced or repaired promptly.

- Procedures have been developed to store reactive and ignitable waste in such a way that it is protected from any material or condition which may cause the waste to ignite or react (see Section 7.2.6.2). These procedures will be used when appropriate.

7.3.5 Solidification Facilities

- Building construction, equipment, and other structures will meet prescribed safety standards and be designed in accordance with good engineering practice.

- Solidification cells and tanks will be clearly identified to prevent the commingling of incompatible wastes.

- Procedures will be utilized for testing and preventative maintenance at all locations critical to the structural integrity of the solidification building.

- The facility will be designed so that all wash water from building clean-up is collected for proper treatment and disposal.

- Physical inspections will be made routinely throughout this building, and results will be recorded on inspection report forms, as provided in Section 7.2.4 in the general inspection plan.

- All damages and sub-specification conditions will be recorded and replaced or repaired promptly.

- Exhaust systems and air pollution control equipment will be installed to prevent the possibility of explosion, to protect the workers' health, and to assure that emissions from the solidification building do not adversely affect ambient air quality. This equipment will be inspected and tested as recommended by the manufacturer.

7.3.6 Off-Site Vehicle Wash Area

- Wash water from cleaning the interiors of hazardous waste transporters will be captured and transferred directly to the appropriate contaminated water holding pond.

- Wash water from cleaning exteriors of hazardous waste transporters will be recycled to clean the interior of the vehicles with subsequent wash water treatment as previously described.

- Building construction, equipment, and other structures will meet prescribed safety standards and be designed in accordance with good engineering practice.

7.3.7 Maintenance Building

- The water from the washing of equipment which has been on the active portion of the site will be transferred to the contaminated water holding pond.

- All equipment from the active portion of the site will be properly cleansed before maintenance is performed.

- Building construction, equipment and related facilities have been designed to meet prescribed safety and design standards, and designed in accordance with good engineering practices.

7.3.8 Surface Impoundment (Mixing Cells in Phase I Operation)

- A freeboard of at least two feet will be maintained to prevent any escape of liquid due to overfilling.

- A daily site inspection will be performed to check and record the freeboard level, as outlined in Section 7.2.4.

- A weekly inspection will be performed to check and record any deterioration or failures in the cells or tanks, as outlined in Section 7.2.4.

- Any deterioration or malfunction will be recorded in the inspection report and will be promptly remedied.

- There will be no mixing or commingling of incompatible waste, or of wastes and other materials, which may: generate extreme heat, pressure, fire, explosion or violent reaction; produce uncontrolled toxic or flammable mists, fumes, or dusts in sufficient quantities to threaten human health; or cause damage to the structural integrity of the impoundment.

7.3.9 Surface Impoundments (Contaminated Water, Non-Contaminated Surface Water, and Potentially Contaminated Water Holding Ponds)

- A freeboard of at least two feet will be maintained to prevent any escape of liquid due to overfilling, wave action, or a storm.

- Appropriate protective material or vegetation will be used as a protective cover to minimize wind and water erosion of the surface impoundment berms.

- A site inspection will be performed to check and record any deterioration or failures in the impoundment, as provided in the general inspection plan in Section 7.2.4.

- Deterioration and malfunctions will be recorded in the inspection report and will be promptly remedied.

- The surface impoundment for contaminated and potentially contaminated water will have a containment system which meets the design and operating requirements of 40 CFR, Part 264 Subpart K. A daily schedule will be developed for inspection of the surface impoundment's containment system. If any liquids are collected by the impoundment's leachate collection system, the liquid will be immediately analyzed to determine if it is leachate. If the analytical data identifies the liquid as leachate, then (as required in 40 CFR 264.227 (b)) the surface impoundment will be removed from service and repaired.

7.3.10 Secure Disposal Area

- Loud speakers and/or two-way radios will be located to ensure the alerting of landfill personnel in the event of an emergency.

- Each piece of operating equipment will carry a fire extinguisher.

- The secure disposal cell will be designed to prevent run-off from and run-on into the disposal area.

- A map will be maintained showing the location, depth and dimensions of each cell with respect to a surveyed permanent benchmark.

- A map will be maintained showing the approximate location and type of hazardous waste within each cell.

- Incompatible wastes will either be pretreated to reduce or eliminate incompatibility, or will be isolated by compacted clay barriers on all sides when placed in the secure disposal cell.

- All liquid wastes or wastes containing free liquids will be solidified before being placed into the disposal cell.

- A groundwater monitoring system will be installed which meets the requirements of 40 CFR 265 Subpart F, as discussed in Section 7.6.

- Each secure disposal cell excavation will be inspected prior to liner placement to insure that higher permeability zones (if encountered) are monitored outside the disposal cell.

- Each disposal cell will be lined with at least five feet of re-compacted clay and contain a head dissipating and leachate detection/collection system.

7.4 CONTINGENCY PLAN AND EMERGENCY PROCEDURES

7.4.1 Introduction

The preparedness and prevention plan presented in Section 7.3 is designed to minimize the possibility of fire, explosion, or unplanned sudden or non-sudden release of hazardous waste. The contingency plan and emergency procedures presented in this section outline the actions to be taken by facility personnel in the event of a fire, explosion, or unplanned sudden or non-sudden release of hazardous waste to air, soil, or surface water. In the event of an emergency, the provisions of this plan will be implemented immediately.

This plan describes the actions which will be taken by facility personnel in response to an emergency. It describes the arrangements made with and addresses/telephone numbers for (Appendix F) local police departments, hospitals, and state and local emergency response teams to assist during an emergency event. It designates qualified individuals as emergency coordinator and alternates. The emergency coordinator and his alternates will be thoroughly familiar with all aspects of the facility's contingency plan, the operational activities of each process, the location and characteristics of wastes handled, the location of all facility records and the facility layout. The emergency coordinator will have the authority to commit the resources necessary to fully implement the contingency plan.

The emergency procedures to be carried out by the emergency coordinator or his alternate are outlined in detail within this plan. These procedures detail the responsibilities of the emergency coordinator or his alternate during and after the emergency.

This plan provides for a trained and equipped on-site emergency response unit to respond to all on-site emergency events and any off-site company hazardous waste transportation accidents. This unit will be available to assist any local, state, or federal agency, upon request, in the event of other non-company hazardous waste accidents. The emergency coordinator or his alternate will direct this group.

A list of typical on-site emergency equipment and its location was provided in Figures 7.3.1 through 7.3.5 and 7.3.9. This includes all fire extinguishing systems, spill control equipment, external and internal communication and alarm systems, decontamination equipment, and safety showers and eye washes.

An evacuation plan will be prepared following preparation of detailed design/construction plans. This evacuation plan will cover all areas where there is a possibility that evacuation could be necessary. Both primary and secondary evacuation routes will be designated, where appropriate. A preliminary indication of evacuation routes was presented in Figures 7.3.6 through 7.3.8.

The required training program will instruct all facility personnel as to their specific responsibilities during emergency situations. The alarm system has been designed to identify the location of the incident to the emergency response unit. The emergency coordinator will thoroughly

review the contingency plan on a quarterly basis in the monthly employee safety meeting.

Amendments will be made to the contingency plans whenever:

- the regulations change;
- the plan is found to be deficient during an emergency;
- the facility changes its design, construction, operation, or maintenance;
- the emergency coordinator changes; or
- the list of emergency equipment changes.

Copies of this contingency plan will be maintained on-site and submitted to all local police departments, hospitals, and state and local emergency response teams that may be called upon during an emergency. Lists of specified emergency response agencies will be posted near the telephone of the emergency coordinator, the employee bulletin board, the main guard house and in the laboratory.

7.4.2 Emergency Coordinator

The operations manager will be designated as the emergency coordinator. The site supervisors will be designated as emergency coordinator alternates. These employees will have a thorough knowledge of all aspects of the facility's activites and contingency plans and the authority to commit the resources needed to carry out the plan.

7.4.3 Emergency Procedures of Emergency Coordinator

1. Whenever there is an imminent or actual emergency situation the emergency coordinator will immediately activate the facility alarm system, thus alerting all personnel as to the situation.

2. He will immediately identify the character, exact source, amount, and the extent of any fire, explosion or release of hazardous waste.

3. He will notify the appropriate Federal, State and local agencies affected by the emergency.

4. He will immediately assess the possibility of hazards to facility personnel.

5. He will assist the local authorities in deciding whether local areas should be evacuated and to what distances.

6. During the emergency, the emergency coordinator will take the appropriate reasonable measures necessary to prevent recurrence or spreading.

7. After facility shut-down due to an emergency, the emergency coordinator will monitor for other dangerous situations which may occur due to the incident.

8. The emergency coordinator will make arrangements to store, treat, or dispose of all hazardous clean-up residual.

9. The district manager will submit a report to the EPA Regional Administrator and appropriate State and local agenices within 15 days after the incident which details the incident and includes the following:

   a. Name, address, and telephone number of the facility owner.
   b. Name, address, and telephone number of the facility.
   c. Date, time, and type of incident.
   d. Name and quantity of material(s) involved.
   e. The extent of injuries, if any.
   f. An assessment of actual or potential hazards to human health or the environment, where applicable.
   g. Estimated quantity and final disposition of recovered material that resulted from the incident.

7.4.4 Laboratory Contingency Plan

7.4.4.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the building using predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct supervision of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator will evaluate all injuries and take appropriate steps to minimize them.

7. The hospital or other medical facility will be given all known information concerning the injury of any incoming patients.

8. The cause of the incident will be determined and appropriate measures will be taken to prevent future fires or explosions.

7.4.5 Tank Farm and Drum Storage Contingency Plan

7.4.5.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. Hospital or other medical facilities will be given information concerning the injury of any incoming patients.

8. The cause of the incident will be determined and appropriate measures will be taken to prevent another fire or explosion.

7.4.5.2 Sudden or Unexpected Release

1. The person first noting the release will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using the predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. The hospital or other medical facility will be given information concerning the injury of any incoming patients.

8. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

9. The cause of the incident will be determined and appropriate measures taken to prevent another release.

7.4.5.3 Non-Sudden Release

1. The person first noting the release will immediately notify the emergency coordinator or his alternate.

2. The emergency coordinator or his alternate will determine if there is an imminent or actual emergency situation.

3. If the situation is determined to be an imminent or actual emergency situation, then the emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

4. The tank contents will be transferred to another storage facility, taking care to assure compatibility of materials.

5. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

6. The cause of the incident will be determined and appropriate measures taken to prevent another release.

7.4.6 Solidification Facility Contingency Plan

7.4.6.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using predesignated evacuation routes.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. Hospital or other medical facilities will be given information concerning the injury of any incoming patients.

8. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

9. The cause of the incident will be determined and appropriate measures taken to prevent another fire or explosion.

7.4.6.2 Sudden or Unexpected Release of Gases or Vapor

1. The person nearest an alarm station will immediately activate the alarm system.

2. Employees will immediately put on respirators or self-contained breathing equipment, or leave the building.

3. The alarm will automatically alert the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator or his alternate will evaluate all injuries and take appropriate steps.

7. Hospital or other medical facilities will be given information concerning the injury of any incoming patients.

8. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

9. The cause of the incident will be determined and appropriate measures will be taken to prevent another release.

7.4.7 Surface Impoundments

7.4.7.1 Liner or Berm Failure

1. As soon as it has been determined that the primary liner has failed, the emergency coordinator or his alternate will be contacted immediately.

2. The emergency coordinator or his alternate will determine if there is an imminent or actual emergency situation, and will implement his responsibilities as listed in Section 7.4.3.

3. The flow of waste into the impoundment will immediately cease and no other wastes will be discharged into the impoundment.

4. Any leakage will be contained and if possible the leak will immediately be stopped.

5. The impoundment will be emptied if the leak cannot be stopped.

6. The cause of the incident will be determined and appropriate measure taken to prevent another failure.

7. Upon determining the cause, the containment system will be repaired and certified by a registered professional engineer prior to reuse.

7.4.7.2 Non-Sudden Release

1. The leachate collection system will be inspected monthly for the presence of liquids.

2. The ground water monitoring wells will be sampled and analyzed for evidence of ground water contamination in accordance with the provisions contained in Section 7.6.

3. If liquids are found in the leachate collection system, an analysis will be performed to determine if the liquid is leachate.

4. If liquid extracted is determined to be leachate, or the groundwater appears to be contaminated, the emergency coordinator or his alternate will be notified.

5. The emergency coordinator or his alternate will determine if there is an imminent or actual emergency situation.

6. If the situation is determined to be an imminent or actual emergency situation, the emergency coordinator or his alternate will implement and complete his responsibilities as listed in Section 7.4.3.

7. The cause of the release will be determined and appropriate measures taken to prevent another release.

7.4.8 Secure Disposal Cells

7.4.8.1 Fire or Explosion

1. The person first noting the fire or explosion will immediately activate the alarm system.

2. Upon hearing the alarm, all employees will evacuate the area using predesignated evacuation routes.

3. The alarm automatically alerts the on-site emergency response unit. This unit is under the direct instruction of the emergency coordinator or his alternate.

4. The alarm will continue to sound until deactivated by the emergency coordinator or his alternate.

5. The emergency coordinator will implement and complete his responsibilities as listed in Section 7.4.3.

6. The emergency coordinator will evaluate any injuries and take approporiate steps.

7. Hospital or medical care facilities will be given all known information concerning injuries of the incoming patient(s).

8. Upon completion of clean-up, the area will be tested to ensure no residual environmental contamination exists.

9. The cause will be determined and appropriate measures taken to prevent another fire.

7.4.8.2 Non-Sudden Release

1. The head dissipating system will be inspected monthly for the presence of liquids.

2. The ground water monitoring wells will be sampled and analyzed for evidence of ground water contamination in accordance with the provisions contained in Section 7.6.

3. If liquids are found in the head dissipating system, it will be pumped out and treated as a hazardous waste. As a hazardous waste, the liquid in the head dissipating system must be analyzed prior to treatment and disposal. The analysis would include, at a minimum, specific conductance, total organic carbon, total organic halides, corrosivity (as pH), and ignitability. Additional parameters may be selected based on a review of the disposal cell contents.

4. Immediate actions, as deemed appropriate by the emergency coordinator or his alternate, will be taken to determine the cause of liquid formation and define measures to be taken to prevent further liquid formation.

7.4.9 Emergency Contacts

In the event of an emergency, the emergency coordinator must notify the appropriate state, local, or federal agencies which have been designated response roles if their help is needed. These appropriate agencies along

with their responsibilities and capabilities have been identified and will be periodically briefed to ensure a knowledgable working relationship in the event of an emergency. Also, the nearest hospitals, and emergency transportation services have been located to ensure proper care and removal in the event of an on-site injury. Their capabilities and response times have been identified and are described within the plan.

Appendix F lists the local, state, and federal agencies and hospitals and emergency transportation services which may be contacted in the event of an emergency or injury and gives their emergency telephone numbers and contact persons. The Colorado State Patrol dispatchers will be the primary contact for the Colorado Department of Highways for notification of off-site waste spills.

The Adams County Sheriff will be contacted initially by the emergency coordinator in the event of an on-site or off-site emergency as soon as the emergency coordinator has knowledge of the event. The facility is not located in a fire district; thus, the county sheriff assumes the same responsibilities as a fire chief. He would also assist the emergency coordinator in dealing with other local and state agencies.

The Tri-County Health Department will be contacted by the emergency coordinator in the event of an emergency. The Department's primary responsibility is as a consultant to the emergency coordinator for containment and evacuation. The Health Department does not have any equipment which the facilities lack which would be necessary to extinguish fires or contain and clean up spills.

The Hazardous Waste Control Section of the State Health Department will also be contacted by the emergency coordinator in the event of an emergency. They will provide technical assistance to the local agencies if requested and can obtain samples for analysis, as required. The Hazardous Waste Control Section does not have the equipment necessary to extinguish fires or contain and clean up spills.

The U.S. EPA Region VIII Emergency Response Branch will also be contacted by the emergency coordinator in the event of an emergency. The EPA Response Branch will assess the reported emergency and determine if they are required at the site. They will also assist in the contacting of appropriate state and local agencies. Their equipment is limited to personal protection devices. They can obtain samples and perform analysis if required, to test for residual contamination.

In the event of an injury, the on-site first aid specialist (on-site and available during all operating hours) who supports the emergency coordinator will evaluate the extent of the injury. The on-site first aid station will contain a sink with running water, a bed, first aid kit (industrial type containing bandages, gauze pads, tourniquet, antiseptic swabs, etc.), a stretcher, and blankets. The first aid station is mainly for minor injuries. For serious personal injuries, the first aid to be administered will be: (1) stop bleeding, (2) artificial respiration, and (3) avoid shock until medical help is secured. Information on the capabilities of the hospitals referenced in this section was obtained by Harding Lawson Associates during personal visits to these sites.

If the first aid specialist determines that the injury is serious, emergency medical air service will be immediately contacted. This service consists of two helicopters and is provided by the St. Anthony Hospital. St. Anthony's Hospital is a major metropolitan hospital located in Denver, which provides complete health care facilities. However, specific injuries such as burns or poisoning are transported instead to the University of Colorado Medical Center or Denver General Hospital, respectively. Each helicopter contains electrocardiographic monitors, oxygen, defibrillator, suction apparatus, endotracheal intubation equipment, intravenous fluids, and emergency drugs and is staffed by specialized registered nurses (RNs) who are trained in critical injury care. Each helicopter can accommodate two stretcher patients, one patient sitting, the critical injury care nurse, and the pilot. The helicopter has a range of 300 miles and response time to the site would be approximately 40 minutes.

Upon arrival, the critical injury care nurse will evaluate the type of injury, stabilize the patient, and depending on the type of injury determine the appropriate hospital. The air service has access to an emergency medical service patch matrix communication system which connects the critical injury care nurse with the designated hospital or any physician who will be utilized upon arrival of the patient. This allows for specialized treatment of the injury while enroute to the designated hospital.

If the on-site first aid specialist determines the injury to be non-serious, then the Morgan County Ambulance service will be contacted for transport. The service is operated by the Morgan County government and

has ambulances located in Ft. Morgan (two), Brush, and Wiggins. The ambulances are on call 24 hours a day and are staffed by emergency medical technicians. The estimated response time to the facility is one hour.

A non-critical patient will be transported to the Ft. Morgan Community Hospital rather than the Brush Hospital because it is a larger facility. The facility has 40 beds, 10 staff doctors, 10 registered nurses, and 15 licensed practical nurses. Serious injuries to the head or spinal column and chemical or third degree burns can be stabilized at this hospital, then transported to the appropriate hospital in Denver. The hospital has a 24 hour emergency room staffed with trained emergency medical technicians (EMT's) and has doctors on call for serious injuries. There are two x-ray suites, two operating rooms, a complete laboratory, and 24 hour respiratory therapy.

Contractual arrangements will be made between local hospitals/clinics and on-site personnel prior to operation for use of Flight for Life and other services.

The facility will have its own trained and fully equipped on-site emergency response team for the containment and clean-up of hazardous waste releases. In the event of a release, the necessary equipment will be utilized to contain the release and clean up the area.

7.4.10 Emergency Equipment

Fire fighting equipment to be used by the emergency response team will include the site water trucks which will be modified for fire fighting use and (for Phase II) a trailer mounted foam dispensing unit to be used on chemical fires. A water pump, such as the Angus "Lightweight 1200"

high performance pump, will be mounted on the site water truck with fire hoses and adjustable nozzles for fire fighting. A combination fire/chemical suit, such as the Fyrepel 1000 Series, will be kept with the emergency response equipment. A mobile foam unit, similar to TAC 300 Foam Trailer, will be used. This unit has a dual axle steel frame with high flotation tires, lineal 300 gallon foam tank, 4-inch header, three 2-1/2-inch hose connections, and generates 5,000 gallons of foam solution.

Emergency life support equipment will include a self-contained breathing apparatus, such as the Scott Presur-Pak 11a, which will be located in the guardhouse, solidification building, laboratory, and with the emergency response equipment. These locations will also contain fire blankets, such as the wall mounted MSA Fire Blanket; first aid kit; and pole stretchers, such as the Ferno-Washington Model 108-AF folding pole stretcher. Each employee will be issued a respirator, such as the 3M Respirator #8725.

Each piece of operating equipment which will come into contact with the waste will have attached, and within easy access, an emergency escape mask, such as the Robert Shaw Air Capsule, Part Number 900-002-268-12.

Fire extinguishers will be of the multi-purpose dry chemical type, such as the General 26 pound Triplex Extinguisher, Model TGC-30D, and will be located in each of the buildings as shown in Figures 7.3.1 through 7.3.5 and 7.3.9 of the Facility Plan. In addition, Purple K extinguishers, such as the General Purple K extinguishers Model KGC-30D, will be placed at the fuel stations, truck sampling area, truck wash facility, drum storage area, and solidification facilities. The solidification building

will have an automatically activated fire extinguishing/suppressing system, such as the Chemetron HALON 1301. Mobile fire units, such as the Angus AF100 mobile foam unit, will be placed at the fuel stations, tank farm, and drum storage area. Also, a foam unit, such as the TAC 300 foam and trailer unit, will be kept with the emergency response equipment.

Major equipment maintained on-site for containment and clean-up of hazardous waste in the event of a release consists of vacuum equipment (at least one truck for transfer and emergency response available at all times), absorbents, foams, back-hoes, bulldozers, and dump trucks. The facility will have an equipped emergency response van which will contain shovels, rakes, ropes, personal safety equipment, volatile vapor analyzers, and other support equipment. The location of the emergency response van and equipment has been designated as shown in Figure 7.3.1, pending detailed design of the facility.

Spill control equipment will include absorbent booms and chips, such as the Kys Oil-Klean (Oil Absorbent Products), to absorb any accidental spills. Other spill equipment will include chemical resistant boots and gloves; eyewear; hard hats; rakes; shovels; respirators, such as the 3M Respirator #8725; safety lights, such as the Koehler Commando 281GB; combustible gas indicators, such as the MSA Explosilarm Portable Combustible Model 100; and a portable emergency eyewash station, such as the Hows Model 7606. The on-site backhoes, dump trucks, and bulldozer will also be available for use in the event of a spill. The water pump on the 6,000 gallon site water truck can be used for decontamination of personnel and small equipment. A high pressure steam-cleaning unit will be located at the truck wash facility for decontamination of larger equipment.

The facility will have both internal and external alarm and loudspeaker systems located throughout the site to ensure immediate response to the emergency in the appropriate area of the facility. The loudspeakers will be connected to the plant telephones located in the administration office, dispatchers office, chemist's office, truckwash building, tank farm, and solidification facility. Typical locations of loudspeaker telephones and alarms were indicated in Figures 7.3.1 through 7.3.5 and 7.3.9. Alarm boxes will be transferred from closed cell to the new cell so that there will be an alarm at the active disposal cell at all times.

Automatic (not human activated) alarm systems are to be installed on-site to aid the security personnel who will be on-site 24 hours per day. Constant facility-wide surveillance is thus assured, even in the event of a power failure. The fire extinguishing/suppressing system in the solidification building will have an automatic warning alarm. In addition, automatic combustible gas indicators, such as the MSA Explosilarm Model 100, will be used to monitor the building. This unit can detect the presence of a broad range of flammable gases or vapors to their lower explosive limit (LEL) in air. Also, the sprinkler systems located in the employee/laboratory facilities, and truckwash and maintenance facilities, will automatically emit an alarm, if activated.

Safety showers and eye washes will be located in the laboratory, tank farm area, solidification facility, truck wash area, and secure disposal cell area. The showers and eye washes will be located in convenient positions in the event of a spill or fire. Typical locations of the showers and eye washes are indicated in Figures 7.3.1 to 7.3.5 and 7.3.9.

7.4.11 Off-Site Spill Response

BFI will respond to off-site cleanup for both company and non-company accidents, as requested. BFI has performed cleanup for many spills, including the Coast Guard on oil spills into waterways, Independent Refinery (Texas) for a gasoline line rupture, and Southern Pacific and Kansas City Southern Railroads for derailments with toxaphene, and adipic acid spills to name a new examples.

BFI has entered into a mutual aid agreement with the Mutual Aid Fire Chief's Association. This agreement provides emergency response information for specific chemicals, a commitment from BFI to assist when requested with containment/disposal of any off-site spill, and training/equipment for emergency response personnel. The provisions of the agreement are given below.

- BFI is engaged in an attempt to obtain permits for the construction of a hazardous waste disposal facility (the "Facility") in Adams County, Colorado, and will, if such facility is constructed, establish and maintain the capability to conduct chemical spill response and cleanup operations at such facility. The members of the Mutual Aid Fire Chief's Association are obligated by the provisions of Colorado Senate Bill 519 to develop and maintain similar capabilities within their respective areas of responsibility in Adams County. For their mutual benefit and assistance in developing and maintaining such spill response and cleanup capabilities, the Association and BFI would agree, subject to terms and conditions to be set out in the Agreement, that each would, upon request, assist the other in conducting such spill response and cleanup operations at the Facility or in the appropriate areas of Adams County, respectively. The terms and conditions upon which BFI would assist the Association in conducting such operations would include, but not be limited to, appropriate measures (1) to ensure that BFI, in providing such assistance, would be deemed to be acting under lawful orders of duly constituted governmental authority; (2) to protect BFI from liability to third parties resulting from BFI's provision of such assistance to the Association; and (3) to establish and preserve BFI's right to be reimbursed for the reasonable cost of providing such assistance.

- BFI would acquire, for use by the Association and its members in furtherance of the purposes of the Agreement, emergency equipment substantially equivalent to that described in Table 7.4.1.

- o BFI would permit personnel of the Association and its members to participate in training sessions conducted at the Facility by BFI to train its own personnel in techniques for handling of hazardous materials, spill response and cleanup, and related safety procedures.

TABLE 7.4.1

ADDITIONAL EQUIPMENT SUPPLIED BY BFI FOR HAZARDOUS MATERIAL RESPONSE VAN

Item	Cost
4 - Survive Air/self-contained breathing apparatus 60 min., 4.5 psi, #984620	$ 1,398 each
4 - Air tanks	592 each
1 - Eye wash tank	300
1 - Set non-sparking safety tools (brass)	1,800 per set
4 - Man training	1,600
1 - Radio telephone/auto patching system	5,000
4 - Hand-held portable radios with chargers	2,000

Members of the Mutual Aid Fire Chief's Association include the following fire districts:

- o Sable Altura Fire District
- o Westminster Fire District
- o Brighton Fire District
- o West Adams County Fire District
- o Federal Heights Fire District
- o Thornton Fire District
- o Rocky Mountain Arsenal
- o North Washington Fire District
- o Southwest Adams County Fire District
- o South Adams County Fire District

7.4.12 Evacuation

In the event of an imminent or actual emergency situation the emergency coordinator will activate internal facility alarms or communication systems to alert facility personnel. The personnel will evacuate the facility using the pre-designated primary and secondary evacuation routes

which were designated in Figures 7.3.6 to 7.3.8. The evacuation will be directed by the emergency coordinator and be coordinated with the security guard(s) on duty to expedite the evacuation.

Emergency evacuation equipment will include self-contained breathing apparatus located in the guardhouse, solidification building, laboratory, and emergency response equipment room. Each piece of operating equipment which will come into contact with the waste will have attached, and within easy access, an emergency escape mask. Also, each employee will be issued a respirator with appropriate filters.

A 4-wheel drive vehicle will be maintained on-site for the purpose of removing personnel from an area in the event of an emergency evacuation. In addition to the emergency vehicle, the facility will have a completely equipped emergency response van that will contain spill control equipment, fire extinguishers, and emergency life support systems. The van will also be used to transport the foam unit in the event of a fire or spill. The emergency van will respond to all company accidents and will assist any other response personnel as requested.

7.5 MANIFEST SYSTEM, RECORD KEEPING, AND REPORTING

The interim status standards contain various requirements for record keeping systems and for reporting operations and incidents. These requirements are summarized in Subpart E of the standards, although certain details of the requirements are also contained in various other subparts.

The following discussion is intended to identify the applicable record keeping and reporting requirements, and to indicate the procedures to be used to comply with these requirements.

7.5.1 Use of Manifest System

All hazardous waste treatment, storage, and disposal facilities which receive hazardous wastes from off-site generators must utilize a manifest system which meets the requirements contained in 40 CFR 265.71 and 265.72. Only properly manifested wastes (in drums or bulk) will be handled at this facility.

This facility will comply with these requirements by employing the following procedures:

1. The designated facility technical staff member will sign, date, and return to the transporter a copy of each manifest received with each shipment of hazardous waste, whether exempt (small quantity) or not.

2. Any significant discrepancies in the quantity and type of hazardous waste received and quantity and type of hazardous waste described in the manifest will be reconciled with the generator within 15 days of receipt of the waste or the details of the discrepancy will be immediately reported by letter to the EPA Regional Office. Additional procedures for discrepancies may be found in Sections 7.5.2 and 7.2.3.

3. Within 30 days of receipt of a conforming hazardous waste, the operator will send a copy of the signed manifest to the generator for purposes of verifying to him that the conforming waste was received.

4. The facility's copy of the manifest will be retained on file at the facility for a minimum of three years.

7.5.2 Manifest Discrepencies

As indicated in Section 7.5.1, any significant discrepancies in the quantity and type of hazardous waste received or the quantity and type of hazardous waste described in the manifest will be reconciled with the generator within 15 days of receipt of the waste before processing or in the event of no reconciliation, the details of the discrepancy will be immediately reported in detail by letter to the EPA Regional Office, along with copies of the manifest.

A "significant discrepancy" in quantity is:

- for bulk waste shipments, any variation in quantity greater than 10% of weight; or
- for containerized shipments, any variation in piece count, such as a discrepancy of one drum per truckload.

A significant discrepancy in type is a difference which can be discovered through visual inspection or waste analysis, such as waste solvent substituted for waste acid, or toxic constituents not being reported.

All significant discrepancies must also be noted on the manifest.

7.5.3 Operating Records

During the operating life of the facility, the operations manager will maintain a written operating record. This record will be retained until final closure of the facility.

The operating record will contain the following information:

- An itemized listing of each hazardous waste received, including a waste description, quantity, and the method(s) and date(s) of treatment, solidification, and disposal.
- The location and quantity of each waste stored or disposed of at the facility. The location and quantity of each waste will be recorded on a grid map of the disposal cell. This data will also be cross-referenced to the manifest numbers associated with each waste.
- Results of all analyses and trial tests conducted on wastes.
- Reports showing pertinent details of every incident which required implementation of the contingency plan contained in Section 7.4.
- Results of facility inspections and corrective action taken as outlined in Section 7.2.4. As noted in that section, these records will be retained for three years.
- Results obtained from the groundwater monitoring program described in Section 7.6. These results will be retained throughout the post-closure monitoring period.

- Closure and post-closure cost estimates, including subsequent annual adjustment or revisions, as described in Section 7.6.

7.5.4 Training Records

The district manager will maintain complete training records to show both the training provided to employees, and employees participation in formal and on-the-job training. These records are described in Section 7.2.5 and will contain:

- The job title for each position at the facility related to hazardous waste management, and the name of the employee filling each position.
- A written job description for each position. This description will include the requisite skill, education, or other qualifications and duties assigned to each position.
- A written description of the type and amount of both introductory and continuing training that will be given to each person filling each position listed.
- Records that document that training or job experience required has been given to and satisfactorily completed by all appropriate facility personnel.

7.5.5 Availability, Retention, and Disposition of Records

The records, plans, and other data that are developed and employed in accordance with Section 7.5 and Subpart E of the interim status standards will be furnished upon request, and made available at reasonable times for inspection, by any officer, employee or representative of U.S. EPA who is duly designated by the administrator of that agency. Similar access to these records, plans, and data will be granted to duly authorized representatives of Colorado or local governmental agencies acting either under specific statutory authority with respect to hazardous waste facilities, or the written authorization of the administrator of U.S. EPA.

The minimum retention period for each of the records mentioned in this section is three years. In the event of any enforcement action, the retention period for all records will automatically be extended indefinitely, pending resolution of that action. From initial notification of an enforcement action and until its resolution, none of the records covered by the action will be discarded or destroyed. Should the EPA Regional Administrator or his duly appointed representative ever request extension of the retention period for any records, that request will be honored.

7.5.6 Annual Report

Prior to March 1 of each year of the operating life of the facility, BFI will prepare and submit (as requested) to the U.S. EPA Regional Administrator an annual report, using EPA Form 8700-13, as shown in Figures 7.5.1 and 7.5.2. Upon notification that the enforcement authority for RCRA has been transferred to a Colorado State agency, BFI will instead begin submitting annual reports on the prescribed form to the designated State agency. Upon final closure of the facility, a final annual report will be prepared and submitted.

The annual report will provide the following information, as a minimum:

- The EPA identification number, name, and address of the facility.
- The calendar year covered by the report.
- The EPA identification number for each hazardous waste generator from which the facility received hazardous waste during the year. For imported shipments, the report will give the name and address of the foreign generator.
- A description and the quantity of each hazardous waste the facility received during the year, by EPA identification number for each generator.
- The method of treatment, solidification, and disposal for each hazardous waste.

FIGURE 7.5.1

Reprinted from:

Federal Register / Vol. 45, No. 98 / Monday, May 19, 1980 / Rules and Regulations

Please print or type with ELITE type (12 characters per inch).

EPA No. 12345 XX
Form Approved OMB No. 158-00XX

EPA U.S. ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE REPORT

PLEASE PLACE LABEL IN THIS SPACE

I. TYPE OF HAZARDOUS WASTE REPORT

PART A: GENERATOR ANNUAL REPORT
THIS REPORT IS FOR THE YEAR ENDING DEC. 31, 19

PART B: FACILITY ANNUAL REPORT
THIS REPORT FOR YEAR ENDING DEC. 31, 19

PART C: UNMANIFESTED WASTE REPORT
THIS REPORT IS FOR A WASTE RECEIVED (day, mo., & yr.) - - 19

INSTRUCTIONS: You may have received a preprinted label attached to the front of this pamphlet; affix it in the designated space above—left. If any of the information on the label is incorrect, draw a line through it and supply the correct information in the appropriate section below. If the label is complete and correct, leave Sections II, III, and IV below blank. If you did not receive a preprinted label, complete all sections. "Installation" means a single site where the waste is generated, treated, stored, or disposed of. Please refer to the specific instructions for generators or facilities before completing this form. The information requested herein is required by law (Section 3002/3004 of the Resource Conservation and Recovery Act).

II. INSTALLATION'S EPA I.D. NUMBER

F 1

III. NAME OF INSTALLATION

IV. INSTALLATION MAILING ADDRESS

STREET OR P.O. BOX
3

CITY OR TOWN | ST. | ZIP CODE
4

V. LOCATION OF INSTALLATION

STREET OR ROUTE NUMBER
5

CITY OR TOWN | ST. | ZIP CODE
6

VI. INSTALLATION CONTACT

NAME (last and first) | PHONE NO. (area code & no.)
2

VII. TRANSPORTATION SERVICES USED (for Part A reports only)

List the EPA Identification Numbers for those transporters whose services were used during the reporting year represented by this report.

VIII. COST ESTIMATES FOR FACILITIES (for Part B reports only)

A. COST ESTIMATE FOR FACILITY CLOSURE $

B. COST ESTIMATE FOR POST CLOSURE MONITORING AND MAINTENANCE (disposal facilities only) $

IX. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. PRINT OR TYPE NAME | B. SIGNATURE | C. DATE SIGNED

EPA Form 8700-13 (4-80)

PAGE 1 OF

FIGURE 7.5.2

Reprinted from:

Federal Register / Vol. 45, No. 98 / Monday, May 19, 1980 / Rules and Regulations

GSA No. 12345-XX
Form Approved OMB No. 158-R00XX

Please print or type in the ELITE type (12 characters/inch).

U.S. ENVIRONMENTAL PROTECTION AGENCY

EPA

FACILITY REPORT – PARTS B & C

(Collected under the authority of Section 3004 of RCRA.)

FOR OFFICIAL USE ONLY (Items I & II)

I. DATE RECEIVED

II. RECEIVED BY

XVI. TYPE OF REPORT (enter an "X")

☐ PART B ☐ PART C

XVII. FACILITY'S EPA I.D. NO.

G 1

XVIII. GENERATOR'S EPA I.D. NO.

XX. GENERATOR ADDRESS (street or P.O. box, city, state, & zip code)

XIX. GENERATOR NAME (specify)

XXI. WASTE IDENTIFICATION

LINE NUMBER	A. DESCRIPTION OF WASTE	B. EPA HAZARDOUS WASTE NUMBER (see instructions)	C. HANDLING METHOD (enter code)	D. AMOUNT OF WASTE	E. UNIT OF MEASURE (enter code)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

XXII. COMMENTS (enter information by line number – see instructions)

EPA Form 8700-13B (5-80)
BILLING CODE 6560-01-C

PAGE ____ OF ____

- Monitoring data for the previous year.
- The most recent closure cost estimate and the most recent post-closure cost estimate.
- The certification section of the report will be signed by the district manager or his authorized representative.

7.5.7 Unmanifested Waste Report

In the event unmanifested hazardous wastes are received by the facility and are stored, treated, or disposed of without being reconciled with the generator, the operator will file a report utilizing EPA form 8700-13 and 8700-13B (see Figures 7.5.1 and 7.5.2) within 15 days of receipt of the waste. This report will include the following information:

- The EPA identification number, name and address of the facility.
- The date the facility received the waste.
- The EPA identification number, name, and address of the generator and the transporter, if available.
- A description and the quantity of each unmanifested hazardous waste the facility received.
- The method of treatment, storage, solidification, or disposal for each hazardous waste.
- A brief explanation of why the waste was unmanifested, if known.
- The certification of the report will be signed by the district manager or his authorized representative.

If a hazardous waste shipment is unmanifested because it is in an exempted quantity, the district manager will endeavor to obtain certification of the exempted status of the waste from the generator. However, it is BFI's policy to require manifests on small quantity wastes even if exempted. This certification will be incorporated into the facility's operating records and also reported to the EPA Regional Administration. If such certification cannot be obtained, an unmanifested waste report will be prepared and submitted as described above.

7.5.8 Additional Reports

In addition to the annual reports and the unmanifested waste reports previously discussed, the facility operator will prepare and submit to the EPA Regional Administrator, or the appropriate Colorado State agency, the following reports:

- Hazardous Waste Release Reports. All reportable spills, leaks, fires and explosions will be reported immediately to the local governmental emergency response coordinator and the National Response Center (Phone 800-424-8802). A written report will be submitted to the EPA Regional Administrator within 15 days. At a minimum, this report will include:

  - Name, address, and telephone number of the facility operator.
  - Name, address, and telephone number of the facility.
  - Date, time, and type of incident (e.g., fire, explosion).
  - Name and quantity of material(s) involved.
  - Extent of injuries, if any.
  - An assessment of actual or potential hazard to human health or the environment, where this is applicable.
  - Estimated quantity and disposition of recovered material that resulted from the incident.

- Closure Notification. At least 180 days prior to commencement of closure, the facility operator will submit the closure plan for approval to the EPA Regional Administrator. Following completion of closure, the operator and an independent registered professional engineer will certify to the Regional Administrator that the facility has been closed in accordance with the specifications in the approved closure plan.

7.6 ENVIRONMENTAL MONITORING PROGRAM

The fundamental objectives of environmental monitoring at land disposal sites are to serve as a check on potential leachate contamination of groundwater; surface water contamination from runoff; air quality changes; and surface soil contamination. In cases where potential groundwater contamination is sufficiently neutralized by natural hydrogeological conditions and by engineered safeguards, EPA regulations provide that the requirement for groundwater monitoring may be waived(6).

The environmental monitoring program for the BFI facilities was developed by F. M. Fox & Associates (Environmental Monitoring Plan for the Proposed Highway 36 Disposal Facility, December 2, 1981, Revised). The monitoring plan was used as the basis for the preparation of Section 7.6 of this report.

This facility is located in a favorable hydrogeological setting, and the surface impoundments and disposal cells will be provided with a head dissipating system, a leachate collection/detection system, and recompacted clay liners. Even though these conditions would appear to be sufficient to justify waiving the groundwater monitoring requirements, it has been decided, as an additional safeguard, to initiate a monitoring program to detect any potential impact the facility may have on groundwater quality.

Monitor wells have been installed and will periodically be sampled along with surface water impoundments for analysis of selected parameters. The analytical data from the routine monitoring program will be submitted, on a regular basis, to the Colorado State Department of Health and the Tri-County Health Depatment for their review. Initial background levels will be compared to subsequent measurements to determine if there has been a change in value for any parameters. Such changes will be statistically evaluated to determine if they were actually significantly different, or were simply caused by variations inherent to the sampling and analytical methods. This evaluation will employ the use of statistical procedures as indicated in pertinent 40 CFR 265 Subpart F.

If a determination should ever be made that the facility may be contaminating the environment, a monitoring program review will be performed.

If this review indicates sufficient grounds, a more comprehensive environmental assessment program will be implemented, as recommended in 40 CFR 265 Subpart F.

In conjunction with the groundwater monitoring program, BFI will attempt to acquire as much information as possible about the in-place solidified waste performance. This will be accomplished through collection and analysis of representative samples obtained from the disposal cells. It is probable that waste will be collected by auger drilling and sampling techniques and that analysis will include permeability testing, moisture content testing, and density testing. In order to obtain reasonable long-term performance data, samples of waste will be collected within one year after placement and at two-year intervals in the first cell constructed. Data obtained from sampling and testing procedures will be on file with BFI and will be available to the Colorado State Department of Health upon request.

The Colorado Air Quality Commission has the authority under the Colorado Revised Statutes 1973, Section 25-7-106 to request that BFI monitor air quality at the facility. In accordance with suggestions made by the State, BFI will implement a meterological monitoring program when Phase I operations are initiated.

The meterological monitoring station will be placed downwind of the active site area along the most predominant wind direction. Existing wind direction data available for the study were from Denver, Colorado and Akron, Colorado. From this data it seems most likely that the predominant winds at the site will be from the south. However, before any air quality monitoring equipment is installed at the site, the location

of monitoring equipment will be determined on the basis of the local conditions and in consultation with the Colorado Department of Health, Air Pollution Control Division. The station will continuously monitor wind speed (vertical and horizontal components), wind direction, temperature, pressure, humidity, precipitation (rain and snow), and pan evaporation. The system will utilize a micro-processor unit for storage and averaging the raw data for various time periods, i.e., 1-hour, 3-hour, 24-hour averages, totals and minimum/maximum values. The unit will also include an audio cassette recorder for recording the processed data and a cassette tape reader to convert the data to computer compatible code.

Data from the system would be sufficient for input into a stability class determination model, a Wind Rose program, a STAR program, or similar programs for air quality modeling. It is noted that stability class may be determined by the methods proposed by EPA in its publication OAQPS Guideline Series, Guidelines in Air Quality Models, Proposed Revisions, October 1980, Appendix C. This methodology is similar to the NRC Safety Guide 1.23.

An annual report containing meterological data shall be formulated and submittted to the State of Coloardo Air Pollution Control Division.

7.6.1 Groundwater Monitoring Program

Monitoring of groundwater quality provides the means for ensuring that the engineering design criteria, construction techniques, and operational methods are effective in preventing contamination. The best means of preventing groundwater contamination is to first prevent the formation of leachate. This will be accomplished at the subject site by controlling entry of surface water into the disposal cells, controlling the moisture

content of the deposited wastes, and minimizing surface water infiltration into the completed cell by constructing a low permeability cover or seal. Secondly, in the event fluids or leachates are formed, the disposal cell must be able to contain them. Leachates will be controlled by lining the disposal cell with a low permeability clay liner incorporating head dissipating and leachate collection systems. Thirdly, the monitoring program discussed in detail below will function as a detection system for leachate generation and will provide a continuous appraisal of the disposal cells' effectiveness in preventing contamination of groundwater resources.

7.6.1.1 General Groundwater Monitoring Network Design

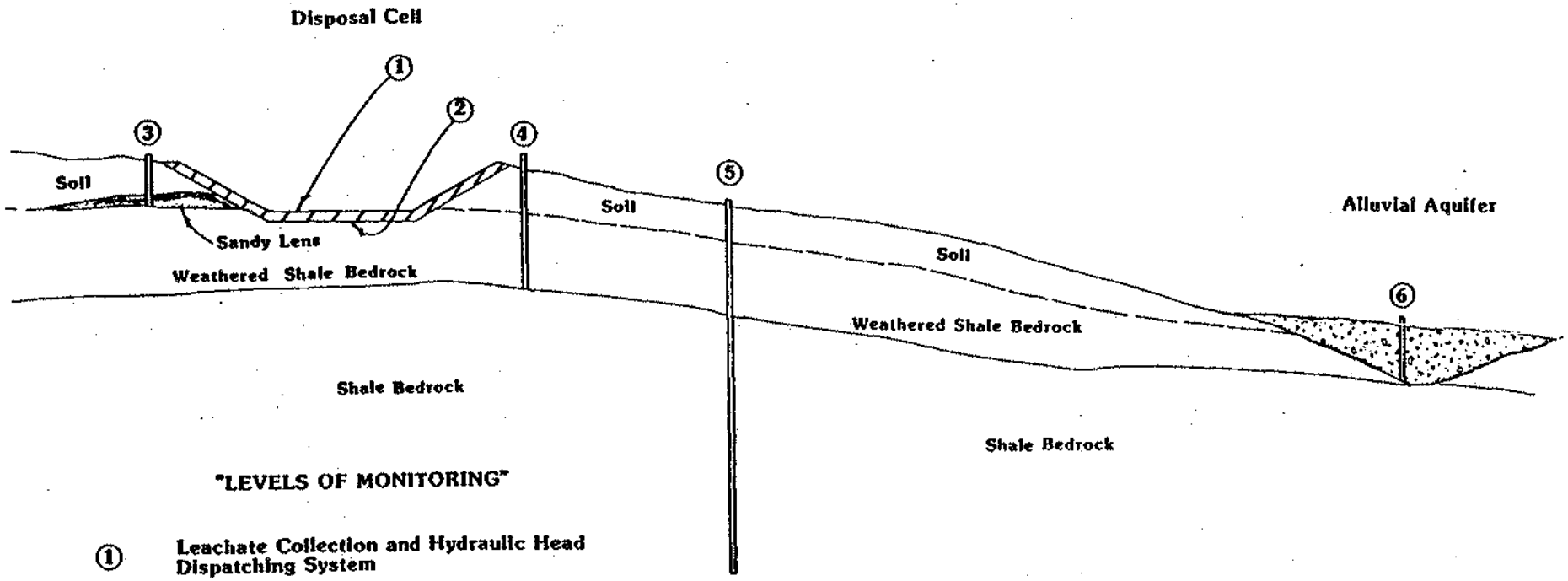
Potential contamination of groundwater in the vicinity of the disposal cells will be monitored by a network system consisting of six "levels of monitoring." The various levels are based upon the geologic and hydrologic conditions beneath the site and the design and location of the disposal cells.

Figure 7.6.1 shows the six levels of monitoring associated with a typical disposal cell. The rationale behind each of the levels is discussed below.

- Monitoring Level 1: The hydraulic head dissipating system will consist of a permeable sand bed below the base of the solidified waste material and overlying the clay liner. The sand layer (cell bottom) will slope towards a recovery sump located at the base of the disposal cell sidewall. The recovery sump will be accessible by a 6-inch diameter PVC riser pipe that will extend from the sump to the ground surface. The design details for the hydraulic head dissipating system are presented on Figure 7.6.2.

  Systematic monitoring of the riser pipes (monitoring points) will be conducted to determine if fluids are present. If fluids are detected, they will be pumped out immediately and treated along with the incoming hazardous waste material. Monitoring and immediate removal of any fluids will ensure that fluid heads on the clay liner are minimized.

LEACHATE AND GROUND-WATER MONITORING SCHEMATIC



"LEVELS OF MONITORING"

1. Leachate Collection and Hydraulic Head Dispatching System
2. Leachate Detection System
3. Sandy Lens Monitor Well
4. Perched Fluid Monitor Well
5. Deep Pierre Shale Monitor Well (500')
6. Shallow Saturated Zone Monitor Well

LEACHATE and GROUND-WATER MONITORING SCHEMATIC	
FOX Consulting Engineers and Geologists	
Date: 10/10/81 Drawn By: SLV Reviewed By: KAH Job No: 1-2543-3233	FIG. 7.6.1

- Monitoring Level 2: The leachate detection system will be constructed in a similar manner as monitoring level 1. It will consist of a permeable sand layer constructed between the base of the previously mentioned clay liner and an additional clay liner constructed along the disposal cell floor (refer to Figure 7.6.2). This sand bed will again slope towards a recovery sump which will be accessed from surface via a 6-inch diameter PVC riser pipe. Systematic monitoring of the riser pipe will ensure that fluids do not migrate out of the disposal cell and that the controls identified under monitoring level 1 are functioning according to design and construction specifications.

  Should contaminated fluids be detected in monitoring level 2, all wastes deposited in the disposal cell will be removed along with the cell liner and the cell will be properly reconstructed. The material removed from the malfunctioning disposal cell will be properly treated (solidified) and deposited in a secure disposal cell.

- Monitoring Level 3: The sandy lens monitoring wells will be located in specified areas adjacent to the disposal cells. Wells will be located where sandy soil lenses are encountered during excavation and construction of the disposal cells. The sandy lenses are higher in permeability than the adjacent subsoils and, therefore, should be the first areas where laterally migrating fluids would accumulate with saturated flow conditions. Systematic monitoring for the presence of fluids within these sandy lenses will ensure the system is functioning to design expectations.

- Monitoring Level 4: The perched fluid monitoring wells will be located within the processing and disposal cell areas and in all drainages leading away from the disposal area. The monitoring wells will extend through the weathered shale to the unweathered Pierre shale interface. The purpose of these wells will be to detect the formation of fluid mound build-up and horizontal migration through the soils and weathered shale. Systematic monitoring at this level will be especially useful in determining whether or not fluids have escaped and become perched on top of the shale. The level 4 type wells will be constructed within the processing area, in the drainages adjacent to the disposal cells, and arrayed within the disposal cell area.

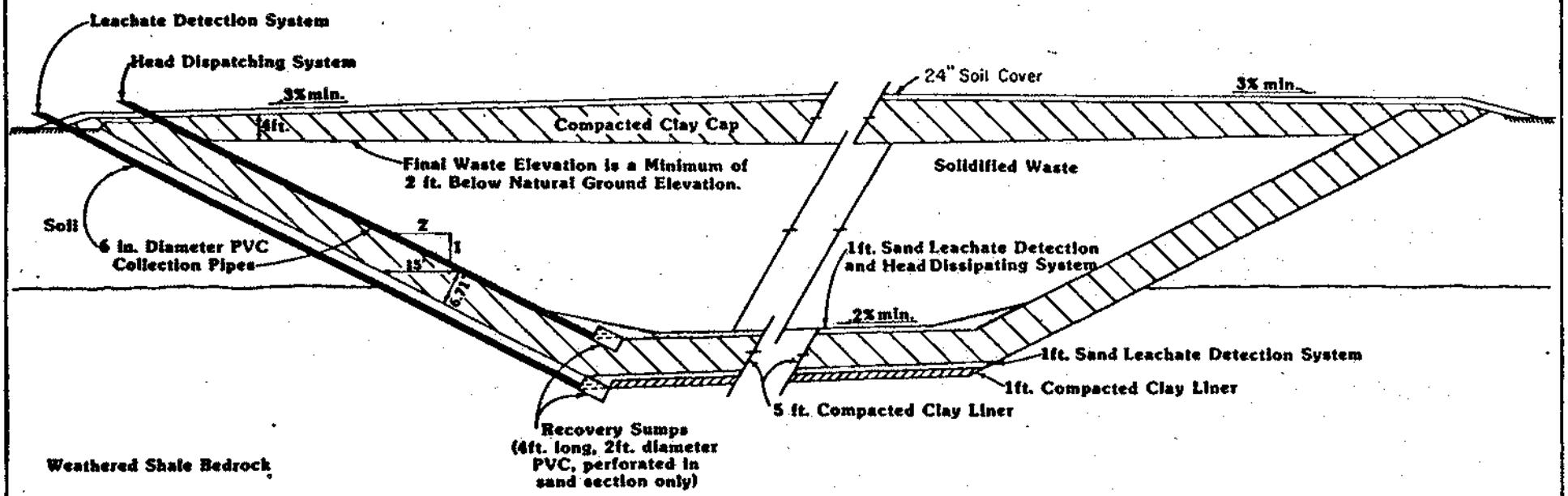
- Monitoring Level 5: The deep Pierre shale monitoring wells will be located at designated points down gradient from the disposal cells. A total of three level 5 type wells are planned. Regular monitoring and chemical analyses of the groundwater present in the Pierre shale will be compared to baseline water quality norms and will verify the presence or absence of contamination within the deeper groundwater systems.

- Monitoring Level 6: The shallow saturated zone monitoring wells will be located at specified points in all surface water drainages within the vicinity of the disposal cells. All 11 of the

TYPICAL SECURE DISPOSAL CELL

TYPICAL

Cell Length - 600 feet
Cell Width - 300 feet
Cell Depth - 30 feet
Cell Volume - 125,000 cu. yds.



General Notes:

1) Cell excavations should be inspected by a qualified soils engineer prior to any fill placement to insure that the cell is bottomed in weathered shale.
2) Clay liners and cap should be compacted to 95% of ASTM D-1557 at 0 to plus 3% of optimum moisture content.
3) Clays for liner material must meet material specification of:
   a) more than 80% passing the No. 200 Sieve
   b) Liquid Limit greater than or equal to 30
   c) Plasticity Index greater than or equal to 7
4) All fill placement should be monitored by a qualified soils technician under the supervision of a registered professional engineer.

Shale Bedrock

0 10 20 30ft.

TYPICAL SECURE DISPOSAL CELL

FOX Consulting Engineers and Geologists

Date: 10/12/81
Drawn By: DAG
Reviewed By: RAH
Job No: I-2543-3233

FIG. 7.6.2

level 6 type wells have been installed, and those wells containing water have been sampled and analyzed. This baseline water quality data can be compared to testing results obtained through future monitoring. Systematic monitoring of these wells will detect water quality variation within the shallow groundwater system.

7.6.1.2 Monitoring Well Locations

The monitoring well locations are indicated on Figure 7.6.3. Because two of the wells could not be shown on the scale of map presented, a larger scale addition is included.

The specific location of the monitor points associated with monitoring levels 1 through 3 are not shown. However, a typical location of monitor points (collection pipe risers) for levels 1 and 2 is indicated on Figure 7.6.2. It should be noted that each disposal cell will have two monitoring points, one associated with the head dissipating system and one with the leachate detection system. Monitoring level 3 wells will be located in the future in areas where sand lenses are identified during cell excavation.

The proposed locations of monitoring level 4 type wells, the perched fluid monitoring wells, are indicated on Figure 7.6.3. There will be a total of 25 level 4 type wells, six arrayed in the area of the Phase II processing area, five arrayed in the small drainages leading from the disposal cell area, and the remaining 14 dispersed among the disposal cells (a minimum of one monitor well for four disposal cells).

Of the three level 5 type monitoring wells (deep Pierre shale) shown, two of the wells have already been constructed and water samples collected and analyzed. An additional well is proposed and will be located 1,000 feet west of the disposal cell area.

Monitoring level 6 (shallow saturated zone monitoring wells) are located in the vicinity of the disposal cell area where shallow groundwater tables were encountered at the time of drilling (predominantly in the drainages). The level 6 wells have been installed and water samples collected and analyzed. Of the 11 wells installed, six contain water and have been sampled and analyzed on a regular basis.

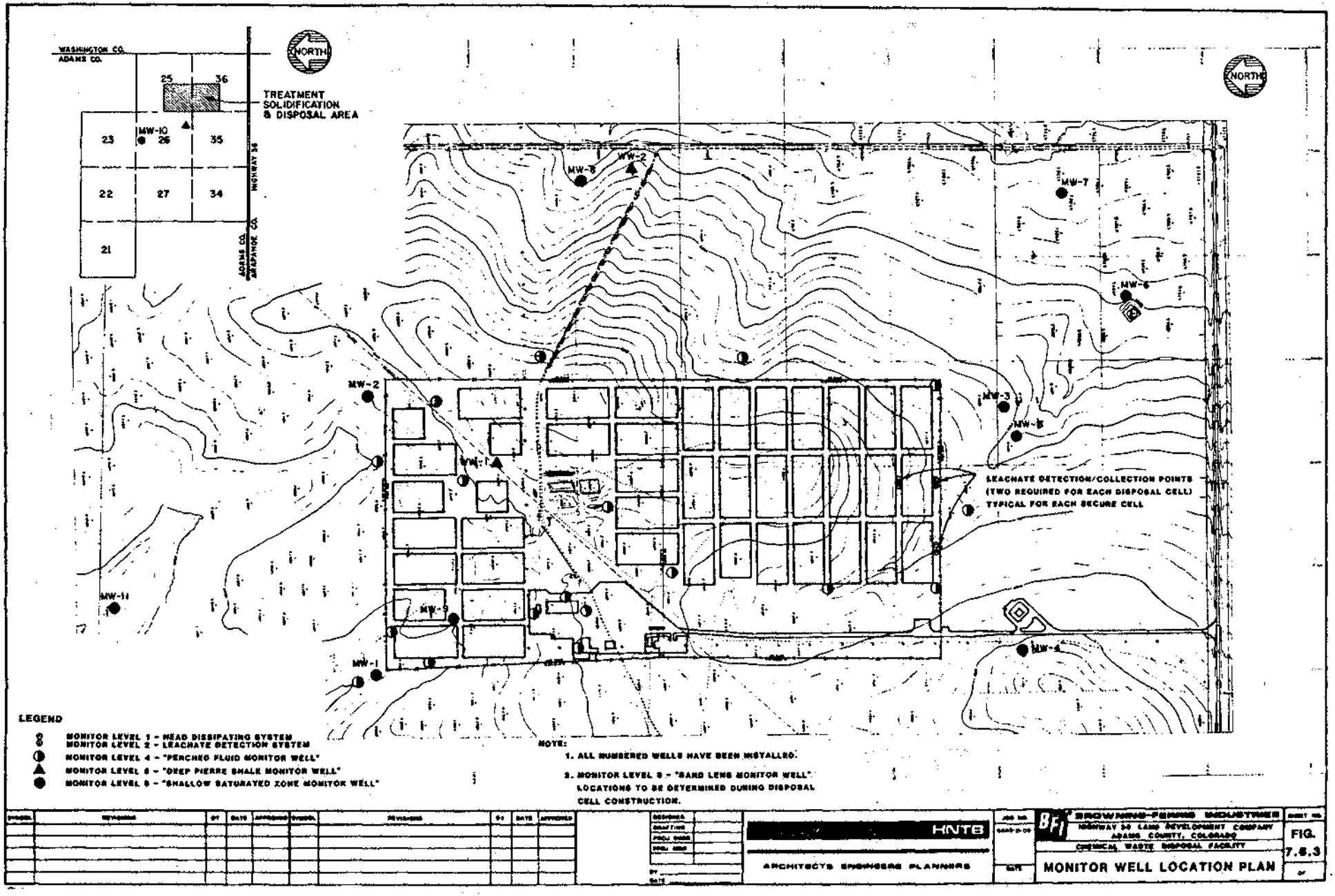
7.6.1.3 Monitoring Well Construction

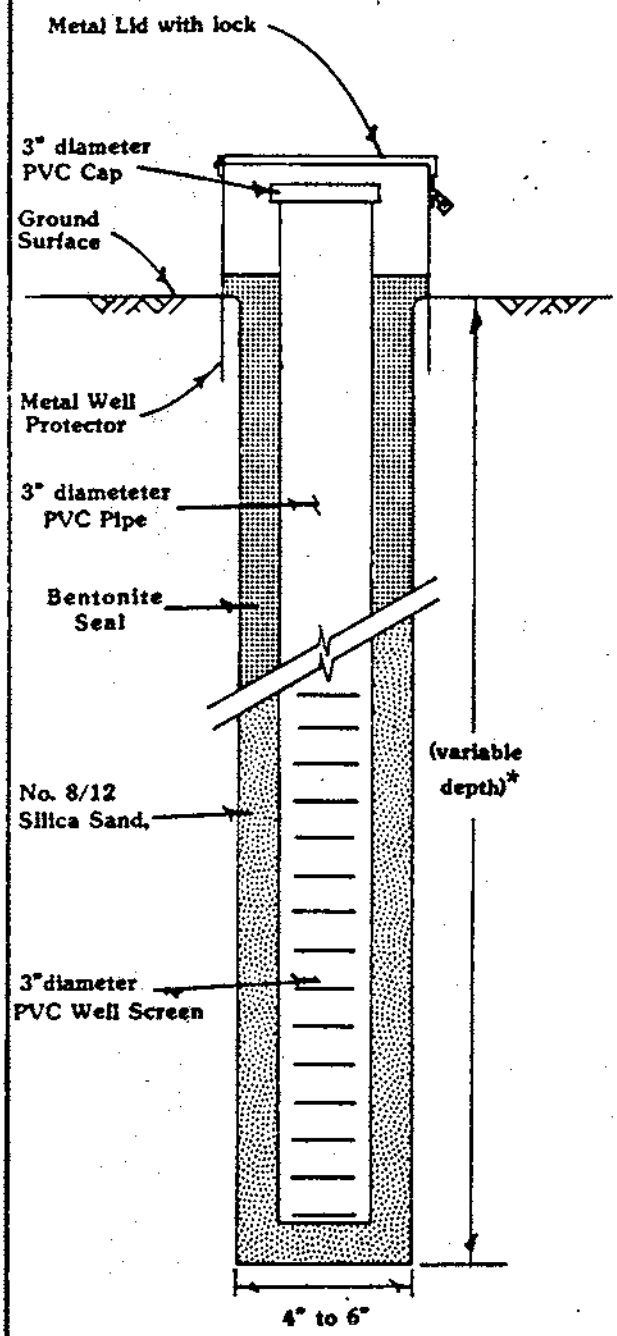
All wells were drilled with either 4- or 6-inch diameter solid auger. Polyvinylchloride pipe (PVC) containing well screen at varying depths was used to case the wells. The holes were backfilled in the annular spaces with silica sand the entire length of the well screen. The PVC pipe was coupled using square threaded flush joints. A bentonite seal was then placed around the entire non-perforated interval to the ground surface. Each of the wells was protected with a metal lid and lock. Figure 7.6.4 shows a typical monitoring well cross section and an explanation of the corresponding well depth, perforated interval, and bentonite seal locations for each of the various monitoring well functions or "levels of monitoring." Installation details of the level 6 wells and one level 5 well are given in Table 7.6.1.

7.6.1.4 Sample Collection

Specific guidelines and techniques must be followed during sample collection. The collection procedure ensures that the sample is representative of the groundwater.

All monitoring wells will be sampled using a stainless steel bailer. The bailing method was selected because of the small volume of water available and the low recharge rate. The bailer will be cleaned with acetone


WASHINGTON CO.
ADAMS CO.
NORTH
25
36
TREATMENT
SOLIDIFICATION
& DISPOSAL AREA
23
MW-10
26
35
22
27
34
21
HIGHWAY 36
ADAMS CO.
ARAPAHOE CO.
MW-8
MW-2
MW-7
MW-6
MW-2
MW-3
MW-5
MW-1
MW-11
MW-9
MW-1
MW-4
LEACHATE DETECTION/COLLECTION POINTS
(TWO REQUIRED FOR EACH DISPOSAL CELL)
TYPICAL FOR EACH SECURE CELL
LEGEND
MONITOR LEVEL 1 - HEAD DISSIPATING SYSTEM
MONITOR LEVEL 2 - LEACHATE DETECTION SYSTEM
MONITOR LEVEL 4 - "PERCHED FLUID MONITOR WELL"
MONITOR LEVEL 6 - "DEEP PIERRE SHALE MONITOR WELL"
MONITOR LEVEL 8 - "SHALLOW SATURATED ZONE MONITOR WELL"
NOTE:
1. ALL NUMBERED WELLS HAVE BEEN INSTALLED.
2. MONITOR LEVEL 3 - "SAND LENS MONITOR WELL". LOCATIONS TO BE DETERMINED DURING DISPOSAL CELL CONSTRUCTION.
HNTB
ARCHITECTS ENGINEERS PLANNERS
BFI BROWNING-FERRIS INDUSTRIES
NORTHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY
MONITOR WELL LOCATION PLAN
FIG. 7.5.3



Not to Scale

Note: The construction details of each well will be based upon its' function, or "Level of Monitoring" as indicated below:

Monitoring levels 1 & 2 - apply to head dissipating and leachate detection systems; monitoring well data is not applicable.

Monitoring Level 3 - "Sand Lens Monitoring Wells" will be installed to a depth equal to the depth the sand lens is encountered during construction and excavation for the disposal cell. The upper 10 feet of the casing will be sealed with bentonite.

Monitoring Level 4 - "Perched Fluid Monitor Wells" will be installed to a depth where the weathered shale and Pierre Shale interface. Specific depths will be determined during drilling. All wells of this type will be perforated the bottom 10 feet followed by a bentonite seal to the ground surface.

Monitoring Level 5 - "Deep Pierre Shale Monitoring Wells" will range in depth from 300 to 500 feet. Wells of this type will be perforated at the Pierre Shale interval only, and sealed with bentonite or cement to the ground surface.

Monitoring Level 6 - "Shallow Saturated Zone Monitor Wells" are installed, range in depth from 40 to 120 feet, and are sealed with bentonite a minimum of 8 feet below the ground surface.

TYPICAL MONITORING WELL CROSS SECTION	Job No:	1-2543-3233
FOX Consulting Engineers and Geologists	Date:	10/6/81
	Figure	7.6.4

TABLE 7.6.1

MONITORING/WATER WELL INSTALLATION DETAILS

HOLE NO.	HOLE DEPTH (ft.)	WATER DEPTH (ft.)	INTERVAL CASED AND SEALED (ft.)	INTERVAL SLOTTED AND SAND PACKED (ft.)
MW-1	120	None	0-60, 3" I.D. threaded PVC	60-120, 3" I.D. threaded PVC
MW-2	120	None	0-20, 3" I.D. threaded PVC	20-120, 3" I.D. threaded PVC
MW-3	119	None	0-42, 3" I.D. threaded PVC	42-119, 3" I.D. threaded PVC
MW-4	120	None	0-8, 3" I.D. threaded PVC	8-120, 3" I.D. threaded PVC
MW-5	50	35.7	0-9, 3" I.D. threaded PVC	9-50, 3" I.D. threaded PVC
MW-6	49	None	0-9, 3" I.D. threaded PVC	9-49, 3" I.D. threaded PVC
MW-7	54	46.0	0-9, 3" I.D. threaded PVC	9-54, 3" I.D. threaded PVC
MW-8	49	None	0-8, 3" I.D. threaded PVC	8-49, 3" I.D. threaded PVC
MW-9	49.5	44.0	0-8, 3" I.D. threaded PVC	8-49, 1/2, 3" I.D. threaded PVC
MW-10	40	15.0	0-8, 3" I.D. threaded PVC	8-28, 3" I.D. threaded PVC
MW-11	40	12.0	0-8, 3" I.D. threaded PVC	8-38, 3" I.D. threaded PVC
WW-1*	500	251.0	0-100, 8-5/8" I.D. steel casing	100-500, 4" I.D. threaded PVC

*Level 5 monitoring well. All others are level 6.

in a laboratory prior to field sampling. The bailer will then be rinsed a minimum of three times with distilled water prior to obtaining a water sample from each of the monitoring wells.

As a general rule, a minimum volume of 1.5 times the volume of water in the casing will be withdrawn from each well by bailing prior to withdrawing a sample. In cases where this minimum volume of water cannot be withdrawn (such as wells having very low recharge), the wells will be bailed dry and allowed to recover prior to sample withdrawal. In the deeper water wells (Pierre shale) where the time (and cost) required to evacuate the casing with a small stainless steel bailer would be excessive, the wells will be bailed with a larger steel bailer operated from a winch truck. The wells will be bailed dry and, normally, sampled two days later (prior to full recovery) using the stainless steel bailer. The same cleaning and rinsing procedure using acetone and distilled water will be followed.

In obtaining a water sample, the stainless steel bailer will be lowered by hand into the well with a nylon rope. New, separate nylon ropes will be used for each well sampled. The rope will be kept clean during sampling by placing it on a plastic cloth. The cloth will be rinsed with distilled water prior to sampling each well.

All samples will be placed in appropriate containers and preserved as indicated in Table 7.6.2. The samples will be immediately labeled, placed on ice, and stored in an insulated cooler. The samples will be transported to a qualified analytical laboratory within eight hours after collection.

TABLE 7.6.2

SAMPLE CONTAINERS AND PRESERVATION

Parameter Group	Sample Containers and Preservation
(1) Metals	Polyethylene bottle, 1-l, filtered, then add 5 ml/l conc. HNO_3.*
(2) Radiochemistry	Polyethylene bottle, 1-l, filtered, then add 5 ml/l conc. HNO_3.
(3) Inorganics - solids, pH, alkalinity	Polyethylene bottle, 500 ml, unfiltered, store at 4°C.
(4) Inorganic - other	Polyethylene bottle, 500 ml, filtered, store at 4°C.
(5) Fecal coliforms	Sterile glass bottle, 250 ml, unfiltered, store at 4°C.
(6) Nutrients	Glass bottle, 1-l, filtered, then add 2 ml/l conc. H_2SO_4, store at 4°C.
(7) TOX	Polyethylene bottle, 500 ml, decanted, add 2 ml/l sodium thiosulfate and 2 ml/l conc. HNO_3, store at 4°C.
(8) Cyanide	Polyethylene bottle, 500 ml, filtered, then add 2 ml/l 12.5N NaOH, store at 4°C.
(9) Pesticides	Glass bottle, 1-l, with Teflon-lined cap, filtered, store at 4°C.
(10) Herbicides	Glass bottle, 1-l, with Teflon-lined cap, filtered, store at 4°C.
(11) Volatile Organics	Two 40 ml septum capped vials, unfiltered, store at 4°C.
(12) Acidic Organics	Glass bottle, 1-l, with Teflon-lined cap, centrifuged, store at 4°C.
(13) Base/Neutral Organics	Glass bottle, 1-l, with Teflon-lined cap, centrifuged, store at 4°C.
(14) Soils	Glass bottle, 1-l, with Teflon-lined cap, store at 4°C.

*For preservation, pH of less than 2 required. Generally 5 ml conc. HNO_3 per liter is the amount of nitric acid required for all samples to assure that a pH of less than 2 is achieved.

Because a significant amount of data is generated during sample collection, a water quality monitoring field data sheet has been developed for recording data in the field at the time of sampling. Refer to Table 7.6.3, and note the specific data required and reported for each monitor well.

7.6.1.5 Labeling and Chain of Custody

Each sample will be labeled at the time of collection. The sample label will contain the well number, surface impoundment designation, and the date (which together shall constitute the sample number), preservatives used, analyses required, and the sampler's initials.

The samples will be handled by as few people as possible. Generally, the sampler will be the only custodian of the samples until delivery to the analytical laboratory. If any other transfers of custody must be made, a chain of custody document will be used. The person relieved of the samples will sign a release and the recipient will sign for them. Samples will always be in the personal possession of the custodian or under lock. Shipment containers will be sealed with evidence tape or its equivalent. Upon receipt of the samples, laboratory personnel will examine the evidence tape to make sure it has not been tampered with.

7.6.1.6 Monitoring Frequency

The frequency of monitoring varies slightly with the level of monitoring. With the exception of monitoring points associated with 1 and 2 (refer to Figure 7.6.1), all wells will be monitored on a quarterly schedule during the active (operational) life of the facility, and semi-annually for 30 years following site closure.

TABLE 7.6.3

WATER QUALITY MONITORING FIELD DATA

Project: HIGHWAY 36 LAND COMPANY, ADAMS COUNTY, COLORADO

Well Number or Location:

Date of Sampling:

Time of Sampling:

Water Level:

Well Casing Diameter:

Well Casing Depth:

Volume of Water in Casing:

Volume of Water Removed Prior to Sampling:

Visual Discription (Photo Yes _____ or No _____):

Date and Time Delivered to Laboratory:

Sample Collected By:

Notes:

During the active (operational) life of a disposal cell, and for six months after its completion, the presence of fluids in monitor level 1 will be monitored on a weekly schedule. Level 2 will be monitored monthly during active (operational) life of a disposal cell and for six months after completion of the cell. During the operational life of the facility, level 1 in each closed cell will be monitored on a monthly schedule, whereas level 2 will be monitored on a quarterly schedule. Following the facility's closure, levels 1 and 2 will be monitored annually for a period of 30 years.

Baseline groundwater quality data are presently being collected. Complete baseline information is necessary because a significant variation (defined by RCRA) in water quality is an indication that the groundwater system has been impacted. To date, samples have been collected and analyzed for the months of January, July, August, October, November, and December 1981 and February and May 1982. The results of the chemical analyses were presented previously in Section 5.6. The frequency of baseline quality sampling will continue on a regular schedule, but will eventually be reduced pending Colorado Department of Health review and recommendations.

7.6.2 Surface Water Monitoring

A total of four surface water sampling sites will be monitored on a regular basis. The sampling site location, method of collection, and monitoring frequency are discussed below.

7.6.2.1 Location of Surface Water Sampling Sites

Two surface water sampling sites are presently located on site. One is the small brine water pond associated with the existing oil well. The

brine water pond is located approximately 300 feet west of WW-1. The other existing sampling site is the stock water pond located approximately two miles southwest of the proposed waste processing area. Baseline water quality data are being established at both of these sites. The results of the chemical analyses were presented previously in Section 5.6. Two additional sites are planned during Phase II of the facility operation. The two sites are the two non-contaminated run-off collection ponds. (Refer to Section 6.2.3 for the design, function, and location of these ponds.)

7.6.2.2 Surface Water Collection

Generally, the surface water will be obtained from a point in the middle of the impoundment at a depth of three feet or midway between the surface and the bottom if the total depth is less than five feet. A Kemmerer type water sampler will be used to collect the sample. The previous information pertaining to sample containers, labeling, preserving, and transporting presented in Section 7.6.1.4 of this report will be followed.

7.6.2.3 Monitoring Frequency

The surface water sampling sites will be monitored quarterly during the active life of the facility. Monitoring of surface water during the inactive, post closure period will not be warranted because the surface facilities will have ceased operation and at least three of the four sampling sites will have ceased as impoundment facilities following site closure. Only the stock pond may be remaining.

7.6.3 Soil Monitoring

A total of six soil sampling plots will be monitored on a regular basis. The sample site locations, method of collection, and monitoring frequency are discussed below.

7.6.3.1 Location of Soil Sampling Sites

At present, three soil sampling plots exist and have been monitored regularly along with the baseline water quality sampling. The three plots are located approximately 100 yards north, west, and south of the Phase I process area. These will be incorporated into the soil monitoring program with three additional sites, all to be located equidistant around the site buffer zone. The site buffer zone is the area within a one-half mile radius of the proposed secure cell disposal area. Each sampling plot constitutes an area of approximately one-fifth acre.

7.6.3.2 Soil Sample Collection

Composite soil samples will be obtained from each plot by removing five soil samples from a depth ranging from zero to six inches. The soil will be removed with a stainless steel spoon, thoroughly mixed in a glass bowl, stored in a glass bottle with a teflon cap, and placed in a sample safe with ice. The previous information pertaining to labeling, preserving, and transportation, presented in Section 7.6.1.4 of this report, will be followed.

7.6.3.3 Monitoring Frequency

The soil sampling sites will be monitored semi-annually during the active life of the facility. No monitoring of soil during the inactive, post closure period is warranted because the surface facilities will have ceased operation.

7.6.4 Preservation and Chemical Analyses

All samples collected in the field will be delivered to a qualified analytical laboratory on the same day the sample is obtained. When the samples arrive at the laboratory they will be centrifuged, filtered, and preserved. The specific methodology for analyzing the various water quality parameters has been developed by Rocky Mountain Analytical Laboratory and is presented in Tables 7.6.4 through 7.6.10. These tables include information on EPA standards, laboratory detection limits, sample preservation, method of analyses, and the methodology reference. The parameters are grouped or characterized as follows: parameters characterizing the suitability of the groundwater as a drinking water supply (refer to Table 7.6.4); required parameters establishing groundwater quality (refer to Table 7.6.5); parameters used as indications of groundwater contamination (refer to Table 7.6.6); other inorganic parameters to establish baseline groundwater quality (refer to Table 7.6.7); summary of organic parameters to establish baseline groundwater quality (refer to Table 7.6.8); list of organic chemicals and detection limits (refer to Table 7.6.9); and leachable metals in soil samples (refer to Table 7.6.10). The type of sample container material and the method of preservation are presented in Table 7.6.2.

The methodology suggested by the Colorado Department of Health has been reconciled with the methods used for the BFI baseline monitoring. The only significant difference is that the State wants lower detection limits for cadmium, chromium, and lead (Table 7.6.4). This change has been made during the third and subsequent samplings.

TABLE 7.6.4

PARAMETERS USED AS INDICATORS OF GROUNDWATER CONTAMINATION

Parameter	Units	Detection Limits	Preservative*	Method	Methodology Reference**
pH	pH units	.1	11	Electrode	3 - Method 150.1
Specific Conductance	umhos/cm	10	11	Wheatstone Bridge	3 - Method 120.1
TOC	mg/l	1	5	Combustion Infrared	3 - Method 415.1
TOX	ug Cl/l	5	4	Dohrman TOX	8 - Method 450.1

* See Sample Methods and Preservation, Table 7.6.2.
** See References, Section 7.10.

TABLE 7.6.5

REQUIRED PARAMETERS ESTABLISHING GROUNDWATER QUALITY

(40 CFR 265.92.b.2)

Parameter	Units	EPA Standard	Detection Limits	Preservative (1)	Method	Methodology Reference (2)
Chloride	mg/1	250	5	3	Tiration	10 - Method 325.3
Iron	mg/1	0.3	0.02	1	Flame AA	10 - Method 236.1
Manganese	mg/1	0.05	0.01	1	Flame AA	10 - Method 243.1
Phenolics	mg/1	--	0.005	6	Distillation-Colorimetric	10 - Method 420.1
Sodium	mg/1	--	1	3	Flame AA	10 - Method 273.1
Sulfate	mg/1	250	5	3	Turbidimetric	10 - Method 375.4

(1) See Sample Containers and Preservation, TABLE 5.6.2 in text.
(2) See References, Section 7.10.

TABLE 7.6.6

PARAMETERS USED AS INDICATORS OF GROUNDWATER CONTAMINATION

(40 CFR 265.92.b.3)

Parameter	Units	EPA Standard	Detection Limits	Preservative (1)	Method	Methodology Reference (2)
pH	pH units	6.5-8.5	0.01	4	Electrode	10 - Method 150.1
Specific Conductance	umhos/cm	--	10	3	Wheatstone Bridge	10 - Method 120.1
TOC	mg/1	--	1	6	Oxidation-Infrared	10 - Method 415.1
TOX	ug Cl/1	--	5	7	Dohrman TOX	13 - Method 450.1

(1) See Sample Containers and Preservation, TABLE 5.6.2 in text.
(2) See References, Section 7.10.

TABLE 7.6.7

OTHER INORGANIC PARAMETERS TO ESTABLISH BASELINE GROUNDWATER QUALITY

Parameter	Units	EPA Standard	Detection Limits	Preservative[1]	Method	Methodology Reference[2]
Aluminum	mg/l	--	0.2	1	Flame AA	10- Method 202.1
Antimony	mg/l	--	0.001	1	Furnace AA	10- Method 204.2
Beryllium	mg/l	--	0.005	1	Flame AA	10- Method 210.1
Calcium	mg/l	--	1	1	Flame AA	10- Method 215.1
Cobalt	mg/l	--	0.02	1	Flame AA	10- Method 219.1
Copper	mg/l	1	0.015	1	Flame AA	10- Method 220.1
Magnesium	mg/l	--	1	1	Flame AA	10- Method 242.1
Molybdenum	mg/l	--	0.05	1	Flame AA	10- Method 246.1
Nickel	mg/l	--	0.02	1	Flame AA	10- Method 249.1
Potassium	mg/l	--	1	1	Flame AA	10- Method 258.1
Thallium	mg/l	--	0.002	1	Furnace AA	10- Method 279.2
Tin	mg/l	--	0.05	1	Furnace AA	10- Method 282.2
Titanium	mg/l	--	0.75	1	Flame AA	10- Method 283.2
Zinc	mg/l	5	0.010	1	Flame AA	10- Method 289.1
Alkalinity(pH 4.5 as $CaCO_3$)	mg/l	--	10	4	Titration	10- Method 310.1
Alkalinity(pH 8.3 as $CaCO_3$)	mg/l	--	2	4	Titration	10- Method 310.1
Ammonia (as N)	mg/l	--	0.05	6	Electrode	10- Method 350.3
Boron	mg/l	--	0.1	3	Colorimetric	10- Method 212.3
Bromide	mg/l	--	2	3	Titrimetric	10- Method 320.1
Cyanide	mg/l	--	0.010	8	Distillation-Colorimetric	10- Method 335.2
Phosphate (as P)	mg/l	--	0.01	3	Colorimetric	10- Method 365.2
Total Dissolved Solids	mg/l	500	10	4	Gravimetric	10- Method 160.1
Total Suspended Solids	mg/l	--	5	4	Gravimetric	10- Method 160.2

(1) See Sample Containers and Preservation, TABLE 5.6.2 in text.
(2) See References, Section 7.10.

TABLE 7.6.8

SUMMARY OF ORGANIC PARAMETERS TO ESTABLISH BASELINE GROUNDWATER QUALITY

Parameter	Units	Detection Limits (3)	Preservative (1)	Method	Methodology Reference (2)
Volatile Priority Pollutants (31 compounds)	ug/l	1-100	11	Purge & Trap-GC/MS	1 - Method 624
Acidic Priority Pollutants (11 compounds)	ug/l	5-25	12	Extraction-GC/MS	1 - Method 625
Base Neutral Priority Pollutants (46 compounds)	ug/l	5-10	13	Extraction-GC/MS	1 - Method 625
Chlorinated Pesticides/PCB's (26 compounds)	ug/l	0.001-0.5	9	Extraction-GC	1 - Method 608
Phosphorus Pesticides (18 compounds)	ug/l	0.001-1	9	Extraction-GC	1 - Method 622
Nitrogen Pesticides (11 compounds)	ug/l	0.001-1	9	Extraction-GC	11 -

(1) See Sample Containers and Preservation, TABLE 5.6.2 in text.
(2) See References, Section 7.10.
(3) Detection limit of compounds specific - see TABLE 7.6.9.

TABLE 7.6.9

LIST OF ORGANIC CHEMICALS AND DETECTION LIMITS

Volatile Priority Pollutants - Detection Limits

Compound	Waters(ug/l)
Acrolein	100
Acrylonitrile	100
Benzene	1
Bis(chloromethyl) ether	10
Bromoform	1
Carbon tetrachloride	1
Chlorobenzene	1
Chlorodibromomethane	1
Chloroethane	10
2-Chloroethylvinyl ether	1
Chloroform	1
Dichlorobromomethane	1
Dichlorodifluoromethane	10
1,1-Dichloroethane	1
1,2-Dichloroethane	1
1,1-Dichloroethylene	1
1,2-Dichloropropane	1
1,3-Dichloropropylene	1
Ethylbenzene	1
Methyl bromide	10
Methyl chloride	10
Methylene chloride	1
1,1,2,2-Tetrachloroethane	1
Tetrachloroethylene	1
Toluene	1
1,2-Trans-dichloroethylene	1
1,1,1-Trichloroethane	1
1,1,2-Trichloroethane	1
Trichloroethylene	1
Trichlorofluoromethane	10
Vinyl chloride	10

Acidic Priority Pollutants - Detection Limits

	Waters(ug/l)	Soils(mg/kg)
2-Chlorophenol	10	0.4
2,4-Dichlorophenol	10	0.4
2,4-Dimethylphenol	10	0.4
4,6-Dinitro-o-cresol	25	1.0
2,4-Dinitrophenol	25	1.0
2-Nitrophenol	10	0.4
4-Nitrophenol	10	0.4
P-chloro-m-cresol	10	0.4
Pentachlorophenol	10	0.4
Phenol	10	0.4
2,4,6-Trichlorophenol	10	0.4

TABLE 7.6.9
(Continued)

LIST OF ORGANIC CHEMICALS AND DETECTION LIMITS

Base/Neutral Pollutants - Detection Limits

Compound	Water(ug/l)	Soils(mg/kg)
Acenaphthene	10	0.4
Acenaphthylene	10	0.4
Anthracene	10	0.4
Benzidine	10	0.4
Benzo(a)anthracene	10	0.4
Benzo(a)pyrene	10	0.4
3,4-Benzofluoranthene	10	0.4
Benzo(ghi)perylene	10	0.4
Benzo(k)fluoranthene	10	0.4
Bis(2-chloroethoxy)methane	10	0.4
Bis(2-chloroethyl)ether	10	0.4
Bis(2-chloroisopropyl)ether	10	0.4
Bis(2-ethylhexyl)phthalate	10	0.4
4-Bromophenyl phenyl ether	10	0.4
Butyl benzyl phthalate	10	0.4
2-Chloronaphthalene	10	0.4
4-Chlorophenyl phenyl ether	10	0.4
Chrysene	10	0.4
Dibenzo(a,h)anthracene	10	0.4
1,2-Dichlorobenzene	10	0.4
1,3'-Dichlorobenzidine	10	0.4
1,4-Dichlorobenzene	10	0.4
3,3-Dichlorobenzidine	10	0.4
Diethyl phthalate	10	0.4
Dimethyl phthalate	10	0.4
Di-N-butyl phthalate	10	0.4
2,4-Dinitrotoluene	10	0.4
2,6-Dinitrotoluene	10	0.4
Di-N-octyl phthalate	10	0.4
1,2-Diphenylhydrazine (as Azobenzene)	10	0.4
Fluoranthene	10	0.4
Fluorene	10	0.4
Hexachlorobenzene	10	0.4
Hexachlorobutadiene	10	0.4
Hexachlorocyclopentadiene	10	0.4
Hexachloroethane	10	0.4
Ideno(1,2,3-cd)pyrene	10	0.4
Isophorone	10	0.4
Naphthalene	10	0.4
Nitrobenzene	10	0.4
N-nitrosodimethylamine	10	0.4
N-nitrosodi-N-propylamine	10	0.4
N-nitrosodiphenylamine	10	0.4
Phenanthrene	10	0.4
Pyrene	10	0.4
1,2,4-Trichlorobenzene	10	0.4

TABLE 7.6.9
(Continued)

LIST OF ORGANIC CHEMICALS AND DETECTION LIMITS

Chlorinated Pesticides/PCB's - Detection Limits

Compound	Waters(ug/l)	Soils(mg/kg)
Aldrin	0.003	0.0001
BHC (alpha)	0.001	0.00004
BHC (beta)	0.004	0.0002
BHC (gamma) (lindane)	0.004	0.0002
BHC (sigma)	0.002	0.0001
Chlordane	0.04	0.002
4,4'-DDT	0.012	0.0005
4,4'-DDE	0.006	0.0002
4,4'-DDD	0.016	0.0006
Dieldrin	0.006	0.0002
Endosulfan (alpha)	0.005	0.0002
Endosulfan (beta)	0.01	0.0004
Endosulfan sulfate	0.03	0.001
Endrin	0.009	0.0004
Endrin aldehyde	0.02	0.0008
Heptachlor	0.002	0.00008
Hepthchlor epoxide	0.004	0.0002
PCB-1242	0.04	0.002
PCB-1254	0.50	0.02
PCB-1221	0.04	0.002
PCB-1232	0.04	0.002
PCB-1248	0.05	0.002
PCB-1260	0.50	0.02
PCB-1016	0.04	0.002
Toxaphene	0.40	0.02
2,3,7,8-Tetrachlorodibenzo-P-dioxin	0.50	0.02
Methoxychlor	0.25	0.01

Herbicides - Detection Limits

2,4-D	0.0005	0.02
2,4,5-TP (Silvex)	0.001	0.004

TABLE 7.6.9
(Continued)

LIST OF ORGANIC CHEMICALS AND DETECTION LIMITS

Phosphorus Pesticides - Detection Limits

Compound	Waters(ug/l)	Soils(mg/kg)
DDVP	0.4	0.02
Phosdrin	2.0	0.08
Demeton	2.0	0.08
Phorate	1.0	0.04
Diazinon	0.5	0.02
Disulfoton	1.0	0.04
Dimethoate	1.0	0.04
Methyl parathion	0.2	0.008
Ethyl parathion	0.2	0.008
Ronnel	0.1	0.004
Malathion	1.0	0.04
Trichloronate	0.05	0.002
Tetrachlorvinphos	0.5	0.02
Merphos	0.3	0.01
Ethion	0.6	0.02
Trithion	0.5	0.02
Guthion	8.0	0.3
Zolone	1.0	0.04

Nitrogen Pesticides - Detection Limits

	Waters(ug/l)	Soils(mg/kg)
Atraton	1.0	0.04
Simazine	10	0.4
Simetryn	1.0	0.04
Ametryn	1.0	0.04
Prometryn	1.0	0.04
Prometon	1.0	0.04
Propazine	1.0	0.04
Atrazine	1.0	0.04
Terbutryn	1.0	0.04
Propanil	10	0.4
Vegadex	0.5	0.02

TABLE 7.6.10

LEACHABLE METALS IN SOIL SAMPLES[1]

Parameter	Units	Detection Limits	Preservative[3]	Method	Methodology Reference[2]
Aluminum	mg/kg	20	14	Flame AA	10 - 202.1
Antimony	mg/kg	0.1	14	Furnace AA	10 - 204.2
Arsenic	mg/kg	0.1	14	Furnace AA	10 - 206.2
Barium	mg/kg	10	14	Flame AA	10 - 208.1
Beryllium	mg/kg	0.5	14	Flame AA	10 - 210.1
Cadmium	mg/kg	0.5	14	Flame AA	10 - 213.1
Calcium	mg/kg	100	14	Flame AA	10 - 215.1
Chromium	mg/kg	3.5	14	Flame AA	10 - 218.1
Cobalt	mg/kg	2	14	Flame AA	10 - 219.1
Copper	mg/kg	1.5	14	Flame AA	10 - 220.1
Iron	mg/kg	2	14	Flame AA	10 - 236.1
Lead	mg/kg	3.5	14	Flame AA	10 - 239.1
Magnesium	mg/kg	100	14	Flame AA	10 - 242.1
Manganese	mg/kg	1	14	Flame AA	10 - 243.1
Mercury	mg/kg	0.02	14	Flameless AA	10 - 245.1
Molybdenum	mg/kg	5	14	Flame AA	10 - 246.1
Nickel	mg/kg	2	14	Flame AA	10 - 249.1
Potassium	mg/kg	100	14	Flame AA	10 - 258.1
Selenium	mg/kg	0.1	14	Furnace AA	10 - 270.2
Silver	mg/kg	1	14	Flame AA	10 - 272.1
Sodium	mg/kg	100	14	Flame AA	10 - 273.1
Thallium	mg/kg	0.1	14	Furnace AA	10 - 279.2
Tin	mg/kg	5	14	Furnace AA	10 - 282.2
Titanium	mg/kg	75	14	Flame AA	10 - 283.2
Zinc	mg/kg	1	14	Flame AA	10 - 289.1

(1) Values based on dry weight of sample.
(2) See References, Section 7.10.
(3) See TABLE 5.6.2 in text.

The specific parameters to be tested vary with the type of sample collected (groundwater, surface water, soil), function or purpose of monitoring, frequency of sampling, and phase of operation (either active or inactive). The tables of parameters to be analyzed for each type of sample are presented in Table 7.6.11.

The district manager of BFI and its consultants will work closely with the Colorado Department of Health and the U.S. EPA to decide if additional monitoring is required.

7.6.5 Evaluation of Data; Indicator Monitoring Program

The Student's t-test will be used to determine the statistical significance of changes in the values of parameters used as indicators of water contamination as compared to the initial background levels established during the first year. All measurements made prior to operation of the facility will be used to calculate the initial background arithmetic mean and the initial background variance for each parameter for each sampling point. For subsequent samples (i.e., after facility start-up), the arithmetic mean and the variance will be calculated from the four replicate measurements made of each water contamination indicator parameter for each sampling point.

The Student's t-test involves the calculation of a t-statistic for each parameter for each sampling point. This t-statistic is then compared to critical values of "t" in an appropriate statistical table. If the calculated value of "t" exceeds the single tailed value of t found in the table (or the double-tailed value of "t" in the case of pH) at the 0.01 level of significance, then there is a statistically significant difference between the two arithmetic means.

TABLE 7.6.11

ENVIRONMENTAL MONITORING PROGRAM SUMMARY

"Level of Monitoring"	Frequency	Parameters
Groundwater Monitoring-Active		
1[a]	Weekly/Monthly	Tables 7.6.4 thru 7.6.8
2[a]	Monthly/Quarterly	Tables 7.6.4 thru 7.6.8
3	Quarterly	Tables 7.6.4 thru 7.6.8
4[b]	Quarterly	Tables 7.6.4, 7.6.5, 7.6.6
5 & 6	Quarterly	Tables 7.6.4, 7.6.5, 7.6.6
5 & 6	Annually	Tables 7.6.4 thru 7.6.8
Groundwater Monitoring-Inactive		
1-6[c]	Semi-Annually	Table 7.6.6
1-6[c]	Annually	Table 7.6.4
Surface Water Monitoring-Active		
(4) Sampling Sites	Quarterly	Tables 7.6.4, 7.6.5, 7.6.6
	Annually	Tables 7.6.4 thru 7.6.8
Surface Water Monitoring-Inactive		
Not Applicable (refer to text)		
Soil Monitoring-Active		
(6) Sampling Plots	Semi-Annually	Tables 7.6.8 and 7.6.10
Soil Monitoring-Inactive		
Not Applicable (refer to text)		

NOTES:

a. Level 1 and 2 are monitored weekly and monthly, respectively, during cell construction, and for six months following completion. During the remaining active life of the facility, levels 1 and 2 will be monitored monthly and quarterly, respectively.

b. Initially for characterization purposes, level number 4 type monitor wells will be monitored for parameters listed in Tables 7.6.4 through 7.6.8.

c. Parameters not listed in Tables 7.6.4 and 7.6.5, but found to be significant (as defined by RCRA) from previous chemical analyses, will continue to be monitored during the 30 year inactive monitoring period.

If no significant differences are found among the four indicator parameters and, in the absence of other evidence to the contrary, the water will be evaluated as not contaminated. The occurrence of a statistically significant increase in a parametric value (or pH decrease), will indicate a possible problem which will be evaluated in a monitoring review, as provided for in Section 7.6.6.

7.6.6 Monitoring Review

If the indicator monitoring program reveals a possible groundwater or surface water problem, a monitoring review shall be conducted as rapidly as possible to ascertain the need for the more comprehensive water quality assessment program (see Section 7.6.7). The monitoring review shall consist of two parts:

1. Analytical Check - additional samples will be obtained immediately from all potentially involved sampling locations. These samples will be split in two, and four replicate measurements of the parameter(s) of interest will be taken on all these additional samples to determine whether the significant difference was a result of laboratory error.

2. Program and Analytical Review - in conjunction with the additional analytical work, the monitoring program shall be reviewed. In particular, the results for the particular sampling point(s) of interest need to be compared with similar results from other points in the monitoring system. The spatial distribution of the points must be considered in relationship to the indicated zone(s) of potential contamination, groundwater flow rates and flow directions, and the locations of possible sources of contamination. Historical data may need to be considered. Additional statistical procedures may need to be used to check or further clarify the apparent discrepency. The entire monitoring program must be considered before a determination can be made that the facility is indeed contaminating the environment.

Results of a monitoring review will be forwarded to the EPA Region VIII Regional Administrator and to the appropriate State and county agencies within seven days of its conclusion.

7.6.7 Water Quality Assessment

If the conclusion of the monitoring review is that hazardous waste or hazardous waste constituents from the facility may be contaminating groundwater or surface water, then a water quality assessment will be conducted. To accomplish this, a plan will be developed which will specify:

- The number, location and depth of any new sampling points.
- Frequency of sampling and sampling methods.
- Parameters chosen and analytical methods to be employed. Parameters which may be used to trace the migration of possible waste plumes may include, but are not limited to, the parameters developed in the initial background work.
- Evaluation procedures, including any use of previously gathered water quality information.

This plan will be designed to determine, at a minimum:

- Whether hazardous waste or hazardous waste constituents have, in fact, entered the water.
- The rate and extent of migration of hazardous waste or hazardous waste constituents in the water.
- The concentrations of hazardous waste or hazardous waste constituents in the water.
- An evaluation of the data generated by the assessment.
- An initial prediction of the environmental and economic consequences of the contamination, if such exists.

The first set of determinations will be made as soon as technically feasible and the results will be reported to the EPA Region VIII administrator and to the appropriate state and county health agencies within 15 days of completion. If it is determined that no hazardous waste or hazardous waste constituents have entered the water, the indicator monitoring program will be reinstated. If it is determined that hazardous waste or hazardous waste constituents have entered the water and that this condition represents a significant impediment to the beneficial use of the

water, then the water quality assessment program will continue on a quarterly basis with reports to be submitted on an annual basis, until final closure of the facility.

7.6.8 Record Keeping and Reporting

- Quarterly reports: During the first year or prior to start-up operation, the values of parameters measured to establish the suitability of ground and surface water for drinking will be reported to the EPA Region VIII Regional Administrator and to the appropriate State and local officials within 15 days of the completion of each quarterly analysis. This report will separately identify for each sampling point, any parameter whose value has been found to exceed the limits specified in the National Interim Primary Drinking Water Standards(4).

- Annual reports under the indicator monitoring program: The values of parameters used as indicators of water contamination, together with the evaluations of these values will be included in an annual report to the EPA Region VIII administrator and to the appropriate State and local officials. This report will separately identify any significant differences in monitoring points from the background levels established during the first year.

- Annual reports under the water quality assessment program: The annual report will be adjusted to include the results, should a water quality assessment program be implemented as provided in Section 7.6.7. This report will include, but not be limited to, calculations (or measurements) of the extent of any water contamination and the rate of transport of any hazardous wastes or hazardous waste constituents in the water during the reporting period.

- Record keeping: Records of all analyses, together with evaluations, performed under the water monitoring program will be maintained during the entire active life of the facility and during the post closure period (see Section 7.7).

7.7 CLOSURE AND POST-CLOSURE PLANS

This section presents the closure and post-closure plans for BFI's chemical waste treatment/solidification and disposal facility located in Adams County, Colorado. Section 3004 of RCRA, through its implementing regulation contained in 40 CFR, Subpart G, requires that hazardous waste disposal facilities have closure and post-closure plans. The plans'

purposes are to ensure that the facility is closed properly to minimize future maintenance and also prevent post-closure escape of contaminants to the environment. In accordance with the RCRA regulations, these plans are addressed separately and are written as essentially a complete and separate document.

7.7.1 Facility Closure Plan

7.7.1.1 General

The facility closure plan presents the methods and procedures by which this facility will be ultimately closed in order to minimize the need for post-closure maintenance and also to control, minimize or eliminate post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall, or waste decomposition by-products, to the extent necessary to protect human health and the environment.

Some of the individual disposal and process facilities will be closed prior to final closure of the entire site. These early closures are specifically addressed in the plan.

7.7.1.2 Facility Description

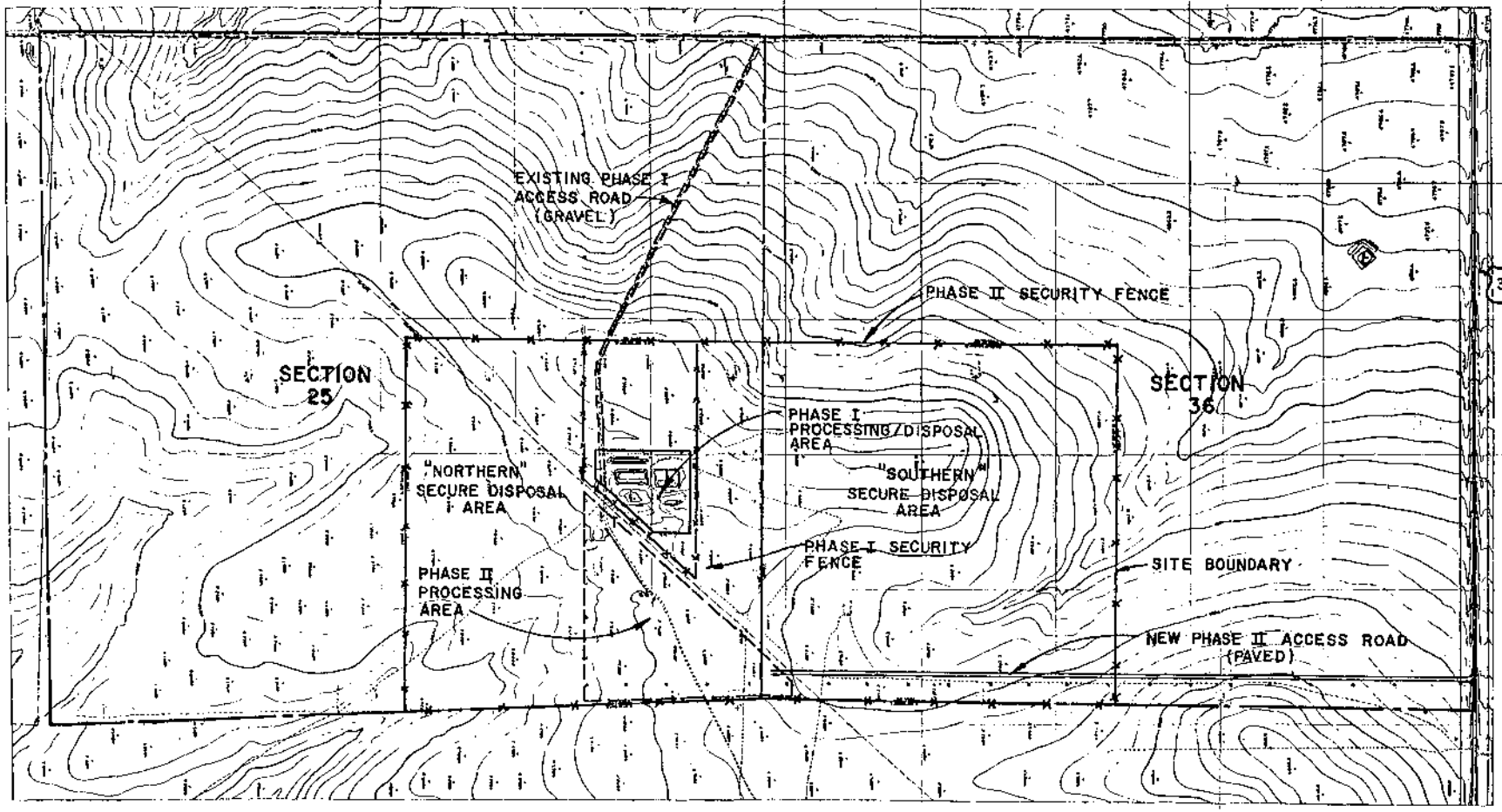
The site will be operated under two levels. Phase I level of operation essentially consists of clay-lined earthen waste solidification mixing cells, secure disposal cells, and a contaminated water holding pond. Phase II will consist of a more sophisticated solidification building with concrete mixing tanks and reagent silos, a tank farm, a drum storage and segregation area, additional secure disposal cells, the same contaminated water holding pond, a potentially contaminated water holding pond, and two non-contaminated surface water collection ponds. The locations of the Phase I and Phase II processing areas are shown in Figure 7.7.1. The proposed processes at this facility are:

- the segregation and temporary storage of bulk and drummed liquid waste;
- treatment and solidification of liquid waste and sludges;
- secure landfill disposal of bulk and drummed solid wastes and previously solidified liquids and sludges.

It is anticipated that this treatment, solidification, and disposal facility will receive a wide variety of chemical wastes, as discussed in Chapter 3. Operating records, daily logs and manifest will contain specific information on the types, quantities, and disposal of the wastes accepted for treatment. It is estimated that these facilities, when in full operation, will handle a peak annual raw waste volume of 12,000,000 gallons which will be about 75% liquids, 20% semi-liquids (sludges), and 5% solids. The facility is expected to have an operating life of about 40 years.

The basic operational concept for solidification is the mixing of reagents with liquid or semi-liquid chemical wastes to form a solid product for burial in secure disposal cells. The resultant treated/solidified product can be handled more easily and is very resistant to the formation of leachate. Cement kiln dust and fly ash will be the primary reagents used and will be stored in portabulk containers for Phase I and reagent silos for Phase II.

Some wastes will be received in 55-gallon drums. The drum storage area during Phase I operations will consist of an open area with an 18-inch minimum thickness compacted clay liner which will extend up the sides of a total enclosed dike. During Phase II operations, the drum storage area will be a separate area within the treatment/solidification building.



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ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE 16 MAR 81

BFI BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

LOCATION OF PHASE I & PHASE II PROCESSING AREAS

SHEET NO.
FIG. 7.7.1
OF

One holding pond is to receive and contain contaminated surface run-off from disposal cells and access routes (the active area), the external truck washing area, and any collected leachate from the head dissipating system. A second holding pond will contain potentially contaminated runoff from portions of the paved surfaces in the Phase II processing area including the general areas around the solidification facility and tank farm.

The secure disposal cells will receive the treated/solidified wastes. The standard size cell will be approximately 300 feet by 600 feet by 30 feet deep, including a five foot thick compacted clay liner. A head dissipating and leachate collection/detection system will be installed in the cell bottom with provisions for removal of accumulated leachate, even though leachate formation is unlikely.

7.7.1.3 Site Conditions

7.7.1.3.1 General

The facility is located approximately 70 miles east of Denver in the gently rolling high plains of eastern Colorado. The topography of the site varies between elevation 4,835 and 4,900 feet (mean sea level datum). There are two producing oil wells on the site that are expected to remain in production throughout at least some portion of the facility's life. An oil pipeline runs through the site in a northeast and southwest direction. The site has been used in the past for wheat farming and grazing. The surrounding area is used for similar agricultural purposes.

The climate is semi-arid with an approximate mean temperature of about 50°F and an average precipitation of about 14 inches per year. The average evaporation rate applicable to the impoundments of the facility (lake evaporation) is about 55 inches per year.

A detailed geological and hydrogeological site characterization was prepared by F. M. Fox & Associates Inc., Consulting Engineers and Geologists. The study indicated that the site was geotechnically suitable for the facility.

7.7.1.3.2 Subsurface Soils

The site is located on top of a geologic unit known as the Pierre shale that is about 4,300 feet thick. No major aquifers exist beneath the site and the site does not contribute to recharge of major aquifers.

The Pierre shale below the site has weathered to varying degrees and for discussion purposes has been divided into three major soil groups, as follows, with the lowest group number the closest to the surface.

Group I

Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The uppermost soil (top six inches) is generally a very silty clayey soil, slightly sandy, medium stiff to very stiff (increasingly stiff with depth), dry to slightly moist, light brown (CL-ML). The clay content, moisture content, and dry density generally increase with depth, and in many borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec. pH values range from 7.9 to 8.2 Based on the cation-exchange capacity values (see Appendix G) and the geologic environment, the clays appear to be an illite. No x-ray defraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1×10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it can be expected to meet or exceed the requirements as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface, except in test holes G1, G2, and G3 which are outside the processing/disposal area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4×10^{-7} cm/sec and a low of "completely impervious" (no flow could be induced).

7.7.1.3.3 Groundwater Conditions

Groundwater was encountered in the test borings drilled in drainages outside the perimeter of the secure disposal cell area. This water is most likely a result of surface recharge from rainfall run-off. Only one of the test borings in the secure disposal cell area encountered groundwater. This was the 500 foot deep borings which encountered very minor amounts of water in fractures of the shale at a depth of about 100 feet. Pumping tests were conducted on this well and the results of the test indicate essentially dry well conditions.

7.7.1.4 Closure Methods

The facility's projected life span is about 40 years at which time the space available for disposal of the solidified wastes will be exhausted. When this point is reached, wastes will no longer be accepted at the facility and it will be closed in accordance with the applicable regulations in the manner discussed in the subsequent sections. The projected final topography of the closed facility is presented on Figure 7.7.2.

7.7.1.4.1 Drum Storage Area

When final closure of the facility is imminent, receipt of drummed waste materials will be terminated. All drums on hand which contain flammable solids will be placed in a secure disposal cell based upon compatibility of waste materials. Drummed liquids and semi-solid wastes will be removed from the drums and solidified. The emptied drums will be crushed or shredded and buried. The Phase I drum storage area and protective barriers will be excavated and buried in a secure disposal cell. The excavation will be backfilled with clean, compacted on-site soils. The Phase II drum storage area is contained within the treatment/solidification building and will be closed as indicated in Section 7.7.1.4.3.

7.7.1.4.2 Storage Tanks

Receipt of bulk liquid wastes will be terminated when final closure of the facility is imminent. At that time, all bulk liquids and residues remaining in storage will be solidified. The resulting solidified product will be disposed of in a secure disposal cell.

Tanks, pumps, valves, controls or piping will be salvaged, if possible, only after cleaning and triple rinsing with appropriate cleaning materials has removed any residual contamination. Any equipment which cannot

be feasibly or adequately cleaned and salvaged will be dismantled and buried in a secure disposal cell.

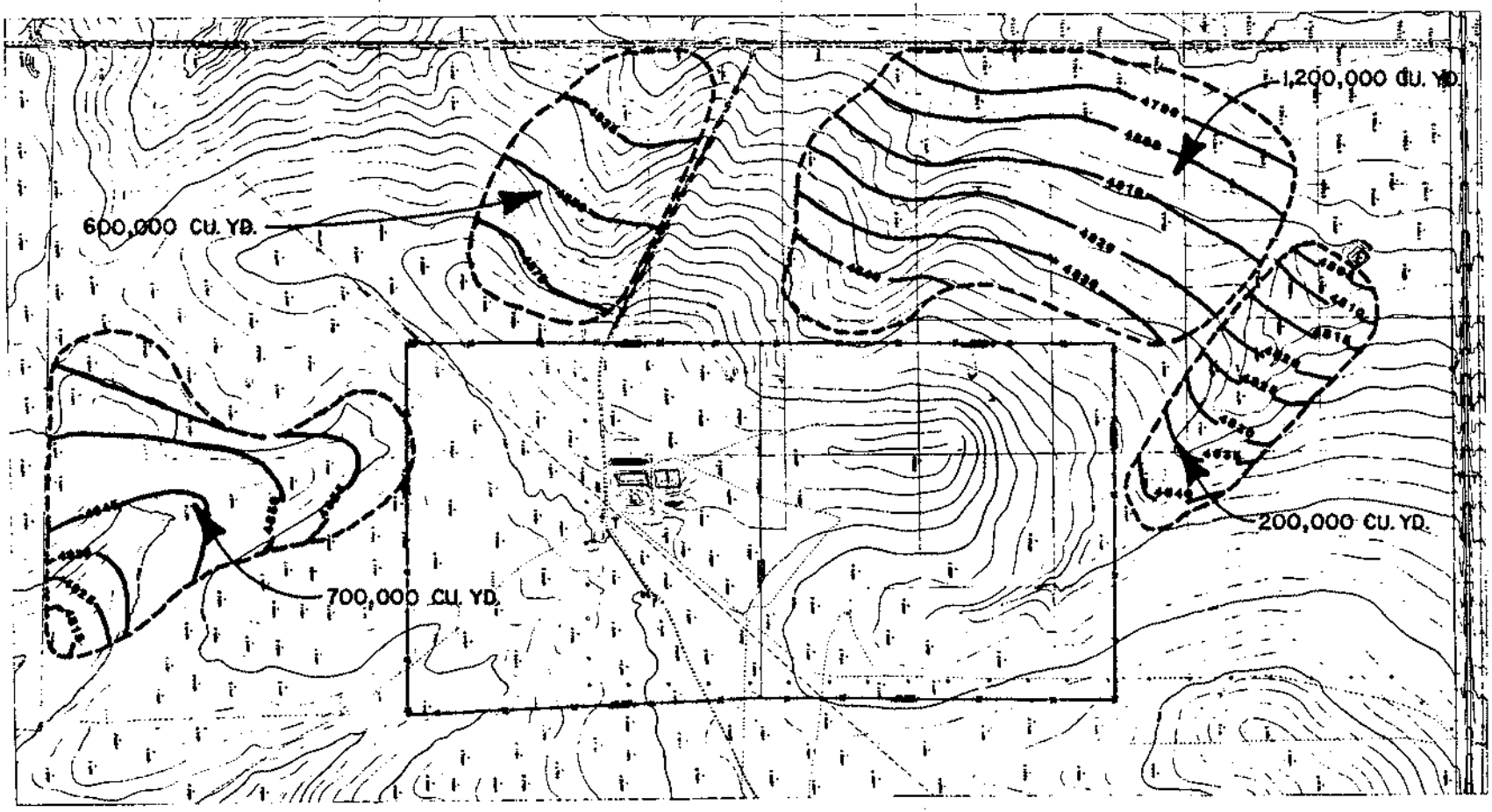
All auxiliary facilities, such as loading/unloading pads and equipment, protective barriers and drainage facilities will be removed, and either salvaged or buried as indicated above. Any contaminated soil will be removed and buried. After all equipment and any contaminated soil has been removed, the area will be backfilled with clean compacted soil and graded to provide positive drainage.

7.7.1.4.3 Solidification Facilities

The Phase I solidification facility will be closed when the Phase II facility is operational. This is expected within 12 to 24 months after the site is approved. When the Phase I facility is closed, the solidification cell liners and all contaminated soil will be removed and disposed of in a secure disposal cell. The excavation will be backfilled with clean compacted on-site soils up to the original ground surface. The surface will be graded to conform with the surrounding ground.

The Phase II facility will be closed after all liquids and sludges from closure of the other facilities have been solidified. The remaining solidification reagents will be emptied from the storage silos and either removed from the site for other uses or buried in a disposal cell.

All equipment which can be decontaminated and has salvage value will be thoroughly cleaned and triple rinsed. All facilities and equipment which either cannot be decontaminated or which have insufficient salvage value will be dismantled and buried in a disposal cell.



REVISED OVERBURDEN

HNTB

ARCHITECTS ENGINEERS PLANNERS

BROOMFIELD-PERRINE INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

PLACEMENT OF OVERBURDEN

FIG. 7.7.2

The concrete solidification tanks will be cleaned of any remaining waste materials. On-site soils will be placed as compacted backfill in the tanks. The concrete pads also will be decontaminated and covered with about two feet of compacted fill. The entire top surface will be final graded with a slight crown to provide positive drainage.

7.7.1.1.4 Secure Disposal Cells

The secure disposal cells shall be the repository of all of wastes treated and solidified at this site. Closure of the secure disposal area will occur progressively throughout the life of the facility. Each completed disposal cell will be capped with a four foot thick cover of clay compacted to 95% of Modified Proctor maximum dry density (per ASTM D1557 test method) at or above the optimum moisture content. Laboratory tests performed on on-site clays to the above compaction specifications indicate that a permeability of 1×10^{-8} cm/sec can be achieved. The cap will be covered with 24 inches of the original topsoil material and seeded to provide protective vegetation on an earthen mound with 3% slopes to promote surface drainage.

7.7.1.4.5 Holding Ponds

Liquid in the potentially contaminated and contaminated holding ponds will be allowed to evaporate and the residual will be removed, solidified, and then disposed of in a secure disposal cell. Any contaminated soil, including the liner, will be excavated and buried. The ponds will be filled with compacted on-site soils and sloped to prevent ponding and promote drainage. The non-contaminated water collection ponds will be emptied via spray irrigation, excavated to final depth, and affected surfaces relined in accordance with the specifications of the secure

disposal cells. Head dissipating and leachate collection/detection facilities will be installed, and then the cells will be utilized as the final secure disposal cells.

The non-contaminated water impoundments will not be simultaneously used for waste disposal and runoff collection. Rain falling in the final disposal cells during closure operations will either be evaporated in the contaminated water holding pond or solidified in place.

When the ponds are taken out of service as non-contaminated water holding ponds, closure operations will be under way. Prior to that, the berms around the active area will have been revised, reducing the active area, and returning closed areas to their natural drainage. As this takes place, the requirements for runoff collection will decrease until only a small area around the last cells will be bermed. A small auxiliary retention facility will be constructed within this area to collect runoff.

7.7.1.4.6 Equipment Decontamination

All contaminated tools and equipment, including trucks, will be thoroughly cleaned with high-pressure, heated water prior to removal of the protective berms serving the area in which the equipment is washed. Judgments regarding the adequacy of decontamination of each vehicle or piece of equipment will be made by the district manager or his appointed representative. All other equipment, clothing, and personal use items which cannot be decontaminated will be buried.

7.7.1.4.7 Final Grading

When the facility is closed, the site berms will be removed and the site will be graded so that natural drainage patterns are reinstated. The

tops of berms around the active site will be flattened to their original grading so that earth work during closure will be minimal. The result will be to smooth out the contour lines of the site and provide adequate surface drainage. Following this, the site will be fertilized and seeded with appropriate vegetation (see Chapter 8).

Samples of surface runoff will be collected and tested semi-annually for one year to ensure that all surfaces are not contaminated.

7.7.1.5 Monitoring Wells

Monitoring wells have been designed to conform with 40 CFR, Part 265, Subpart F. Additional wells will be installed throughout the life of the site, as required. The wells will be used to perform groundwater monitoring. The monitoring wells will not be closed or abandoned when the site is closed. They will continue to be used for post-closure monitoring of the site. Figure 7.6.3 showed the location of the existing wells.

7.7.1.6 Environmental Safety Features

A key element of site closure is protection of the environment from release of contaminants by the facility. The design of this facility in combination with the natural geologic features and climatic conditions provides excellent protection of the environment.

The potential source of contamination from a facility of this type would be leachate seeping from the disposal cells into groundwater. The possibility of this occurring is extremely remote for the following reasons:

- In order for leachate to form, a liquid medium must be present to leach the contaminants from the wastes. The formation of leachate at the facility is a remote possibility because of the absence of groundwater available to infiltrate into the cells, the

low annual rainfall, provisions to promote runoff from the landfill cells and the highly impervious cap to prevent surface infiltration. Also, the wastes will be solidified so that they themselves will not generate any free liquids.

- In the unlikely event leachate should form, the cell has been designed to prevent its escape. First, a head dissipating system is provided in each cell. Leachate collected in the system will be pumped from the cell and disposed of at the site during the site operating life and hauled to another disposal facility after site closure. Second, each cell is provided with a five foot thick compacted clay liner and leachate detection/collection to retain the leachate. The liner will have a permeability less than 1×10^{-7} cm/sec. Should leachate be detected, the contents of that cell will be removed, the liner reconstructed, and the waste solidified and disposed in a secure disposal cell.

- In the extremely unlikely sequence of events that leachate forms, that the head dissipating system fails, and that leachate seeps through the liner into the leachate detection/collection system, the leachate would have to seep through one foot of compacted clay liner and at least 100 feet of natural soils with permeabilities of 1×10^{-6} cm/sec. or less before reaching groundwater under the disposal area.

- Preliminary water quality test results indicate that the groundwater currently fails to meet the National Interim Drinking Water Standards. Also, the quantity of groundwater available appears to be insufficient for municipal supply based upon pump test results.

- A final safeguard is that a water quality monitoring program, as discussed in Section 7.6, has been developed for the site and will be performed during the life of the site and for the post-closure period.

7.7.1.7 Site Security

During closure the district manager will be responsible for maintenance and repair of the security systems used during the previous operations and to prevent access by unauthorized persons, livestock, or other animals. Following the final closure, the entrance gate will remain locked at all times when the site is unattended. Emergency information will be provided on signs at the gate.

7.7.1.8 Schedule of Final Closure

The following schedule for closure of the facility is proposed:

Approximately one week prior to commencing of closure	- Cease acceptance of all wastes - Complete treatment and disposal of waste materials in drum and tank storage
Closure begins	- Initiate treatment and disposal of liquids and/or residues in the holding ponds
Week 1	- Dismantle and dispose of tank and drum storage facilities
Week 3	- Dispose of all other equipment, tools, etc., that cannot be decontaminated - Decontaminate vehicles
Week 4	- Begin final grading - Complete treatment and disposal of liquids and/or residues in holding ponds
Week 6	- Complete removal of solidified wastes from solidification facility
Week 7	- Decontaminate and dismantle solidification facility
Week 9	- Complete backfilling and grading of the holding ponds, solidification facility, and final disposal cell
Week 12	- Complete site grading for drainage
Week 14	- Complete vegetation of site. SITE CLOSED

7.7.1.9 Closure Notification

When closure activities have been completed, a notification of closure letter will be forwarded, in accordance with the requirements of 40 CFR, Section 265.115, to the EPA Regional Administrator and/or other appropriate State and local regulatory agencies. This letter will contain certifications by a duly-authorized representative of the facility and a professional engineer that the closure has been completed in accordance with this plan or its approved modified plan.

7.7.1.10 Notice to Local Land Authority

Within 90 days of the completion of final closure activities, the site manager will notify the local land authority and the Regional Administrator. A certified survey plat will be provided indicating the location and dimensions of the disposal cells with respect to permanently surveyed bench marks. A record of the type, location and quantity of hazardous wastes disposed of within each cell will also be provided. The plat will contain a note including the restriction on the use of the land during the post-closure period which will probably include:

- The land cannot be farmed for food products for human consumption, either directly or by food chain.
- The compacted soil cover cannot be removed unless:
  - Provisions to control the run-on, runoff, and groundwater are acceptable to the EPA Regional Administrator, or other appropriate authority.
  - Provisions to re-establish the cover as a barrier to infiltration of runoff or rainfall are acceptable to the Regional Administrator or other appropriate authority.
- The land use shall preclude the establishment of surface impoundments.
- The land use shall not diminish the effectiveness of the groundwater monitoring system.

At the completion of closure, the district manager will designate to the EPA Regional Administrator or other appropriate authority the agent which will conduct post-closure activities.

7.7.1.11 Closure Cost Estimate

The following figures are the estimated cost (in 1982 dollars) for closure of the site:

A. Solidification Facility	
- Cost of building demolition is equal to the salvage value: no net cost	$ -0-
- Decontamination of building pad and mixing pits: $3,000 lump sum	3,000
- Earth backfilling of cells & tanks plus earth cover over building pad: 15,000 CY @ $3.50/CY	52,500
B. Drum Storage	
- Cost of building demolition is equal to salvage value: no net cost	-0-
- Remove concrete pad and containment wall and bury: 150 CY @ $12.00/CY	1,800
C. Tank Farm	
- Tank decontamination: $1,000/tank x 4 tanks	4,000
- Tank removal is equal to salvage value: no net cost	-0-
- Remove concrete slab and walls: 250CY @ $12.00/CY	3,000
- Regrade tank from area: $2,000 lump sum	2,000
D. Holding Ponds	
- Excavate contaminated pond, contaminated soil and residue; bury in disposal cell: 12,000 CY @ $1.75/CY	21,000
- Excavate potentially contaminated pond contaminated soil and residue; dispose of in disposal cell: 15,000 CY @ $1.75/CY	26,300
- Backfill contaminated pond: 20,000 CY @ $3.50/CY	70,000
- Backfill potentially contaminated pond: 32,000 CY @ $3.50/CY	112,000
E. Disposal Cells	
- Cover and mound, 1 cell maximum: 29,000 CY @ $4.50/CY	130,500
F. Miscellaneous Site Grading	
- Remove berms, grade site, install ditches and clean up: 325 acres @ $120.00/acre	39,000
- Establish vegetation: 150 acres @ $60.00/acre	9,000
TOTAL ESTIMATED CLOSURE COST	$474,100

7.7.2 POST-CLOSURE PLAN

7.7.2.1 General

The post-closure plan presents the requirements for post-closure maintenance including periodic groundwater and leachate monitoring and site

inspections. The plan also describes the conditions at the site and the environmental safeguards the facility possesses to prevent contaminant migration.

7.7.2.2 Facility Description

The project is a treatment/solidification, and disposal facility for hazardous wastes. The facility will receive primarily liquid and semi-solid wastes that will be solidified using absorbent reagents. The resultant solidified product will be buried in secure disposal cells.

The facilities will be operated under two levels. Phase I level of operation essentially consists of clay-lined earthen waste solidification mixing cells, secure disposal cells, and a contaminated water holding pond. Phase II level of operation will consist of a more sophisticated solidification building with concrete mixing tanks and reagent storage silos, a tank farm, a drum storage area, additional secure disposal cells, the same contaminated holding water pond, a potentially contaminated water holding pond, and two non-contaminated surface water collection ponds. Figure 7.7.1 presented the locations of the Phase I and Phase II processing areas.

It is anticipated that the treatment, solidification, and disposal facility will receive a wide variety of chemical wastes. Operating records, daily logs and manifests will contain specific information on the types, quantities, and disposal of the wastes at the site. It is estimated that these facilities, when in full operation, will handle a peak annual volume of 12,000,000 gallons of raw waste which will be about 75% liquids, 5% solids, and 20% semi-solids (sludges). At this rate, the available disposal area will be completed in approximately 40 years.

Closure of the Phase I solidification facility will occur when the Phase II facility is operational (about 12 to 24 months after the site is approved). Closure of the secure disposal cells will be done progressively as each is filled. The remainder of the site will be closed at the end of the facility's life. Figure 7.7.2 presented a final contour plan of the closed facility. A closure plan has been prepared for the site and was presented in Section 7.7.1.

7.7.2.3 Site Conditions

7.7.2.3.1 General

The facility is located approximately 70 miles east of Denver in the gently rolling high plains of eastern Colorado. The topography varies between elevation 4,835 and 4,900 feet (mean sea level datum). There are two producing oil wells on the site that are expected to remain in production throughout at least some portion of the facility's life. An oil pipeline runs through the site in a northeast to southwest direction. The site has been used in the past for wheat farming and grazing. The surrounding area is used for similar agricultural purposes.

The climate is semi-arid with an approximate mean temperature of 50°F and an average precipitation of about 14 inches per year. The average lake evaporation rate applicable to the facility is about 55 inches per year.

A detailed geological and hydrogeological site characterization was prepared by F. M. Fox & Associates Inc., Consulting Engineers and Geologists (see Section 5.4). The study indicated that the site was geotechnically suitable for the facility.

7.7.2.3.2 Subsurface Soils

The site is located on top of a geologic unit known as the Pierre shale that is about 4,300 feet thick. No major aquifers exist beneath the site and the site does not contribute to recharge of major aquifers.

The Pierre shale below the site has weathered to varying degrees and for discussion purposes, has been divided into three major soil groups, as follows, with the lowest group number the closest to the surface.

Group I

Soils from the surface down to 11 to 38 feet consist of slightly silty to very silty clays. The uppermost soil (top six inches) is generally a very silty clayey soil, slightly sandy, medium to very stiff (increasingly stiff with depth), dry to slightly moist, light brown (CL-ML). The clay content, moisture content, and dry density generally increase with depth, and in many borings claystone fragments were noted in the lower portions of this unit. Laboratory testing indicates a liquid limit range of 19% to 63% and a plasticity index range of 4 to 42, with 56.4% to 98.2% by weight passing the #200 mesh sieve. The specific gravity of this material ranges between 2.61 and 2.78. In-situ permeability testing indicates very low natural permeability values with the mean being 2×10^{-6} cm/sec. pH values range from 7.9 to 8.2 Based on the cation-exchange capacity values (see Appendix G) and the geologic environment, the clays appear to be an illite. No x-ray defraction or differential thermal analyses were conducted on the clays.

Based on the laboratory results, approximately 90% of the above described Group I soils, when compacted to 95% of Modified Procter maximum dry density (ASTM D-1557), will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec.

In approximately 20% of the borings, this material is underlain by a generally thin unit of silty, clayey sand. Borings that encountered this material are generally located in the small drainages such as in the southeast corner of Section 36.

Group II

Below the Group I clays is from 25 to 84 feet of weathered shale. This material is generally fractured. In most cases, the fractures contain gypsum deposits. The fracture density decreases with depth. The weathered shale is yellow-brown to dark gray in color. Laboratory testing indicates that natural moisture contents range from 8.7% to 22.8%, and dry densities range from 91 to 124 pounds per cubic foot. The material has a liquid limit range of 39 to 83 and a plasticity index range of 15 to 53, with 96% to 100% passing the #200 mesh sieve. This material will

experience volume increases when wetted. Short duration (30 minutes) field permeability testing indicates initial natural permeability values in the 10^{-5} cm/sec range. Longer term testing (two to four days) indicates an extreme reduction in permeability due to material expansion. The long term permeability value for this material is approximately 1 x 10^{-7} cm/sec.

Group II materials were not permeability tested in a remolded compacted state; however, based on the physical characteristics of the material, it can be expected to meet or exceed the requirements as a compacted liner material.

Group III

This material consists of unweathered Pierre Shale and is first encountered at depths ranging from 59 to 102 feet below the surface, except in test holes G1, G2, and G3 which are outside the processing/disposal area. The material has approximately the same engineering characteristics as the weathered shale, except it is not generally fractured. Permeability tests near the surface of the unweathered shale range between a high of 1.4 x 10^{-7} cm/sec and a low of "completely impervious" (no flow could be induced).

7.7.2.3.3 Groundwater Conditions

Groundwater was encountered in the test borings drilled in drainages outside the perimeter of the proposed secure disposal area. This water is most likely a result of surface recharge from rainfall runoff. Only one of the test borings in the proposed disposal area encountered groundwater. This was the 500 foot deep boring which encountered very minor amounts of water in fractures of the shale at a depth of about 100 feet. Pumping tests were conducted on this well and the results of the test indicate essentially dry well conditions.

7.7.2.4 Facility Design

7.7.2.4.1 General

The primary purposes of post-closure monitoring are to prevent deterioration of the site and, consequently, minimize the possibilities of contaminant migration; and to detect contaminant migration, should it occur. The major design objective for the site is the prevention of leachate formation and migration from the disposal cells into the groundwater.

The design of the facility (discussed below), in combination with the natural geologic features and climatic conditions, provides excellent protection of the environment.

7.7.2.4.2 Secure Disposal Cells

Each disposal cell will be provided with a head dissipating system, a five foot thick compacted clay liner on the bottom and sides, a leachate detection/collection system, and a one foot thick compacted clay liner. On-site clays will be used for the liner and they will be compacted to 95% of the Modified Procter maximum dry density (per ASTM D1557 test method) at or above the optimum moisture content. Laboratory tests performed on the on-site clays to this compaction specification indicate that permeabilities of 1×10^{-8} cm/sec can be achieved.

Each cell also will be provided with a head dissipating system. The system consists of a one foot thick sand layer sloped 2% (minimum) to a recovery sump. The sump will have 6-inch diameter PVC drain pipe placed to remove any leachate, should it form.

Once the cell is filled, a four foot thick, compacted clay cover (cap) will be installed with a 3% slope to promote surface drainage and prevent erosion. The cap will be compacted to the same specifications as the liner and achieve the same permeability. On top of the cap, 24 inches of the original topsoil material will be added. Seeding will provide protective vegetation on the earthen mound.

7.7.2.5 Environmental Safety Features

The potential source of contamination from a facility of this type would be leachate seeping from the disposal cells into the groundwater. Because of the following environmental safety features (both natural and man made), the possibilities of this occurring are extremely remote.

- In order for leachate to form, a liquid medium must be present to leach the contaminants from the wastes. The formation of leachate at the facility is remote because of the absence of groundwater available to infiltrate into the cells, the low annual rainfall, the surface mounding to promote runoff and the highly impervious cap to prevent surface infiltration. Also, the wastes will be solidified so they will not generate any free liquids.

- In the unlikely event leachate should form, the cell has been designed to prevent its escape. First, a head dissipating system is provided in each cell. Leachate collected in the system will be pumped from the cell and disposed of at another facility after closure. Second, each cell is provided with a five foot thick compacted clay liner and leachate detection/collection to retain the leachate. The liner will have a permeability less than 1×10^{-7} cm/sec. Should leachate be detected, the contents of that cell will be removed, the liner reconstructed, and the waste solidified and disposed in a secure disposal cell.

- In the extremely unlikely sequence of events that leachate forms, that the head dissipating system fails, and that leachate seeps through the liner into the leachate detection/collection system, the leachate would have to seep through one foot of compacted clay liner and at least 100 feet of natural soils with permeabilities of 1×10^{6} cm/sec. or less before reaching groundwater under the disposal area.

- Preliminary water quality test results indicate that the groundwater currently fails to meet the National Interim Drinking Water Standards. Also, the quantity of groundwater available appears to be insufficient for municipal supply based upon pump test results.

- A final safeguard is that a water quality monitoring program, as discussed subsequently and in Section 7.6, has been developed for the site and will be performed during the life of the site and the post closure period.

7.7.2.6 Site Security

During site closure all perimeter fencing will be inspected and repaired or replaced, as required, to provide a continuous perimeter access barrier. Any gates, other than the entrance gate to be used after closure,

will be removed or securely locked. The entrance gate itself will be securely locked.

Appropriate signs will be provided to warn that the site is a hazardous waste disposal facility. Emergency procedures, including names and telephone numbers of personnel to be contacted, will be provided on signs at the gate.

7.7.2.7 Monitoring Wells

Monitoring wells have been designed and installed in conformance with 40 CFR Part 265, Subpart F. The locations were presented in Figure 7.6.1. Additional wells may be installed in the disposal cell area during the life of the site. An updated plan showing these locations will be provided prior to site closure.

7.7.2.8 Post-Closure Monitoring

7.7.2.8.1 General

Post-closure monitoring will consist of periodic inspection of the site's grading, security fencing, and disposal cell leachate collection systems and testing of the monitoring wells. These items are discussed in the following sections.

7.7.2.8.2 Site Grading and Security Fencing

Inspection of the site grading and the security fencing will be done on a semi-annual basis for the first year and yearly thereafter. Inspection of both items would be performed at the same time.

Inspection of the site grading will include the drainage facilities and the disposal cell caps. The drainage facilities will be checked for erosion, overtopping and proper slope to ensure that they are functioning properly.

Inspection of the disposal cell caps will include checking for severe surface cracking, erosion, proper slope, and vegetative cover condition. Each cell will be inspected individually to ensure that the caps are functioning properly, preventing surface water infiltration.

The yearly inspections will be performed in the spring as damage would most likely occur during the winter. Any deficiencies encountered will be promptly repaired. A record will be made of the area repaired and the method used.

7.7.2.8.3 Leachate Collection Systems

The head dissipating and leachate detection/collection systems will be monitored quarterly for the first year, semi-annually for the next two years and annually thereafter. Each disposal cell will be checked for leachate. If leachate is detected, the appropriate regulatory agencies will be notified. These agencies may include the EPA, Colorado State Board of Health, Adams County Health Department, and the Tri-County Health Department. Those cells where leachate is found, if any, will be pumped. The liquids will be placed in vacuum trucks and disposed of off-site in accordance with appropriate hazardous waste regulations. Those cells with leachate will be recorded along with the amount of liquid removed and the disposal location. If leachate continues to represent a significant problem, as determined by BFI and the appropriate regulatory agency, the cell contents will be excavated, including the liner, and properly disposed of in a secure cell.

7.7.2.8.4 Monitoring Wells

After site closure, wells will be monitored for the parameters used as indicators of groundwater contamination (Table 7.6.6) semi-annually and

parameters establishing groundwater quality (Table 7.6.4) annually (refer to Table 7.6.11). Other parameters which are found to be significant during monitoring in the active phase will also be routinely monitored. These parameters are well selected to identify any change in groundwater quality. Test results will be reported to the appropriate regulatory agency.

If the monitoring results show a significant variance from previous results, additional samples will be collected and tested. If a significant variance is confirmed, the appropriate regulatory agency(s) will be informed and a specific environmental assessment plan developed. These agencies may include the EPA, Colorado State Board of Health, Adams County Health Department, and the Tri-County Health Department. Upon completion of the assessment the results will be analyzed and additional plans or corrective measures will be developed, as needed.

Current RCRA regulations require post closure monitoring to continue for a period of at least 30 years after the date of completing closure. Such 30-year period is subject to the discretion of the regulatory authority to alter some post closure requirements prior to the end of the 30 years.

7.7.2.9 Monitoring Program Modifications

The frequency or items involved in the post-closure program may be modified depending upon the results of the monitoring as time goes on. Appropriate regulatory agency approval will be obtained prior to any modifications.

7.7.2.10 Post-Closure Monitoring Cost Estimate

The figures below provide the estimated yearly cost in 1982 dollars of the post-closure monitoring discussed in Section 7.7.2.8.

A. Inspect the Site Grading and Security Fencing	
- Inspect the site: 1 man day/visit @ $180/man day @ 2 visits per year =	$ 360
B. Inspect Leachate Collection and Head Dissipating Systems	
- Inspect 40 cells @ 30 min/cell = 20 hours Inspection and travel time from Denver = 4 man days/inspection @ $180/man day x 2 inspections/year =	1,440
- Sample and test 11 monitoring wells	
Purge 11 monitoring wells = 2 man days/inspection @ $180/man day x 2 inspections/year =	720
Sample 7* monitoring wells = 2 man days/ inspection @ $180/man day x 2 inspections/year =	460
Sample lab testing:	
Parameters establishing the suitability of groundwater as a drinking water supply (see Table 7.6.4) $399/sample x 4 repetitions x 7 wells x 1/year =	11,170
Parameters used as an indicator of groundwater contamination (see Table 7.6.6) $95/sample x 4 repetitions x 7 wells x 2/year =	5,320
- Contingency cost for site grading, fence repair and replacement and leachate removal and disposal =	5,000
Subtotal: Estimate annual post-closure cost =	$ 24,470
TOTAL COST: Annual closure cost x 30 year period =	$734,100

*It has been assumed that 4 of the 11 wells will be dry, as is currently experienced.

The above cost estimate has a $5,000 contingency for annual repair costs associated with maintenance of the facility. This cost may vary from year to year but the average cost is representative.

7.8 FINANCIAL REQUIREMENTS

BFI has developed closure and post-closure plans, along with cost estimates for closure and post-closure monitoring and maintenance. These

plans and cost estimate are contained in Section 7.7. The closure cost estimate is based on closure of the facility at a point in its operation when closure costs would be maximized.

Copies of these plans and cost estimates will be maintained at the facility, along with all subsequent estimates that will be prepared in the manner described below.

If the closure plan is ever revised from that contained in Section 7.7 such that the cost of closure changes, the closure cost estimate will be revised accordingly. Likewise, if the post-closure monitoring and maintenance plan change, corresponding revisions to the post closure monitoring and maintenance cost estimate will be made.

Once each year during the operating life of this facility, on or about November 19, BFI will adjust the most recent cost estimates for closure and post-closure monitoring and maintenance. The adjustment will be made by means of an inflation factor, which will be derived from the annual Implicit Price Deflator for Gross National Product, as published by the U.S. Department of Commerce in its Survey of Current Business. The inflation factor to be used for each annual adjustment to the cost estimates will be determined by dividing the then current annual deflator by the annual deflator for the previous year.

The formula for annual adjustments to the cost estimates is as follows:

$$\text{Current Adjusted Cost Estimate} = \text{Most Recent Cost Estimate} \times \frac{\text{Current Annual Deflator}}{\text{Previous Year's Annual Deflator}}$$

BFI will establish financial assurance for the closure of the facility and for the post-closure monitoring and maintenance, in accordance with the plans presented in Section 7.7. The method of establishing financial

assurance for closure and post-closure monitoring and maintenance will be in accordance with federal and state financial assurance requirements. In the case of federal requirements, they are listed in 40 CFR 264.143 and 264.146.

BFI will provide adequate financial security against liability claims which could arise from sudden and accidental, nonsudden and accidental, and general liability occurrences. BFI maintains the following liability insurance to protect its facilities financially from such occurrences:

- Sudden and accidental and general liability occurrences
  - up to $500,000 : self insured
  - $500,000 to $5,000,000 : London Underwriters
  - $5,000,000 to $20,000,000 : London Underwriters

BFI does not require that transporters be bonded. However, insurance is required of subcontractor transporters hauling to a BFI site. The insurance requirements are:

- $500,000/person (Workmen's Compensation)
- $5,000,000/occurrence for bodily damage
- $5,000,000/occurrence for property damage

A ten day written notice prior to any policy limitation changes is required.

7.9 SPECIFIC FACILITY STANDARDS

In addition to the general facility standards and the various requirements for plans, records and reporting contained in the interim status standards, there are several subparts which contain standards pertaining to specific types of facilities which may be provided at a hazardous waste treatment, solidification, and disposal facility.

Section 7.9 is intended to describe how this chemical waste processing/disposal facility will comply with the applicable standards for the specific types of treatment, solidification, and disposal systems being utilized.

The types of waste handling systems and the corresponding subparts in the interim status standards are as follows:

1. Containers: Subpart I - Use and Management of Containers (40 CFR 265.170-265.177)
2. Tanks: Subpart J - Tanks (40 CFR 265.190-265.199)
3. Surface Impoundments: Subpart K - Surface Impoundments (40 CFR 265.220-265.230)
4. Secure Disposal Cells: Subpart N - Landfills (40 CFR 265.300-265.315)
5. Solidification Process: Subpart Q - Chemical, Physical, and Biological Treatment (40 CFR 265.400-265.406)

7.9.1 Containers

The facility will store hazardous wastes for varying periods of time, pending treatment of the wastes in the solidification process. Bulk liquids will be stored in various tanks, according to chemical compatibility, as discussed in Section 7.9.2. Other liquids, semi-solids, and solids with free liquids will be received in drums or similar containers, and will be stored in the drum storage area until the drum contents are transferred to the solidification process.

The drum storage area during Phase I operations will consist of an open area with an 18-inch minimum thickness compacted clay liner, which will extend up the sides of a totally enclosed dike. Crushed rock will be placed above the liner to facilitate all-weather access and provide a stable base for upright drums. A compacted clay entrance ramp will also

be provided. The enclosed dike will be of sufficient height to contain spilled drum contents and any anticipated rainfall, with adequate freeboard. The bottom of the area will be sloped gradually to drain to a corner sump, to facilitate collection and removal of any liquid to the contaminated water holding pond by means of a vacuum truck.

During Phase II operations, the drum storage area will be a separate area within the solidification building. Access to the drum storage area will be by means of a loading/unloading dock. This enclosed drum storage area will have a concrete floor sloped to drain to a sump to facilitate drainage, confinement and recovery of liquid wastes in the event of a spill, leak or rupture of any container.

The following container management practices will be employed by the operator during operations:

- If a container holding hazardous waste is not in good condition, or if it begins to leak, the operator will transfer the hazardous waste from this container to a container that is in good condition, or manage the waste in some other way that complies with the regulations, e.g., place the waste in the solidification cell or tank.

- The operator will use a container made of or lined with materials which will not react with or are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired. In cases where the generator utilizes his own containers, the generator will be required to meet this criteria.

- A container holding hazardous waste will always be closed during storage, except when it is necessary to add or remove waste.

- A container holding hazardous waste will not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.

- Drums under pressure or vacuum will not be sampled until the pressure differential can safely be relieved. The drum will be positioned so that the bung is up. The contents will be allowed to settle. The bung will slowly be loosened with a bung wrench to allow any gas pressure/vacuum to be released, so that the drum can safely be handled. Full protective equipment will be worn during this procedure.

- Containers previously holding liquids, semi-solids, or solids with free liquids will be crushed or shredded and landfilled on-site following emptying.

- The operator will inspect areas where containers are stored, at least weekly, looking for leaks and for deterioration caused by corrosion or other factors, as provided in Section 7.2.4.

- Containers holding ignitable or reactive waste will be located more than 15 meters (50 feet) on the inside of the facility's property line.

- Incompatible wastes, or incompatible wastes and materials, will not be placed in the same container.

- Hazardous wastes will not be placed in an unwashed container that previously held an incompatible waste or material unless the container has been properly cleaned.

- A storage container holding a hazardous waste that is incompatible with any waste or other materials stored in other containers will be physically separated from that waste or other materials.

- Each storage container will be identified as to its contents and generator, and any special precautions associated with the nature of the waste material will be clearly shown, by use of DOT shipping labels or similar methods.

7.9.2 Tanks

No bulk storage tanks for liquid hazardous wastes are proposed for the Phase I operation of this facility. Instead, bulk shipments of liquid wastes will be deposited directly into one of four solidification basins or tanks. The identity and chemical characteristics of each incoming liquid waste shipment will be determined as described in Section 7.2.2 so as to verify correct assignment of each waste to a particular solidification cell, and to assure chemical compatibility, as indicated in Section 7.2.6. These procedures are described more fully in Sections 7.9.3 and 7.9.5.

A tank farm consisting of a maximum of four tanks is planned for the Phase II operation of this facility to provide temporary storage capacity

for bulk shipments of liquid wastes, when necessary, pending transfer of these wastes to the solidification building or to another properly permitted facility.

The tank farm will be surrounded by a continuous concrete wall of sufficient height to impound the liquid waste in the event of a total discharge of the contents of a tank, along with any anticipated precipitation. The ground area within the tank farm will have a concrete surface sloped to drain to a collection sump or sumps which will facilitate removal of spillage or potentially contaminated runoff to the solidification process or the contaminated holding pond, whichever is appropriate.

Each of the tanks will be clearly identified, and will be designated by the facility operator as to the family of compatible liquids a particular tank may receive. The tanks will be completely above grade and will be closed rather than open-top. Each tank will have an access hatch that will permit entry into the tank to inspect for corrosion or internal damage. Other appropriate devices, such as flame arrestors and special vents and emission controls will be provided as necessary for the intended use of particular tanks. None of the tanks will be used for the treatment of hazardous wastes.

The following general operating procedures will be employed:

- Hazardous wastes will not be placed in a tank if such wastes could cause the tank or its liner to rupture, leak, corrode, or otherwise fail before the end of its intended life.
- The tanks will not be operated until the tank farm is equipped with the containment structure.
- In addition to the waste analysis program described in Section 7.2.2, the operator will employ special procedures whenever a tank is to be used to store a hazardous waste which is substantially different from waste previously treated or stored in that

tank. In this event, the operator will conduct waste analyses and trial treatment or storage test (e.g., bench scale or pilot plant scale tests) or obtain written, documented information on similar storage or treatment of similar waste under similar operating conditions to show that this proposed storage will meet all applicable requirements of the items listed above. The operator will place the results from each waste analysis and trial test, or the documented information, in the operating record of the facility, as provided in Section 7.5.

- Inspection of the tank farm facility will be conducted as indicated in Section 7.2.4.
- In the event the facility will store ignitable or reactive wastes in any of the enclosed tanks, it will comply with the National Fire Protection Association's (NFPA's) buffer zone requirements for tanks, contained in Tables 2-1 through 2-6 of the "Flammable and Combustible Code-1977".
- Incompatible wastes, or incompatible wastes and materials, will not be placed in the same tank.
- Hazardous wastes will not be placed in an unwashed tank which previously held an incompatible waste or material.

7.9.3 Surface Impoundments

RCRA regulations 40 CFR-Subpart K, Sections 265.220 to 265.230 cover surface impoundments. There are several surface impoundments at the facility that will be governed by the regulations (Section 265.220). These include the clay-lined earthen solidification cells and contaminated water holding pond constructed during Phase I and the potentially contaminated water and non-contaminated surface water holding ponds to be constructed in Phase II.

The holding ponds will be used to retain the liquid portion of the runoff from various areas of the site as discusssed in Section 6.6 of this report. The ponds have been designed and sized to retain all the runoff from their respective areas. There will be no discharge from the ponds; an NPDES permit will not be required.

The holding ponds will be excavated into the natural soils and lined with compacted clay. In accordance with the general operating requirements (Section 265.222) the holding ponds will have a minimum of two feet of freeboard to prevent overflow. The holding ponds will be inspected daily to check the freeboard level and weekly to check the condition of the ponds in order to detect leaks, deterioration or failures. Wastes will not be directly placed in the holding ponds; therefore, incompability will not be a problem. Leachate, should it occur, will be tested prior to placement in the contaminated holding pond. If the leachate is incompatible with other materials in the pond, it will be solidified and buried in a disposal cell. There will be no treatment of the liquids in the holding ponds.

Any scum on these ponds which proceeds to hinder evaporation will be manually cleaned with a floating baffle. The scum will be solidified and buried in a secure disposal cell.

The Phase I solidification facility is being constructed and will be used until the Phase II facility is operational. The Phase I facility will be used for about the first 12 to 24 months of the site's life. The facility consists of a rectangular earthen "V" bottom trench about 235 feet by 50 feet and 10 feet deep at the center of the "V". It is separated into four mixing cells by earthen cross dikes. The solidification facility is provided with a compacted clay liner along the entire bottom and ends. Since the facility will treat hazardous wastes, it is considered a surface impoundment under Section 265.220 and the regulations under Subpart K are applicable to it. This impoundment is also a mixing facility where liquid wastes will be placed in one of the cells, the solidification

reagent added, and the two substances mixed. The mixed product will be removed, loaded in dump trucks and transported to a secure disposal cell. Since the facility is a mixing unit, the general operating requirement of Section 265.222 requiring two feet of freeboard is not directly applicable. However, the operations will be performed such that the wastes and/or solidified product level will be kept at least two feet below the top. The facility will be used daily, and inspection of the freeboard condition will be monitored. The operator will conduct trial treatment tests or obtain documented information that the treatment/solidification process will work in order to be in compliance with Section 265.225. This subject is addressed in Section 7.9.5. Ignitable or reactive wastes that are treated at the facility will be mixed immediately after placement in the cells/tanks and addition of the reagent. Incompatible wastes will not be placed in the same cell for mixing as required by Section 265.230.

Section 265.228 regulates closure and post-closure monitoring of the site. The closure plan and post-closure plan are presented in Sections 7.7.1 and 7.7.2 of this report, respectively.

7.9.4 Secure Disposal Cells

Secure disposal cells are regulated under 40 CFR-Subpart N, Sections 265.300 to 265.339. All solidified wastes will be buried in a secure disposal cell. Therefore, the facility is regulated under Subpart N according to Section 265.300.

It is estimated that for the projected 40-year life span of the site, about 40 disposal cells will be used. The standard sized disposal cell will be approximately 600 feet by 300 feet by 30 feet deep. However, the

initial Phase I disposal cell is about 250 feet by 150 feet by 20 feet deep. All cells will have the bottom and sides lined with a five foot thick compacted clay liner which will have a permeability less than 1 x 10^{-7} cm/sec. Each cell also will be provided with a head dissipating and leachate collection/detection system with provisions to remove any leachate, even though it is unlikely that leachate will form. When a cell is full, it will receive a four foot compacted clay cap with the same permeability as the liner. Twenty-four inches of the original topsoil material will be added to support vegetation. The surface of the cell will be sloped about 3% to promote surface runoff and control erosion.

Surface water run-on will be prevented from entering the active portion of the secure disposal area by an earthen berm around its perimeter. The same berm will be used to collect any surface run-off within the active area. The run-off will be placed in the contaminated water holding pond.

The wastes received at the site will be predominantly liquids and sludges that will be solidified and will not be subject to dispersal by wind. Those solid wastes received at the site that are fine enough to be windborne will be placed in disposal cells when the wind is calm enough not to disperse them or they will be mixed with other compatible wastes in the solidification tanks.

The facility will maintain operating records. In accordance with Section 265.309, part of the records will include a map showing the location and dimensions, including depth, of each cell with respect to permanently surveyed benchmarks. The facility also will keep records on the contents of each cell and the approximate location of each hazarous waste type.

Section 265.310 regulates closure and post-closure monitoring of the site. The closure plan and post-closure plan are presented in Sections 7.7.1 and 7.7.2 of this report, respectively.

It will be standard practice at the facility to analyze all waste streams. The compatibility of these waste streams will be checked prior to treatment/solidification and disposal to prevent mixture of incompatible wastes.

Disposal in a disposal cell of bulk or non-containerized liquid wastes containing free liquids is prohibited by Section 265.314 unless the cell has a liner, a leachate collection and removal system or the wastes are stabilized chemically or physically. As discussed at the beginning of this section, both of these criteria are met. Each cell will have a bottom and side liner and a leachate collection system that will allow for removal of collected liquids in the unlikely event that leachate should develop. Also, all liquid and semi-solid wastes will be solidified physically by mixing the wastes with kiln dust, fly ash or other suitable reagents, so that the potential for leachate formation is essentially precluded.

7.9.5 Solidification Process

A solidification process will be provided at the facility to convert liquid, semi-solid, and solid wastes with free liquids into a solidified product which can be subsequently deposited in a disposal cell as a stable, solid material. This process will use various reagent chemicals, such as fly ash and kiln dust, to produce the solidification reactions. This process is described in Chapter 3.

During Phase I operations, the solidification process will take place in four clay-lined earthen cells. Section 7.9.3 describes certain aspects of the specific facility standards which are applicable to the solidification process in the impoundments during Phase I.

The Phase II solidification process will take place in open concrete tanks located within the solidification building. Each of the tanks will have a designated use for a family of mutually compatible chemicals. Solidification will be accomplished on a batch process basis, with the type and amount of solidification reagents to be recommended by the chief chemist, based on the characteristics of the particular wastes to be solidified.

Two reagent storage silos will be provided to supply reagents to the solidification tanks by means of a mechanical conveyor system. By providing each set of tanks with a companion storage silo, reagents can be used which are particularly suited to a designated group of wastes intended for each tank.

Wastes will be placed in the solidification tanks in several ways. Liquids which have been stored in holding tanks will be transferred to the appropriate solidification tanks by a vacuum truck. Liquid wastes which are received in drums may be transferred to holding tanks pending accumulation of a sufficient volume for batch treatment. Most commonly, it is expected that drummed liquids, semi-solids, and solids with releasable liquids will be emptied directly into the appropriate solidification tank after appropriate inspection and waste verification. If the appropriate tank is available for use upon arrival of a waste shipment which requires solidification, the waste will usually be deposited directly into the tank.

Under all circumstances, the precautions regarding ignitable, reactive and incompatible wastes described in Section 7.2.6 and subsequently in this section will be observed. Particular care will be exercised to assure that the hazardous wastes and the reagent chemicals will not cause the process facility or equipment to rupture, leak, corrode or otherwise fail suddenly or prematurely. Since this is a batch treatment process, no waste feed cut-off system other than the discharge control valves on the vacuum trucks is necessary. The flow of reagents will be controlled by the operations manager, who will be able to regulate that flow as necessary.

Before treating or processing a new waste, or treating or processing a waste by a different process or with different reagents, the technical personnel will either conduct waste analyses and trial treatment tests (e.g., bench scale or pilot plant scale test) or obtain written, documented information on treatment of similar waste under similar operating conditions to show that this proposed treatment will not damage the facility or equipment, and will meet the requirements in Section 7.2.6 concerning ignitable, reactive, and incompatible wastes. The performance of these waste analyses or trial tests is included in the waste analysis plan provided in Section 7.2.2, and the results of these analyses or tests will be maintained in the operating records described in Section 7.5. Incompatible wastes, or incompatible wastes and materials, will not be placed in the same treatment tank. Hazardous waste will not be placed in unwashed processing tanks which previously held an incompatible waste or material, unless that tank has been adequately cleaned.

The solidification facilities will be inspected regularly, following the procedures contained in Section 7.2.4. During the weekly inspections, specific attention will be paid to the construction materials of the treatment process and equipment, to detect corrosion or leaking of fixtures or seams, and to the area immediately surrounding the processing facility. Should any significant deterioration or other problems be apparent, appropriate corrective measures will be undertaken.

7.10 REFERENCES

1. Guidelines for Establishing Test Procedures for the Analysis of Pollutants, 40 CFR, Part 136, December 3, 1979 as corrected December 18, 1979.

2. Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities, EPA-530/SW-611, August, 1977.

3. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March, 1979.

4. National Interim Primary Drinking Water Regulations, EPA-570/9-76-003, September, 1976.

5. Standard Methods for the Examination of Water and Wastewater, 14th Edition, American Public Health Association, 1975.

6. Groundwater Monitoring, Sampling and Analysis, Federal Register, Volume 45, Part 265, May 19, 1980.

7. Selected Methods of the U.S. Geological Survey for Analysis of Wastewaters, Fishman and Brown, USGS open-file report, 1976.

8. TOX procedure available from the EPA, Environmental Monitoring & Support Laboratory, Cincinnati, Ohio.

9. "Half Hour Determination Method for Chlorophenoxy Acids and Esters Using Liquid Chromatography", Waters Associates, J22, May, 1978.

10. "Methods for Analysis of Water and Wastes", U.S. EPA, EMSL, Cincinnati, Ohio, 1979.

11. Federal Register, 38, No. 75, Part II, 1973.

12. "Standard Methods for the Examination of Water and Wastewater", APHA, 14th Edition, 1975.

13. U.S. EPA, EMSL, Cincinnati, Ohio, November, 1980.

CHAPTER 8

ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATING MEASURES

8.1 INTRODUCTION

This chapter discusses the potential environmental impacts of the project and sets forth mitigating measures to be taken. The items assessed in this chapter include the following:

- o geologic impacts;
- o topographic and surface drainage impacts;
- o water quality impacts;
- o air quality and noise impacts;
- o environmental conditions impacts;
  - climatic impacts;
  - natural ecosystems impacts;
  - land use and population impacts;
  - impacts on economic activities;
  - heritage and cultural resources impacts;
  - traffic and transportation impacts;
  - visual impacts;
- o steps to minimize harm to the environment.

8.2 GEOLOGIC IMPACTS

Due to the relatively small scale of this operation, it is not expected to have any harmful or negative long or short-term impacts on the geology of the region or site during either Phase I or Phase II operations. Other than the displacement of subsoils by construction of individual disposal cells, the project should have no negative impact on the subsoil conditions. As emphasized in Chapter 5, the subsoil conditions at the site are very well suited for a chemical waste disposal facility.

8.3 TOPOGRAPHIC AND SURFACE DRAINAGE IMPACTS

8.3.1 Topographic Impacts

The facility will have only a temporarily negative impact on the site specific topography due to topsoil stockpiles, overburden stockpiles, and open disposal cells. As secure disposal cells are filled, the overburden

and topsoil will be replaced, and the surface will be returned to the original general topography. Figure 6.2.2 detailed final contours of the site. There it was shown that, over the long term, overburden placement will reduce surface slopes in some areas and thereby serve to reduce present soil erosion rates.

8.3.2 Surface Drainage Impacts

8.3.2.1 Rainfall Runoff

Surface runoff will not cause a negative impact, as discussed in Section 8.4.1 on surface water quality.

8.3.2.2 Stream Modification or Impoundment

This facility will not involve the crossing of any streams and will not require the impoundment of any permanent stream.

8.3.2.3 Flood Hazard Evaluation

Based on the flood plain analysis presented in Section 5.5.3, the disposal site is an estimated 93 feet above the 100-year flood level of Beaver Creek. Thus, the project site is not in a flood plain and, therefore, cannot constitute a significant encroachment on any flood plain.

8.4 WATER QUALITY IMPACTS

8.4.1 Surface Water Quality Impacts

The notable surface water sources in the vicinity of the site are two small brine ponds within the site, a permanent stock pond located about one and one-half miles southwest of the site, an intermittent stream (Wetzel Creek) located one-half mile west of the site, and another intermittent stream (Beaver Creek) located approximately one mile east of the site. The Colorado Geological Survey and the Colorado Department of Health(1) recommend a minimum distance of one mile from the disposal site

to any perennial stream channel or permanent body of standing water, or isolation from these features by local topography. No perennial streams or permanent water bodies are located within one mile of the site.

Contamination of surface water by waste polluted groundwater will not be a potential source of water quality degradation because of natural conditions and measures that will be taken to protect groundwater (see Section 8.4.2). However, surface water quality in the vicinity of the site will be monitored as discussed in Section 7.6 of this report.

The solidification process will not be a source of surface water contamination. The earthen solidification cells for the Phase I facility will be provided with a three-foot compacted clay liner and will maintain a two-foot freeboard. The Phase I processing area and disposal area will be surrounded by a berm so that run-on is prevented and all run-off is collected in a contaminated water holding and evaporation pond. When the Phase II facility becomes operational, the Phase I solidification cells will be closed. Upon closure of the Phase I solidification cells, all contaminated materials, including the liners, will be excavated and placed in a secure disposal cell. During the Phase II operation, run-off in the immediate vicinity of the solidification building will be drained directly to the solidification tanks or to the contaminated water holding pond. Further, a potentially contaminated water holding pond will collect run-off from the general Phase II processing area. Run-off from secure disposal cell access roads will be conveyed to the contaminated water holding and evaporation pond.

Liquids held in the contaminated and potentially contaminated holding ponds will not impact surface water quality. Should the level of the ponds get to within two feet of the top, liquid will be drawn off, treated at the solidification facility, and placed in a secure disposal cell. Both ponds will be provided with a five foot thick, compacted clay liner and a leachate detection/collection system.

To further protect surface water quality outside the facility, a berm, constructed from the natural soils of the disposal area, will be placed around the entire site. The berm will eliminate surface water run-on to the site. Further, in conjunction with the non-contaminated surface water collection ponds, it will contain all run-off. The non-contaminated surface water collection ponds will be constructed in the northwest corner and southeast corner of the site. In addition to providing the primary source of water for secure disposal cell construction operations and for controlling fugitive dust, these ponds will provide a convenient means of monitoring the quality of surface water drainage.

Wastewater derived from the washrooms and showers will not adversely impact surface water in the site vicinity. During Phase I, portable sanitary sewage collection units will be provided. The septage from these units will be periodically transported to municipal wastewater treatment facilities. For the Phase II facility, an extended aeration activated sludge treatment system will be constructed to provide secondary treatment of the sanitary sewage. The treated effluent will be utilized on-site to maintain ground cover.

Erosion and sediment control measures will be taken to prevent adverse impacts on surface water quality during construction and earth work

activities. During Phase II construction, the non-contaminated surface water holding ponds and site berm will be established initially to trap debris and sediment and prevent these materials from being transported from the site by surface runoff. During construction activities, exposed areas will be protected from erosion and sedimentation by temporary vegetation and/or other fugitive dust control measures such as wetting the soil.

During the placement of subsoil (transported from the secure disposal area) and removal and redistribution of topsoil in the overburden area, control measures will be taken to reduce erosion. After the topsoil has been redistributed to its final location, the overburden area will be revegetated with a native grass mixture to prevent wind and water erosion. Topsoil overburden stockpiles that will be stored for long periods of time will also be revegetated with a grass mixture suitable for stabilizing slopes, as specified by USDA Conservation Service standards and recommendations(2) or as recommended in Section 8.6.2.1.2 on the revegetation plan. The secure disposal cell caps will be covered with 24 inches of original topsoil material and revegetated with a suitable grass mixture to minimize erosion yet achieve good drainage.

8.4.2 Groundwater Quality Impacts

The Colorado Geological Survey and the Colorado Department of Health have developed a number of suitability criteria for hazardous waste disposal sites to ensure protection of groundwater(1). These criteria and the adherence to these criteria are discussed below.

- The site should contain a minimum thickness of 150 feet of impermeable clay or shale with permeabilities less than 1×10^{-7} cm/sec: The soils in the secure disposal area are predominately silty clays overlying 4300 feet of Pierre Shale bedrock. These

soils and shale have the highest probability of developing a safe storage facility for hazardous waste in the Denver basin. The surficial materials are generally of low permeability and, when densified, will provide a suitable liner material with a permeability in the range of 1×10^{-8} cm/sec (Section 5.4).

- The disposal site should be isolated from any underlying aquifers: No aquifers underlie the site. The site is ideally located east of the Denver metropolitan aquifers and west of the Ogallala exposures in an area where runoff and infiltration do not recharge these aquifers. Groundwater exists only in the sands of surface drainages adjacent to the site and to a very minor extent below depths of approximately 100 feet in the Pierre Shale (Section 5.4).

- Avoidance of geologic hazards such as avalanches, rockfalls, seismic activity, and other related activities should be considered in site selection: No geologic hazards have been observed or are expected at the site (Section 5.4).

- The mean annual evaporation should exceed the mean annual precipitation by 20 inches per year: If evaporation significantly exceeds precipitation, infiltration will be restricted so that surficial water will not contact the waste material. The mean annual lake evaporation rate at the site (55 inches per year) exceeds the mean annual precipitation (14 inches per year) by 41 inches per year.

- The maximum 24-hour storm should be no greater than 6 inches: It is important that heavy rains do not cause erosion of the protective clay cap of the secure disposal cells. The maximum 24-hour storm is slightly over 4 inches at Byers and 5.3 inches at Hoyt, the two nearest weather stations(3). The tops of the secure disposal cell will receive a four-foot compacted clay cap. On top of the cap, additional topsoils will be compacted and vegetated to form a mound with a minimum 3% slope to promote surface drainage while at the same time minimize erosion.

- The site should be resistant to wind erosion, which can reduce the integrity of the disposal cells and contribute to waste release: Wind erosion is a potential problem in the site vicinity due to moderately strong average wind speed (nine miles per hour with a range to 56 miles per hour associated with thunderstorms) and erosive soils(4). However, the area does not experience the severe winds of long duration that occur along the Front Range (3). With proper erosion control measures, e.g., revegetation of the area with a native grass mixture and fugitive dust controls, winds in the site vicinity should not present any serious problems of facility integrity.

In addition to above favorable hydrogeologic and climatic characteristics at the site, the groundwater quality will be further protected by design and operational measures, as briefly discussed below.

Due to the very low permeability of the Pierre Shale, perched water tables typically occur in the alluvial fill drainages. The possibility of groundwater contamination is precluded by the compacted clay cap and liner, solidification of wastes, minimal potential of water infiltration into a cell, and the head dissipating and leachate detection/collection systems in each disposal cell. Possible recharge of perched water tables outside the site from contaminated run-off will be prevented by the berm which will enclose the entire secure disposal cell area.

The Phase I solidification cells are provided with a three foot clay liner compacted to 95% relative compaction (ASTM 1557), which provides permeabilities of less than 1×10^{-7} cm/sec based on laboratory testing. Seepage analyses performed on the clay liner indicate that it will contain the waste for longer than the expected life of the Phase I facility. When the Phase II facility becomes operational, the Phase I solidification cells will be closed by excavating all contaminated materials, including the liners, and placing the material in a secure disposal cell. The Phase II solidification tanks will be constructed of reinforced concrete and will be regularly inspected to ensure no leaks occur. A seepage detection/collection system under each solidification tank will further ensure that no leakage is occurring from the solidification tanks.

During the solidification process, the liquid or semi-solid waste is bound in kiln dust (a waste product from the manufacture of Portland cement), cement powder, or fly ash to form a relatively impermeable solid. The permeability of compacted samples of the kiln dust solidified product is 1×10^{-7} to 2×10^{-6} cm/sec; that of the cement powder product is less than 1×10^{-8} cm/sec; and the permeability of the product solidified with fly ash is on the order of 2.5×10^{-5} cm/sec(5). The low

permeabilities of the solidified product and its absorbant nature virtually eliminates the potential for leaching to occur.

The secure disposal cells are designed to prevent release of any waste products to the environment. A four-foot compacted clay cap will restrict infiltration of precipitation and, thus further eliminate the potential for generation of leachates. The clay cap will form a mound with a minimum 3% slope to promote surface drainage. A five foot compacted clay liner inside the disposal cell will restrict groundwater infiltration and contain any leachate, even though leachate formation is unlikely. The clay will be compacted at or above optimum moisture content to 95% of Modified Procter maximum dry density per the ASTM D1557 test method. Laboratory test results from on-site clays compacted to this extent indicate that the liners will have a permeability of less than 1×10^{-7} cm/sec.

The chief chemist will check for compatibility between the clay liner and laboratory generated leachates from the solidifed wastes. Any leachate generated from the solidified waste should be basic in nature and, therefore, will not dissolve the clay liner material.

Some concern was expressed during public review of the Facility Plan that leachate contact with the selenite crystals encountered in the weathered bedrock horizon would affect the permeability of the natural and recompacted soils. This should not be a concern due to the safeguards used to prevent leachate formation and due to the fact that any leachate formed would be basic and, therefore, would not dissolve the selenite crystals. The laboratory compatibility check and the resistance of the solidified waste to leachate formation, in addition to no groundwater infiltration,

no free liquids in the waste, low rainfall, and minimal surface infiltration, indicate that contamination of groundwater would be virtually impossible.

In summary, no adverse long-term or short-term impacts on surface or groundwater quality are expected. A program will be implemented, however, to monitor surface and groundwater quality (see Section 7.6). Further, a contingency plan has been developed that will serve to minimize potential impacts on water quality in the event of an emergency spill on site or along transportation corridors to the site (see Section 7.4).

8.4.3 References

1. Hynes, J. and Sutton, C., Hazardous Wastes in Colorado, Colorado Geologic Survey and Department of Health, Denver, Colorado, 1980.

2. USDA, Soil Conservation Service, Colorado, Standards and Specifications, Critial Area Planting, Technical Guide, Section IV, August, 1980.

3. Hansen, Wallace, et al., Climatography at the Front Range Urban Corridor and Vicinity, Colorado, USDA Geological Survey Professional Paper, 1019, 1978.

4. National Oceanographic & Atmospheric Administration, Local Climatological Data, Denver, Colorado, 1979.

5. Dillon Consulting Engineers and Planners, Solidification Facilities for Liquid Industrial Wastes, Environmental Assessment Report, Volume II, Prepared for Browning-Ferris Industries, 1980.

8.5 AIR QUALITY AND NOISE IMPACTS

8.5.1 Air Quality Impacts

8.5.1.1 Introduction

A local or microscale analysis was performed to estimate total suspended particulates (TSP) emitted during the Phase I and Phase II levels of operation. The analysis was not done for the other pollutants, e.g., carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_x), etc., because the materials that the facility will accept will generally be

aqueous solutions of inorganics, semi-solids, and solids which, in accordance with the waste segregation practices discussed in Chapters 1, 3, 6, and 7, will not release gases that would affect the National Ambient Air Quality Standards.

The microscale analysis for TSP included the emissions of cement kiln dust from the treatment/solidification operations and fugitive dust emissions from soil removal operations, dumping of soil, wind erosion of soil stockpile and overburden areas, soil replacement operations, traffic over unpaved roads, and particulates emitted by all diesel powered equipment. The analysis was performed for both the Phase I and Phase II levels of operation using EPA's Climatological Dispersion Model (CDM)(1). As an aid in assessing the need to provide fugitive dust emission control measures, the modeling effort employed assumptions that would maximize the calculated emission rates, i.e., operation of the Phase I and Phase II facilities at waste processing rates in excess of the actual design rates (for this analysis a Phase I waste loading of 12,000,000 gallons per year was assumed which is 50% greater than the peak design rate, and a Phase II raw waste loading of 48,000,000 gallons per year was assumed which is 400% greater than the peak design rate), no fugitive dust control measures, and that the facility would operate under all types of wind conditions. Further, a range of particulate fall-out conditions were examined.

8.5.1.2 Project Description

The chemical waste treatment/solidification and disposal facility will have two levels of operation, Phase I and Phase II. During the two phases, the basic construction and waste disposal activities will remain

the same, except an increase in the rate of activity will occur for Phase II in accordance with the raw waste design capacity. However, the treatment/solidification operations for the two phases will differ. For Phase I operations, the treatment/solidification process will take place in open clay-lined cells, whereas for Phase II the process will take place inside a building in concrete tanks and will utilize exhaust hoods and baghouse particulate collectors, as discussed in Chapter 6.

A general listing of the operational activities related to the modeling effort is presented below. Other than the rate at which operations are conducted, the basic sequence of the Phase I and Phase II activities is the same.

1. A 300 foot wide by 600 foot long by 30 foot deep secure disposal cell is dug with earth movers. The cell is overcut to provide for the compacted clay floor and wall liners.

2. Some of the soil removed is stored in a stockpile for later use in preparing the liners, providing intermediate cover, preparing the cell cap, and providing topsoil final cover. The remaining soil is placed in a predesignated overburden area.

3. After the cell is dug, the compacted clay liners, leachate detection/collection system, and head dissipating system are placed in the secure disposal cell.

4. Incoming truck loads of waste are discharged to the solidification tanks or cells, and incoming reagents (e.g., cement kiln dust) are stored in silos or portabulk containers. The reagent is added to the basin or cell and then mixed with the waste material. As noted earlier, the Phase I treatment/solidification operation will take place in open, clay-lined cells whereas the Phase II treatment/solidification process will be conducted in a closed building operated under negative pressure with a baghouse to collect suspended particulates.

5. Upon solidification of the waste, it is loaded into off-highway trucks and taken to the secure disposal cell. After spreading a 42 inch lift of waste in the cell, a 6 inch lift of soil from the stockpile is placed to provide intermediate cover.

6. After the last lift of waste is placed, the secure disposal cell cap is constructed and the topsoil is then replaced; utilization of the next secure disposal cell then begins.

Gravel or paved roads will handle all traffic at the site. The entrance road to the processing area will be gravel for Phase I and paved for Phase II. For both phases of operation, gravel roads will connect the processing facility to the secure disposal cells and the secure disposal area to the overburden areas.

8.5.1.3 Emission Factors

Emission factors for construction equipment were obtained from EPA's "AP-42"(2) for the anticipated equipment at the site. For Phase I and Phase II, the particulate emissions were calculated for each piece of equipment using the hours of operation, the average fuel consumption, and the emission factors. Fugitive dust emissions were calculated for each of the operations. Fugitive dust caused by excavating the secure disposal cells was broken into two parts: that caused by removing the topsoil(3) and that caused by removing the remaining soil(4), i.e., different emission factors were used for each type of soil. The dust emissions from the stockpiled soil were calculated using equations in EPA's "AP-42" (2). These emissions included those caused by traffic, load out from the stockpile, dumping onto the stockpile and back into the cell, and wind erosion. Equations in "AP-42" were also used to calculate the dust from unpaved roads. Factors affecting the emissions from unpaved roads are:

- percentage of silt in the road;
- speed of vehicles;
- number of days per year with 0.01 inches of precipitation;
- number of wheels per vehicle;
- size of tires.

A summary of this data is presented in Table 8.5.1. It is noted that the secure disposal cell design figures in this particular table are based on

TABLE 8.5.1

PARTICULATE EMISSION DATA BASE

STANDARD SIZED SECURE DISPOSAL CELL
CONSTRUCTION (QUANTITIES PER CELL)

Total Excavation per Cell (including overcut for liners)	185,000 cu.yds.
Volume of Topsoil Removed	3,500 cu.yds.
Volume of Soil Removed	181,500 cu.yds.
Volume of Soil to be Stockpiled	73,500 cu.yds.
Volume of Soil Placed in Overburden Area	111,500 cu.yds.
Average Area of Overburden Placement	11.5 Acres

UNCONTROLLED FUGITIVE DUST EMISSION FACTORS
FOR SECURE DISPOSAL CELL CONSTRUCITON

Topsoil Removal(3)	0.38 lb./cu.yd.
Soil Removal(4)	0.075 lb./ton
Dumping of Soil(2)	0.214 lb./ton
Wind Erosion (Stockpile & Overburden Areas)(5)	1.07 tons/acre-yr.

NOTE: Density of soil assumed to be 110 lbs./cu.ft.

UNPAVED ROAD EMISSIONS(2)

Phase 1 (Based on 12,000,000 gals./yr., i.e., 50% higher than the peak waste loading)

Gravel Roads	2% Silt
Days/yr. with 0.01 inches or more of precipitation	93
Vehicle Speed	15 mph
Earthmover Speed	10 mph
Four Wheel Vehicles	0.30 lb./VM
Vehicle Miles	2,600 miles
Six Wheel Vehicles	0.60 lb./VM
Vehicle Miles	1,100 miles
Earthmovers	0.40 lb./VM
Vehicle Miles	2,300 miles

Phase II (Based on 48,000,000 gals./yr., i.e., four times the peak waste loading)

Gravel Roads	10% Silt
Days/yr. with 0.01 inches or more of precipitation	93
Vehicle Speed	15 mph
Earthmover Speed	10 mph
Four Wheel Vehicles	1.51 lb./VM
Vehicle Miles	6,144 miles
Six Wheel Vehicles	3.02 lb./VM

Table 8.5.1
(Continued)

UNPAVED ROAD EMISSIONS(2)

Phase II (Cont'd.)

Vehicle Miles	19,000 miles
Earthmovers	2.01 lb./VM
Vehicle Miles	9,560 miles

WASTE PROCESSING

Phase I

Reagents Used	53,500 tons/yr.
Emitted to Air(1)	14.6 tons/yr.

Phase II

Reagents Used	320,860 tons/yr.
Emitted within Confines of Building(1)	87.3 tons/yr.
Hood Efficiency	95%
Baghouse Efficiency(1)	99.7%
Emitted to Air	4.6 tons/yr.

the original cell design, not as revised and presented in this report. However, these data represent the potential for a more significant air quality impact than would be anticipated because the original volume of overburden was greater and because the processing rates for this analysis for both Phase I and Phase II were significantly higher than actual design processing rates.

The final source of dust considered was the cement kiln dust emitted. In accordance with analogous operations at cement batching plants (without controls), an emission factor of 0.54 pounds of kiln dust per ton of kiln dust was employed(2). For Phase I, it was assumed that all of the particulates go directly into the air since the mixing process takes place outdoors. For the Phase II operation, utilization of the baghouse greatly reduces the dust emission, as indicated in Table 8.5.1.

8.5.1.4 Microscale Projection Methodology

The microscale air quality analysis considered the total TSP emitted for each phase of operation. Based on the factors presented in the preceding section, the particulate emissions from the various sources for both phases were calculated for an annual period. The results are presented in Table 8.5.2. There it can be seen that process emissions will be small, but that fugitive dust emissions could be significant without proper control measures. Such measures will be discussed subsequently.

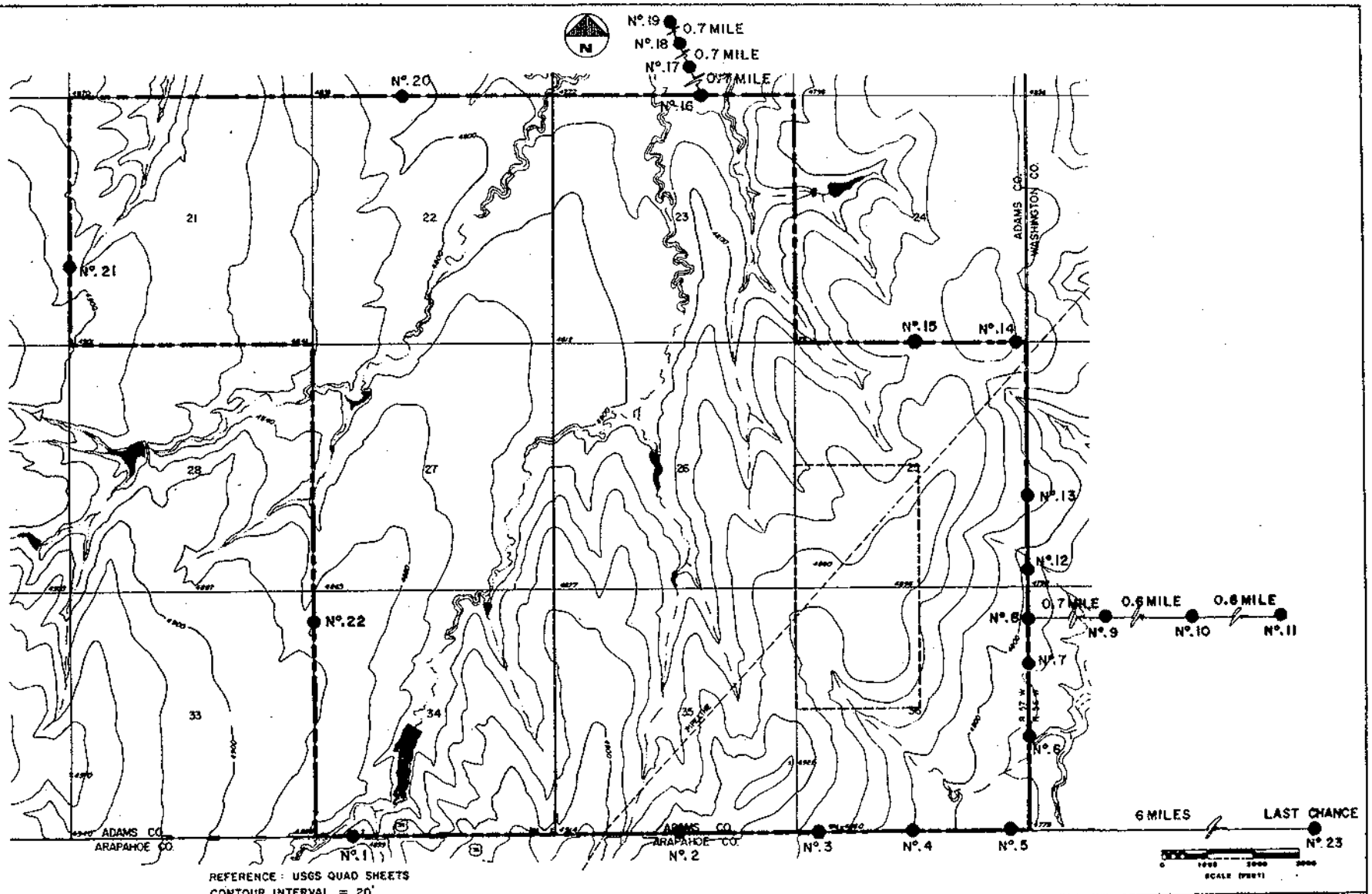
The EPA's CDM computer model was used to predict the TSP concentrations at various locations around the site, as shown by the air quality receptor locations in Figure 8.1. Twenty-three (23) receptors were defined, 16 of which were along the property line. Three were east of the site, and three were north-northwest of the site to be in line with the predominant wind directions. A receptor was also placed in Last Chance, Colorado.

TABLE 8.5.2

TOTAL ANNUAL SUSPENDED PARTICULATE PROJECTIONS
ASSUMING NO FUGITIVE DUST CONTROLS
Tons/Year

SOURCE	PHASE I (1.5 times the max. processing rate)	PHASE II * (four times the max. processing rate)	PHASE II * (two times the max. processing rate)
Diesel Exhaust	0.7	2.8 (2.8)	1.4
Kiln Dust	14.6	4.6 (4.6)	2.3
Fugitive Dust Emissions			
a. Traffic on unpaved roads	1.2	42.9 (31.9)	21.5
b. Wind erosion	13.6	41.2 (19.6)	20.6
c. Topsoil and Soil Removal	10.8	43.2 (43.2)	21.6
d. Dumping soil in Stockpile and Overburden Areas	29.4	117.6 (91.6)	58.8
e. Replacement of soil and Topsoil	15.8	63.2 (46.0)	31.6
TOTAL	86.1	315.5 (243.1)	157.8

* NOTE: Estimates for emissions, assuming application of fugitive dust control measures, are given in parenthesis. None of the estimates take into account particulate fallout.



REFERENCE: USGS QUAD SHEETS
CONTOUR INTERVAL = 20'

SYMBOL	REVISIONS	BY	DATE	APPROVED	SYMBOL	REVISIONS	BY	DATE	APPROVED

DESIGNER
DRAFTING
PROJ. ENGR.
PROJ. MGR.
BY
DATE

HNTB
ARCHITECTS ENGINEERS PLANNERS

JOB NO.
DATE MAR 1981

BF BROWNING-FERRIS INDUSTRIES
HIGHWAY 36 LAND DEVELOPMENT COMPANY
ADAMS COUNTY, COLORADO
CHEMICAL WASTE DISPOSAL FACILITY

AIR MONITORING RECEPTOR LOCATIONS

SHEET NO.
FIG. 8.1

The CDM model is applicable for estimating long-term concentrations of nonreactive pollutants due to emissions from area and point sources in an urban area(1). It is noted that for the original version of the model, the stability class coefficients for the dispersion were established from experiments conducted over flat and relatively smooth rural terrain. To make an allowance for the thermal and mechanical influences of urban areas, corrections are included in the CDM model to take into account that air in an urban area is less stable than in a rural area. For the analysis used herein, however, the original stability class coefficients were returned to the computer program to reflect the rural terrain in the project area.

The projected concentrations are dependent on several parameters used in the program, as listed below:

- area source emission rates;
- location of source;
- location of receptor;
- wind speed, wind direction, and stability class;
- afternoon mixing height;
- nocturnal mixing height;
- decay half-life of the pollutant.

The annual meteorological data used was from a STAR program from Akron, Colorado (Figure 5.7.1). Average afternoon mixing height and noctural mixing height were based on information presented in Reference 6.

Two decay half-lifes were used in each computer run. A very large half life (i.e., infinity) corresponds to no particulate fallout and a half life of .038 hours provides a more reasonable estimate of actual particulate fallout conditions(3). The half-life was calculated using the fallout function(3) and an average wind speed of 12.1 knots (6.33 m/sec)

from the STAR program for Akron, Colorado. All of the data listed above remained the same for both Phase I and Phase II, with the exception of the area source emission rates.

Phase I was modeled using two area sources, both of which were in the general area of the Phase I processing area. Because Phase II operations will be more spread out, ten emission source areas were defined within the site and overburden areas. Separate emissions were estimated for each of the sources in accordance with the respective activities in each area. The totals emitted were equivalent to the estimates presented in Table 8.5.2.

8.5.1.5 Results and Conclusions

The output from the CDM model for Phase I and Phase II is given in Appendix N, and the results are summarized in Table 8.5.3. The results of the computations and computer modeling study indicate that, if no fugitive dust control measures were taken, the maximum particulate emissions from the Phase I and Phase II operations would be 86 tons/year and 315 tons/year, respectively, at 50% and 400% higher peak processing rates than planned. As expected, the vast majority of the particulates would be emitted as fugitive dust. As has been discussed previously, provisions have been made for controlling emissions of fugitive dust. In accordance with Colorado particulate emissions regulations, these include wetting down (including prewatering), replanting with native vegetation, temporary and permanent paving, restricting the speed of vehicles on the site, prevention of the deposit of dirt and mud on paved areas, minimizing topsoil disturbance, and reclaiming as soon as possible. As was indicated in Chapter 6, water collected on site will be used for these purposes,

TABLE 8.5.3

AIR QUALITY MODELING RESULTS

TOTAL SUSPENDED PARTICULATES PROJECTIONS
ASSUMING NO FUGITIVE DUST CONTROL MEASURES
(Micrograms/Cubic Meter)

Receptor Location	Phase I at 1.5 Times the Maximum Processing Rate	Phase II at 4 times the the Maximum Processing Rate	Phase II at 2 times the Maximum Design Peak Processing Rate
1	0-0	0-1	0-0
2	0-1	0-3	0-1
3	0-1	1-5	1-3
4	0-2	2-6	1-3
5	0-1	1-5	1-2
6	1-2	2-8	1-4
7	1-3	4-11	2-5
8	2-5	4-11	2-6
9	0-1	0-4	0-2
10	0-1	0-2	0-1
11	0-0	0-1	0-1
12	2-5	4-11	2-6
13	1-3	3-10	2-5
14	0-1	2-6	1-3
15	0-2	5-12	3-6
16	0-1	0-2	0-1
17	0-0	0-1	0-1
18	0-0	0-1	0-0
19	0-0	0-1	0-0
20	0-0	0-1	0-0
21	0-0	0-0	0-0
22	0-0	0-1	0-0
23	0-0	0-0	0-0

Note: Refer to Figure 8.1 for air monitoring model receptor locations. The range of concentrations given for each level of operation corresponds to the assumed range of particulate fallout rates (see text).

e.g., based on the annual peak design processing rate (12 MG), 0.8 MG for watering access roads, 0.28 MG for dust control at stockpile areas, 0.54 MG for moisturizing placement of the overburden, 1.02 MG for revegetation of overburden, and 1.13 MG for secure disposal cell liner and cap construction. As indicated in Table 8.5.2 (which assumes no particulate fallout), at four times the Phase II maximum processing rate, such fugitive dust control practices are expected to reduce TSP emissions to 243 tons per year. This level is below the threshold quantity for a "major emitting facility," pursuant to Section 169(1) of the Federal Clean Air Act.

Table 8.5.3 shows that even at four times the maximum Phase II processing rate, the annual average total particulate concentrations at the property lines would increase by 0-5 ug/m^3, assuming realistic particulate fallout rates. With the fugitive dust control measures mentioned above, this range is expected to be 0-4 ug/m^3, in accordance with the estimates presented in Table 8.5.2. Considering the base line particulate data presented in Chapter 5, these estimates indicate that the facility will have virtually no impact on air quality.

8.5.2 Noise Impacts

8.5.2.1 Noise Sources

Two sources of noise were considered for the maximum operation level during Phase II - construction equipment noise and site generated traffic. The Phase I operation will generate less activity than Phase II and, therefore, will have fewer noise impacts than the Phase II maximum operation levels considered herein for impact analysis.

8.5.2.1.1 Construction Equipment

Construction of Phase II buildings, access roads, perimeter fences, and berms will require 12 to 24 months. After this construction, normal on-site construction will consist of building additional secure disposal cells and covering completed secure disposal cells. The combined construction equipment used in the noise analysis is listed below:

- off-highway trucks which deliver the solidified waste to the secure disposal cell from the processing facility;
- a bulldozer which spreads and compacts the solidified waste in the secure disposal cell and one that works in the overburden area;
- earthmovers which dig the secure disposal cells and transport the soil to the stockpile and overburden areas;
- motor grader which levels the overburden areas;
- trucks transporting building materials and equipment (concrete, asphalt, etc.).

8.5.2.1.2 Site Generated Traffic

Site generated traffic includes all highway traffic which is caused by the facility. This includes trucks delivering the waste and reagents, plus the employees' daily trips.

The highways affected by the majority of site-generated traffic are:

- U.S. 36 west of Adams-Washington County line;
- S.H. 71 north and south of Last Chance;
- I-70 west of Byers;
- I-25 between Colorado Springs and Denver.

8.5.2.2 Noise Analysis Procedures

The FHWA Level 2 Highway Traffic Noise Prediction Model, STAMINA 1.0 was used to predict the noise levels for the highways affected by the site generated traffic(7). This mathematical model provides accurate noise predictions. The noise level at a point away from the highway is a function of:

- the distance from the roadway;
- the relative elevations of the roadway and the receiver;
- traffic volume on the roadway;
- the percentage of light-duty (2 axles and 4 tires), medium-duty (2 axles and 6 tires), and heavy-duty (more than 2 axles) vehicles;
- vehicle speed;
- roadway grade;
- the noise source height of the vehicles;
  - Automobiles - 0.0 feet (tires produce most of the automobile noise;
  - Medium-Duty Trucks - 2.3 feet (exhaust noise is the primary contribution);
  - Heavy-Duty Trucks - 8.0 feet (combination of engine, mechanical, exhaust, intake, cooling fan and tire noise).

Traffic data used in modeling base line conditions were based on 1978 average daily traffic counts by the Colorado Department of Transportation. These figures were increased to correspond to the 2-1/2% to 3-1/2% average annual traffic growth rate for the specific highways detailed previously in Table 4.2. The maximum site generated traffic (corresponding to a raw waste load of 48,000,000 gallons per year, four times the peak design load) was added to the projected base line traffic volume for simulating traffic noise at the peak operating capacity.

Construction noise levels were modeled according to the Highway Construction Noise: Measurement, Prediction and Mitigation publication(8). Noise levels at the south property line along U.S. Highway 36 and along the east property line were computed using the procedures outlined therein. As a first approach, noise from Phase II construction activities and peak Phase II disposal activities were superimposed. Although this produced unrealistically high noise estimates, it served to show that noise

levels would not be excessive and at the same time eliminated the need to compute noise levels for various alternative situations.

8.5.2.3 Noise Analysis Results

Facility related traffic has no significant increase in traffic induced sound levels along the access routes. The maximum increase was 1 dBA which occurred in two locations: on S.H. 71 south of Last Chance and U.S. 36 between Byers and the site. Table 8.5.4 lists the results of the highway traffic noise modeling with and without the facility.

TABLE 8.5.4

IMPACT OF HIGHWAY TRAFFIC NOISE

Highway and Location	Noise Level, dBA L_{eq}*	
	Without Site	With Site
I-25 between Colorado Springs and Denver	74	74
I-70 between Denver and Byers	70	70
U.S. 36 between Byers and the Site	67	68
U.S. 36 between Last Chance and the Site	67	67
U.S. 36 East of Last Chance	67	67
S.H. 71 North of Last Chance	67	67
S.H. 71 South of Last Chance	65	66

*Measured at the right-of-way.

At a Phase II peak raw waste loading of 48,000,000 gallons per year (four times the design peak load of 12,000,000 gallons per year), the site operational/construction noise anticipated would be less than 79 dBA L_{eq} along the east property line and less than 76 dBA L_{eq} along the south property line. The Colorado Noise Abatement Law for a construction site sets the maximum allowable noise level at 80 dBA with a maximum increase of 10 dBA for a period not to exceed 15 minutes in any one-hour period. These values correspond to a twelve hour L_{eq} of approximately 81 dBA.

Consequently, the Colorado Noise Abatement Law will not be exceeded even when the analysis was based on a processing rate four times the design maximum processing rate.

8.5.3 References

1. Bussee, A. D., Zimmerman, J. R., Users Guide for the Climatological Dispersion Model, EPA-R4-73-0124, December, 1973.

2. U.S. EPA, Compilation of Air Pollutant Emission Factors, Publication AP-42, August, 1977.

3. PEDCIO, Survey of Fugitive Dust from Coal Mines, for EPA, February, 1978, NTIS PB-283 162.

4. EPA Region VIII, EPA Region VIII Interim Policy Paper on the Air Quality Review of Surface Mining Operations, Jan. 1, 1979.

5. U.S. Department of Agriculture Soil Conservation Service, Erosion and Sediment Control in Urbanizing Areas of Colorado, 1979.

6. Holzworth, G. C., Mixing Heights, Windspeeds, and Potential for Urban Air Pollution Throughout the Contiguous United States, EPA AP-101, January, 1971.

7. F. F. Rubber, Jr., D. F. Lam, and P. Cheung, Science Applications, Inc., McLean, Virginia, May 1979.

8. Highway Construction Noise: Measurement, Prediction, and Mitigation, Reagan, Jerry A., Grant, Charles A., U.S. Department of Transportation, January, 1976.

8.6 ENVIRONMENTAL CONDITIONS IMPACTS

8.6.1 Climatic Impacts

The facility will not have any effect on regional or local climatic factors. Precipitation, temperature, wind, and other climatic regimes will remain the same as experienced under present conditions.

8.6.2 Natural Ecosystems Impacts

8.6.2.1 Natural Vegetation

8.6.2.1.1 Impact on Natural Vegetation

The facility will have a beneficial effect on natural vegetation. Less than one acre of native grassland will be lost during Phase I of the

project. At present, essentially all of the site is winter wheat cropland. With Phase II operation of the site, these croplands will be seeded to native range grasses except where earth moving and construction is active.

Weed control in the active area will be accomplished by periodic mowing, as needed, in early stages of native grass regeneration. When native grass has reached the third leaf stage, weeds will be controlled by application of 2,4D at 1 to 1-1/2 lbs./acre. The local Soil Conservation Service will be consulted to insure proper procedures are followed for weed control.

To encourage establishment of the permanent grass cover, sorghum will be planted and stubble left on the site as mulch following harvest. The site will then be planted during the next suitable planting season. During seedbed preparation and seeding, a maximum amount of the plant stubble will be left on the surface to prevent soil blowing and to conserve moisture. The grass mixture to be used for range planting and seeding rates are given in the revegetation plan (Section 8.6.2.1.2).

A permanent cover of native grasses will be established on closed secure disposal cells, berms, and final overburden placement areas. These areas will be covered with at least six inches of topsoil (24 inches on closed secure disposal cells) prior to seedbed establishment. Areas to be revegetated will be fertilized, seeded and mulched in accordance with Standards and Specifications for critical area planting(1) and consultation with the local USDA Soil Conservation Service. Irrigation will be provided for establishment of grass cover when seasonal rainfall is inadequate.

Temporary stockpiles of topsoil and excavated subsoil material will also be seeded to a protective grass cover while these materials are being stored. Areas which are under active construction will be protected from wind erosion and fugitive dust by surface irrigation and temporary erosion control measures, including use of berms.

In summary, there will be both short-term and long-term beneficial effects on natural vegetation. Very little natural vegetation will be destroyed, and in fact, there will be a net increase of vegetated area. As discussed below, an extensive revegetation program is planned to control erosion, to mitigate adverse impacts on soils, and to provide native wildlife habitat.

8.6.2.1.2 Revegetation Plan

At the start of Phase II operation, winter wheat cropping will be discontinued on the active site. At that time, any croplands not affected by active construction or earthmoving activity will be seeded with a native grass mixture to aid in controlling wind and water erosion, minimize dust, and provide wildlife habitat.

Seeding of grasses will be done in accordance with USDA Soil Conservation Service standards and specifications for range seeding(2). The local USDA Soil Conservation Service (SCS) in Deer Trail, Colorado will be consulted throughout the proposed revegetation program. To avoid competition between winter wheat and native grass, sorghum will be planted on the two 1/4 section active areas that are not under excavation, prior to conversion to native grass. The rest of sections 25 and 36 will be planted to crops. The sorghum will be cut for hay before seed maturation and an eight-inch stubble left to provide a seed bed mulch. In late fall

or early spring, depending on availability of moisture, native grass will be seeded on these croplands.

The grass mixture to be used for range planting and seeding rates are given in Table 8.6.1 as recommended by USDA(3).

TABLE 8.6.1

MIXTURE FOR RANGE SEEDING

Species	Mix	Drilled Rate Pounds/Acre	Pounds Live Seed/Acre
Sideoats Grama	50%	4.5	2.25
Blue Grama	30%	1.5	0.45
Western Wheat Grass	20%	8.0	1.6

Topsoil and subsoil stockpiles that will be stored for at least one growing season will be revegetated with a native grass mixture suitable for stabilizing steep slopes, in accordance with USDA Soil Conservation Service standards and recommendations for critical area plantings(3). Also, any berms or impoundments constructed on the site will be revegetated with these critical area plantings.

All steep slopes of stockpiles, berms, etc., will be covered with at least six inches of topsoil, fertilized, seeded and mulched to stabilize the soil surface. Land slopes will be kept within 3:1 slope (33%) wherever practical. Fertilizer will be applied during the seeding operation on steeply sloping areas with at least 40 pounds of nitrogen and 40 pounds of phosphate per acre. When seasonal rains are inadequate for establishment of grass cover, seeded and mulched areas will be irrigated to ensure development of a protective grass cover.

The seeding mixture and rate of seeding will be as shown in Table 8.6.2.

TABLE 8.6.2

MIXTURE FOR CRITICAL AREA PLANTING

Species	Mix	Drilled Rate Pounds/Acre	Pounds Live Seed/Acre
Western Wheat Grass	50%	16	8
Streambank Wheat Grass	50%	11	5.5

8.6.2.2 Wildlife

Full development of the site will benefit wildlife because most of the active area will be converted at the onset of Phase II operation from winter wheat cropland to native grasses. Where active earth moving and construction activities are occurring, there will be a minor loss of wildlife habitat from loss of winter wheat cropland. These croplands provide some habitat for field songbirds, field rodents, and predatory animals, but are of low wildlife habitat value compared to native grassland.

In addition to benefits to wildlife from planting portions of the site not under active development to native grasses, there will also be some benefits to wildlife from revegetation of disposal cell caps and overburden storage and placement areas. As discussed earlier, secure disposal areas and overburden areas will be covered with at least six inches of topsoil (24 inches on closed secure disposal cells) and seeded to native grasses.

There will be some loss of habitat for larger mammals from fencing the processing/disposal area. This area will be fenced for safety purposes

and also to exclude big game animals which might otherwise be subject to contamination in this area. The fence will be chain link of sufficient height to provide these securities.

Following heavy rains, it is expected that some runoff may pond in open disposal cells. This ponded water could be attractive to migratory waterfowl. To minimize water quality degradation and hazard to waterfowl, this water will be drained from the disposal cell and pumped to the contaminated water holding pond. The contaminated water pond is relatively small (about one surface acre) and, therefore, is not likely to attract a significant number of waterfowl. Also, the contaminated holding pond is located near the solidification facilities where day-to-day truck and processing activities will discourage use by waterfowl. If these activities are not sufficient to discourage use by waterfowl, hazing devices will be used. In the unlikely event of injury to waterfowl, the contaminated water pond would immediately be tested to determine the probable cause of injury, and whether the injury was external or internal. The Colorado Division of Wildlife would be notified and appropriate treatment of injured birds taken.

Rodents and other vectors normally associated with sanitary landfills are not expected to be a health problem at this site. The inert nature of the solidified waste and the practice of daily cover with soil in the secure disposal cell will prevent harboring and breeding of vectors.

8.6.2.3 Wetlands

This project will not impact the biological, physical or hydrological processes of any wetlands.

8.6.2.4 Threatened and Endangered Species

No State or Federally threatened or endangered species are known to exist in the site vicinity. No habitat for rare and endangered species will be lost as a result of the facility operation. The range and habitat characteristics of four threatened and endangered species which are dependent on prairie habitat in eastern Colorado were presented earlier in Section 5.8.2.3. These species included the greater prairie chicken, the lesser prairie chicken, the prairie sharp-tailed grouse, and the black-footed ferret. In the case of the first three species, insufficient prairie habitat is present in the immediate vicinity of the active area for support of these species. For the black-footed ferret, the lack of prairie dogs on the site precludes the occurrence of this species.

8.6.3 Land Use and Population Impacts

8.6.3.1 Land Use Impacts

The proposed BFI facility will have negligible adverse impacts on local and county land use and will enhance the quality of the environment within Adams County by providing a secure area in which to safely dispose of hazardous wastes. The proposed facility will minimize the potential for illegal roadside dumping of hazardous wastes and can be used to solve ongoing problems associated with the five uncontrolled hazardous waste dump sites identified in the Waste Management Plan (WMP)(4).

The proposed site encompasses approximately 5,760 contiguous acres in southeastern Adams County, none of which include prime and unique farmland. Only 325 acres, or 5.6% of the land owned by BFI, will be used for waste disposal purposes over the 40 year life of the facility. The half-mile buffer zone area, as well as the remaining seven sections of the

site will be maintained in agricultural production. Thus, of approximately 755,000 acres of agricultural land in Adams County, only 0.043% will be removed from agricultural land uses by operation of the proposed facility. By comparison, the planned Front Range Airport, as subsequently discussed, will remove approximately 5% of the total agricultural acreage in Adams County.

The proposed facility is consistent with other Adams County Comprehensive Plan(5) policies and goals relating to eastern Adams County development and hazardous waste management. Consistent with the East End Development Plan (EEDP)(6) policy to reduce agricultural pollution, the facility will provide Adams County farmers with a safe facility for disposal of hazardous waste produced in agricultural operations.

The BFI facility will be available to help eliminate the illegal and uncontrolled hazardous waste disposal practices in Adams County. It is the conclusion of the Adams County Waste Advisory Committee that the closure of the Lowry site will "promote illegal dumping" of hazardous waste in Adams County(4). Further, in formulating the WMP, a study of existing county waste problems was conducted. The study identified five uncontrolled hazardous waste dump sites located within Adams County. All five sites are located proximate to the major drainage basin of the South Platte. The proposed facility will provide Adams County with the hazardous waste management capacity needed to eliminate pollution problems from these uncontrolled hazardous waste sites.

BFI feels the potential for future industrial growth in the vicinity of the BFI waste facility is minimal and that such growth certainly will not

be triggered by that facility's planned location. The proposed site is attractive to BFI because of its favorable geologic conditions, low population density, good access, and the general remoteness of the area. These very features which make this location attractive to the waste treatment industry make the area unlikely to attract other industrial activity, such as manufacturing, wholesale, and light industrial uses. Such other industrial activities emphasize factors such as proximity to major population centers and transportation corridors in making locational decisions. Close proximity to waste disposal facilities has never been a dominant factor in industrial locational decisions, and, in this specific case, will be far outweighed by factors such as the general remoteness of the region and the lack of a myriad of other support factors needed to stimulate major industrial growth in eastern Colorado.

Further, location of the facility at the proposed site is consistent with east end policies to limit residential growth to existing population centers. BFI will employ approximately 20-35 people, many of whom currently reside in the area. Employees relocating to the area are expected to reside in existing communities. No new residential development is expected. The proposed facility will provide much needed jobs and economic diversity to the east end population, a goal specifically identified in the EEDP(5).

BFI has no plans for expanding the facility beyond the present scope as described in its application. BFI believes that it is very likely that resource conservation and recovery will take new directions as research progresses and that, 40 years from now, most, if not all, waste will be treated or used and not buried in secure landfills. If BFI's projections

are correct, further expansion will not be economically feasible or technologically desirable. In any event, if BFI does make a decision at that time to expand, a new report would have to be submitted and a new certificate of designation applied for, thereby triggering the extensive review process required by law.

The safeguards that are to be installed at this facility, such as the cell design, with leachate detection/collection system, head dissipating system, and six level monitoring program, will insure that there will be no contamination of any sort of adjacent agricultural lands. As part of the monitoring program, soil will be monitored for hazardous material content at six one-fifth acre sample sites which will be located equidistant around the site buffer zone.

The six sample plots will be maintained in winter wheat. Soil samples from each plot will be tested semi-annually for metals and organics selected from the EPA priority pollutant list. If any contamination is found in the buffer zone, the area around the periphery of the buffer zone will be monitored for potential contamination. If contamination is found, then vegetative samples will also be analyzed. Analysis will be performed by a state approved testing facility and the results reported annually to the Colorado Department of Health.

If, however, in the unlikely event that, in spite of these safeguards, evidence arises that nearby crops, water, or livestock have been harmed by the site, the owner of such damaged property will be entitled to submit a claim to BFI's insurance carrier for such damages or pursue other legal remedies. BFI will carry liability insurance to guard against the highly unlikely event of off-site contamination.

Because of the design features described above and the facility's half-mile buffer zone, facility operation will not restrict, in any way, agricultural activities beyond facility boundaries. EPA has proposed a 200 foot buffer zone for all activities, including agricultural activities. With the facility design and monitoring standards imposed by RCRA, the 200 foot buffer zone was deemed sufficient to insure, even in a worse-case situation, that no contaminant could migrate beyond such limit without detection and control. It is anticipated that the majority of states with hazardous waste programs will utilize a 200 foot buffer zone for all activities, including agricultural activities. The largest proposed buffer zone of which BFI is aware of is 500 feet. BFI's buffer zone, by choice, is a minimum of 2,640 feet, five times greater than that anticipated to be required by any state to insure protection of agricultural and other activities beyond facility boundaries. Thus, it is felt that the proposd buffer is technically more than adequate to protect off-site agricultural activities.

Finally, the location of the proposed facility in eastern Adams County is not inconsistent with the EEDP supported general aviation airport. On May 5, 1982, the Adams County Board of County Commissioners approved the application of Adams County requesting rezoning of approximately 63 square miles located between Interstate 70 on the south, the 80th Avenue alignment on the North, County Road 22N on the West, and County Road 31N on the East. This area, zoned primarily for agricultural uses, was rezoned to a Preliminary Airport Influence Zone ("AIZ"), removing approximately 5% of the total County agricultural lands from agricultural uses.

The eastern boundary of the AIZ is located approximately 40 miles from the center of the proposed disposal site. Most waste and reagent transporters will utilize I-70 eastbound to Byers and Highway 36 from Byers to the disposal site and will traverse the southern edge of the AIZ. Vehicular traffic associated with the proposed facility is not expected to cause any change in the level of service on I-70 and should not adversely impact traffic associated with the proposed airport.

8.6.3.2 Population Impacts

The BFI facility will not have any significant impact on local or regional population characteristics. Once facility construction has been completed, BFI will employ a steady work force of approximately 20-35 people, many of whom currently reside in the area. Some moderate impacts may be experienced in local urban areas, but no substantial population shifts are expected.

8.6.4 Impacts on Economic Activities

8.6.4.1 Employment Impacts

Effects on employment from development of the facility will be moderate. The facility will employ between 20-35 people, including plant personnel and truck drivers. These effects will be felt at the local level, but on a county-wide basis this employment increase will be absorbed into existing employment levels and will not cause any significant changes. The labor force for this facility is expected to be found within 40 miles of the area. This will have some moderate, positive impacts on the local economic base of these areas.

8.6.4.2 Impacts on Income

Development of the facility will be beneficial to local area personal income. The facility will provide jobs for secretaries, truck drivers,

heavy equipment operators, supervisors, and other technical personnel. The average salary at the facility will be approximately $25,000. The BFI facility will require between 20 and 35 full time employees when the facility is up to full operation. At this rate, between $0.50 and $0.88 million in personal income will be generated annually. As mentioned in the previous section, the majority of employees for this facility will be found in the small towns in the vicinity of the site. The income they earn at this facility will be introduced into the local economies. Most of this income will be spent in these small towns on goods and services, and through the multiplier effect will be turned over many times. The increased cash flow in these communities will be beneficial to their economic base.

Another effect brought on by operation of this facility is the loss of 1,184 acres of agricultural land. Loss of income and employment in this area will be more than offset by operation of the facility and the income which it will generate. In 1978, the average market value of the products sold per 870 acre farm in Adams County was $94,678. Based on this average, the site's two sections of agricultural land (1,184 acres) can be expected to generate a crop with a market value of $128,849 in a single year, or adjusted for inflation about $162,000 in 1981. A 1,184 acre tract of agricultural land represents only 0.16% of the Adams County total. Therefore, the loss of this tract to an industrial use will not have any significant effects on the overall status of the agricultural areas in the county, from either a loss of income or land perspective.

The value of the land surrounding the disposal site is not expected to be negatively affected. This is based on BFI's past experience in other

parts of the country where land values in the vicinity of disposal facilities have not decreased. If, however, in the unlikely event that, despite the safeguards provided at the site, evidence arises that nearby crops, water, or livestock have been harmed by the site, the owner of such damaged property will be entitled to submit a claim to the BFI insurance carrier for such damages or pursue other legal remedies. BFI will carry liability insurance to guard against the highly unlikely event of off-site contamination.

8.6.5 Heritage and Cultural Resources Impacts

No cultural resource sites are known for the site vicinity, and the project should not impact any significant cultural resources. However, deeply buried subsurface sites are known to exist in northeastern Colorado. In the event that such a site is encountered, construction work will stop immediately and the office of the State Historic Preservation Officer in Denver will be notified.

8.6.6 Traffic and Transportation Impacts

Traffic analysis for peak hour volumes of vehicles in the site vicinity indicate no necessary changes in the level of service on area roads. (Section 4.6). The projected maximum 1982 volume in the vicinity of the site is 102 vehicles per hour, which is well within the service A range of 280 vehicles per hour that can be accommodated by U.S. Highway 36. Other roadways along routes to the site have large enough volumes of traffic to make the increases due to site-generated traffic insignificant. Therefore, increases in traffic levels generated by the site will not cause a significant effect on the level of service provided by area highways. No traffic mitigating measures are necessary with respect to complete development and operation of the site.

No other significant transportation related impacts are expected in conjunction with operation of the site as hazardous waste disposal facility. Federal and State regulations governing transport of hazardous waste will be complied with as discussed in Section 4.2. All vehicles and vehicle tanks will be maintained in secure and roadworthy condition. A contingency plan has been developed (Chapter 7) in the event of a road accident resulting in a spill on access routes to the site.

8.6.7 Visual Impacts

One moderate, adverse short-term visual impact is expected to occur during the Phase I level of operation because the solidification process will not be in an enclosed building. However, full development of the site is not expected to result in any significant adverse visual impacts. The administration building, guard house, and employee welfare/laboratory building will be modern one-story structures that will add to the overall visual qualities of the area. The maintenance building and solidification building will be constructed of prefabricated metal panel siding much like the material and design of many farm buildings in the area. These buildings will not conflict with the rural agricultural scenery of the area.

Extensive revegetation of the area and use of dust control measures will mitigate any adverse effects from increased fugitive dust and extensive earthwork in the area. The construction of a vegetated berm around the entire secure disposal and processing areas will screen much of the active earthwork from nearby roads. Wind blown debris, if any, will be policed to avoid negative visual impacts.

8.6.8 References

1. USDA, Soil Conservation Service, Colorado, Standards and Specifications, Critical Area Planting, Technical Guide, Section IV, August, 1980.

2. USDA, Soil Conservation Service, Colorado, Standards and Specifications for Range Seeding, January, 1971.

3. USDA, Soil Conservation Service, Colorado, Seeding Rates, Technical Guide, Section IV, November, 1980.

4. Adams County Waste Management Plan, Adams County Planning Commission (August, 1982).

5. Adams County Comprehensive Plan, 1975, Adams County Planning Commission.

6. "East End Development Plan," Board of County Commissioners, Adams County, Colorado (October 27, 1977).

8.7 STEPS TO MINIMIZE HARM TO THE ENVIRONMENT

8.7.1 Conclusions

Minimization of potential harm to the environment is an important consideration in all aspects of the site selection, design and operation of any chemical waste management facility. Of primary importance in selecting a site for this facility was location within the most suitable geologic area as defined by the Colorado State Department of Health(1). Principally for this reason, the site was located over the Pierre Shale of eastern Colorado. A large number of other environmental elements or requirements which minimize environmental impacts were also considered in selecting the site location. These include many physical, biological, land use and population, economic, transportation and other environmental elements addressed previously in the text of this report.

Numerous features are included in the design of the facility to eliminate potential harm to the environment. Principal among these are the use of secure, clay-lined disposal cells and waste solidification facilities

that preclude release of waste to the external environment. Other design features include laboratory testing facilities, surface runoff collection facilities, employee facilities, truck washes, protective berms, site security facilities, leachate collecting and monitoring system, and on-site fire, safety and emergency response facilities and equipment.

The operation of the facility also includes a wide variety of environmental protection features, safeguards and contingency plans that minimize harm to the environment or mitigate adverse impacts on the environment. Among these operational features are:

- chemical waste analysis plan;
- safety preparedness and prevention program;
- hazardous spill contingency plan;
- site security plan;
- facility inspection plan;
- air quality maintenance plan;
- water quality monitoring program;
- revegetation plan;
- erosion, sedimentation and water control measures;
- site closure plan;
- post closure plan.

The foregoing discussion and listing of environmental plans provide a general summary of the areas in which measures to minimize harm to the environment will be taken. Specific environmental factors, features and designs relating to these plans are presented and discussed in appropriate sections of this report and form an integral part of this entire chemical waste treatment/solidification and disposal facility plan.

8.7.2 References

1. Hynes, J. and Sutton, C., Hazardous Wastes in Colorado, Colorado Geologic Survey and Department of Health, Denver, Colorado, 1980.

CHAPTER 9

QUALIFICATIONS OF BFI

9.1 INTRODUCTION

The information in the remainder of this chapter was prepared by BFI for HNTB in order to summarize BFI's history of service and qualifications in the chemical waste management industry.

9.2 INTRODUCTION TO BROWNING-FERRIS INDUSTRIES, INC.

Browning-Ferris Industries has been actively engaged in the development of specialized methods for the proper management of industrial waste materials since the early 1970's. In this period of time, the management of such wastes has evolved from the use of standard municipal refuse disposal practices, which were largely unregulated, into a strictly regulated and prescribed assembly of high-technology processes, many of which bear no resemblance to their precursors.

Although use of established concepts from disciplines such as civil, chemical and mechanical engineering, chemistry, geology, and hydrology are fundamental to the development of improved methods for industrial waste management, a tremendous contribution to such development has been derived from practical experience in the management of such wastes. In this respect, those companies with the longest histories of industrial waste management are normally the ones best suited to provide practical solutions to the broad spectrum of waste problems facing industry today.

The extent of Browning-Ferris Industries' current involvement in the management of industrial wastes is documented in subsequent sections of this chapter. As indicated in these sections, Browning-Ferris Industries

has cumulatively managed approximately 3,500,000 tons of industrial wastes at the sites described herein. Each of the sites listed is or was operated over a period of time in which the demands for more sophisticated management methods, greater volume throughput, and environmental protection had increased exponentially. In order to meet these demands, many of the sites have undergone extensive renovation. Specialized technical personnel have been added to site staff in order to provide quality control and ensure compliance with all environmental and occupational safety regulations. In some instances where it was not deemed technologically practicable or economically feasible to upgrade sites to conform to the increasing environmental demands, sites have been closed. Browning-Ferris Industries has been largely successful in responding to the complex and continually changing technological and environmental requirements for safe waste management.

Nevertheless, there have occasionally been judicial or administrative proceedings initiated by various governmental entities, under local, state, or federal law, in which it has been alleged that a particular operation at a site is not conforming to a particular operating standard. These proceedings must be considered in the context of the rapidly changing standards for operation of waste management sites, and are not indicative of a reluctance to meet, or lack of concern regarding, such standards. Many of the alleged violations are in fact procedural, rather than substantive. In those cases where site correction measures have been required, however, BFI has taken prompt and appropriate remedial actions. Just as the company benefits from operating experience, so does it benefit from experience in meeting the complex requirements of regulatory authorities. The ability to draw on both forms of experience,

coupled with the availability of vast technical support both inside and outside the company, has enabled Browning-Ferris Industries to provide practical, responsible solutions to a wide variety of industrial waste management problems and will continue to do so in the future.

9.3 HISTORY OF BFI'S CHEMICAL WASTE DISPOSAL SITES

The following subsections comprise an annotated history of each chemical waste disposal site owned or operated by Browning-Ferris Industries, including facility capabilities, typical waste receipts, date of acquisition, total industrial waste tonnage managed by the facility, regulatory authorities, administrative or judicial proceedings brought by federal, state, or local authorities, and actions taken to resolve or mitigate problems. In addition, a comprehensive list of all other solids waste disposal sites (sanitary landfills) either owned or operated by Browning-Ferris Industries is provided in Table 9.1. This listing is intended to satisfy the February 17, 1981, request of the Adams County Board of Commissioners.

Another request for information from BFI concerned the description of specific details from one particular civil suit pending against BFI's facility in Calcasieu Parish, Louisiana. This is described below.

BFI subsidiaries own and operate a number of facilities in Calcasieu Parish, Louisiana. One of those facilities is the waste injection well near Willow Springs, which has recently been the subject of claims by nearby residents that wastes migrating from the site have contaminated well water or that odors from the site have caused discomfort or illnesses among inhabitants of the surrounding area. In particular, one group of residents has filed a lawsuit seeking damages for assorted

TABLE 9.1

BFI SOLID WASTE SITES
SEPTEMBER 1982

	No. of Sites	Own	Jointly Owned	Partially Owned and Leased	Operate	Lease
Arrowhead Region						
Eden Prairie, Minnesota	1	X				
Boyer (Hamel), Minnesota	1	X				
Boulder, Colorado	1					X
Denver, Colorado	1					X
Jefferson County, Colorado	1					X
Omaha, Nebraska	1				X	
Missoula, Montana	1	X				
Calgary, Canada	1					X
Minneapolis, Minnesota (Phoenix)	1	X				
Illinois Region						
Barrington, Illinois	1	X				
Waukegan, Illinois	1	X				
Rockford, Illinois	1	X				
Peoria, Illinois	1				X	
Hillside, Illinois	1		X			
East Central Region						
Baltimore, Maryland (Norris Farm)	1	X				
Montgomery County, MD	1				X	
Glen Burnie, Maryland	1	X				
Fairfax County, Virginia	1					X
Toledo, Ohio	1	X				
Ridge, Ontario, Canada	1	X				
Grafton, Virginia (Ft. Eustis)	1				X	
Richmond, Virginia	1	X				
Detroit, Michigan (Lyon Development)	1	X				
Marshall, Michigan	1					X
Northeast Region						
Boston, Massachusetts	1	X				
Marshfield, Massachusetts	1					X
Rockingham, Vermont	1	X				
Plymouth, Massachusetts	1				X	
Halifax, Massachusetts	1					X
Quincy, Massachusetts	1				X	
Claypit Road, Massachusetts	1					X
Pacific Region						
Menlo Park, California (Marsh Road)	1				X	
Burlingame, California	1				X	
San Jose, California (Newby Island)	1	X				
Fresno, California	1	X				
Half Moon Bay, California (Ox Mountain)	1	X				
Los Angeles, California *(Sunshine Canyon)	1	X				
South Central Region						
Kansas City, Missouri (Plattco)	1					X
St. Louis, Missouri (Redbird)	1					X
Evansville, Indiana	1					X
Missouri City, Missouri	1					X
Biloxi, Mississippi	1					X
Anniston, Alabama	1				X	
Jackson, Mississippi	1					X
Cincinnati, Ohio (Bobmeyer Road)	1	X				
Cincinnati, Ohio (Bond Road)	1				X	
Mobile, Alabama	2				XX	
Lexington, Kentucky	1				X	
Southeast Region						
Memphis, Tennessee (Holmes Road)	1	X				
Atlanta, Georgia (Bankhead)	1	X				
Charleston, South Carolina	1					X
Knoxville, Tennessee	1					X
Southwest Region						
Houston, Texas (McCarty Drive)	1	X				
Houston, Texas (Little York Road)	1	X				
Hitchcock, Texas	1			X		
Oklahoma City, Oklahoma	1		X			
Tulsa, Oklahoma	1					X
Lake Charles, Louisiana	1			X		
New Orleans, Louisiana	1	X				
Belle Chase, Louisiana (Oakville)	1					X
Alamogordo, New Mexico	1				X	
Katy, Texas	1					X
Lubbock, Texas	1	X				
Austin, Texas	1					X
San Antonio, Texas	1					X
Steel Region						
Youngstown, Ohio (Green Twp.)	1					X
Youngstown, Ohio (Poland Twp.)	1					X
Sandusky, Ohio	1	X				
Pittsburgh, Pennsylvania (Imperial)	1					X
Elyria, Ohio	1					X
TOTALS:	71	27	2	2	14	26

* The Hellger Canyon landfill in California is not shown on this listing since it is not yet operational.

claims of personal injuries and alleged contamination of water supplies, asserting that the disposal operations at the site constitute a nuisance and also asserting that the wastes injected into the subsurface formation have migrated beyond BFI's property lines, causing a so-called "subterranean trespass."

Issues: Alleged air pollution and contamination of water supplies.

Facts: The site is operated by Browning-Ferris Industries Chemical Services, Inc., which owns a portion of the site and leases the remainder. BFI is in the process of acquiring additional acreage surrounding the site. The site was acquired in conjunction with the acquisition of Mudmovers, Inc., and Vacuum Services, Inc., in the early 1970's. Those companies originally were engaged primarily in the business of hauling brine and oilfield mud, but also provided vacuum truck services in refineries and chemical plants. At some point, their customers began to require off-site disposal services, and BFI's predecessors hauled various oilfield and refinery wastes to the Willow Springs site. This method of disposal has been discontinued and, over a period of time, the site was converted to a secure landfill and injection well operation. The cleanup and removal of the open pits and lagoons is now complete.

There are, however, necessarily still some lagoons and tanks associated with the operation of the injection well. The principal controversy surrounding the operation currently is the claim of contamination of water supplies. There is no evidence that any such contamination has occurred. The wastes are injected into a formation at a depth below 4,000 feet, and the deepest known fresh aquifer is at or above 1,600 feet. Moreover, the water bearing sands are separated from the formation used for disposal by

numerous, non-porous geological strata. In addition, the injection tubing is surrounded by an impermeable casing, and the annulus (space) between the injection tubing and the well casing is filled with an inert fluid. The annulus pressure is monitored continuously, and any increase or decrease in annulus pressure that might indicate a leak would result in the shutdown of the well and prompt remedial action. Although there have been reports that nearby wells have been sampled and found not to comply with drinking water standards, the results of the alleged testing have not been made available to BFI and there is no evidence, in any event, that the alleged contamination of water supplies is in any way traceable to the operation of the injection well. Moreover, all sampling and testing of water wells in the area conducted by regulatory agencies and/or accredited laboratories under their direction have shown no contamination that in any way could be associated with the operation of the injection well.

During 1980, a local minister assembled a group of residents to meet with a Lake Charles lawyer. As a result of that meeting, a single lawsuit on behalf of several hundred area residents was filed against Browning-Ferris Industries Chemical Services, Inc., and others. The plaintiffs' pleadings make claims of nuisance and subterranean trespass as well as asserting that well water has been contaminated. The plaintiffs' claim that as a result of the contamination of well water and air pollution emanating from the site, the residents of the area have sustained assorted personal injuries. No medical or scientific substantiation of those claims has been forthcoming, however. In an effort to resolve the controversy, however, BFI instituted a medical referral program whereby any Calcasieu Parish, Louisiana, physician could refer a patient, at BFI

expense, to a specialist for more sophisticated testing and diagnosis if the patient were believed to have any illness not attributable to some other cause. To date, no referral under this program has been made by any Calcasieu Parish medical doctor. Although some area residents (and the news media that has interviewed them) have regarded this referral program with views ranging from distrust to outright hostility, the medical complaints vocalized by these same persons have curiously dwindled. BFI has also cooperated fully with regulatory agencies in reducing possible odors that could migrate from the site and in taking steps to ensure that the site poses no threat to ground or surface waters.

Disposition or Status: The litigation mentioned above is still in the discovery stages, but there is no indication that the claims of contamination of water supplies attributable to the injection well have any substantial basis. Scientific evidence available to BFI indicates, moreover, that the wastes injected into the sub-surface formation could not have migrated beyond the boundaries of the property, and there is no possibility that the wastes have entered the water bearing sands above the formation into which the wastes are injected. To date, no physician has referred any patient for testing and diagnosis at BFI expense, and there has been no confirmed report of any illness traceable to operations at the site.

Comments: Because the litigation is still pending, it would not be appropriate to comment concerning specific evidence or claims. BFI considers the litigation to be unfounded and intends to defend it vigorously. The occasional repeated "reports" indicate at most that some

residents of the area have complained of a variety of illnesses or disorders which could be traceable to any one of a number of sources. For example, the hydrogen sulfide smell and sulphur taste of which some residents have complained is, in all probability, more likely traceable to naturally occurring sulphur and unrelated to operations at the site. Although there is also a heavy concentration of refining and petrochemical activity, the most likely source of contamination, if any, of water supplies is in fact the widespread use by area residents of agricultural chemicals such as pesticides, herbicides and fertilizers.

9.3.1 Facility Name: Browning-Ferris, Inc., Chemical Process Center (CPC), Baltimore, Maryland

Browning-Ferris, Inc. properly closed CPC in February, 1982, in accordance with all applicable federal and state regulations. The closure was not due to environmental problems but the result of a management decision to convert the use of the property to solid waste disposal. The CPC facility was utilized for hazardous waste treatment (neutralization and solidification of liquids) and storage only; no hazardous waste disposal occurred. The facility was closed in accordance with a closure plan approved by the State of Maryland and the U.S. EPA Region III. All areas used for hazardous waste treatment and storage were totally decontaminated. The property is now in use for non-EPA hazardous waste disposal.

Facility capabilities during operating life were:

- Vacuum truck service for collection and transportation of bulk liquid industrial wastes.
- Open basin absorbent solidification of bulk industrial liquid and semi-solid wastes with cement kiln dust. Mixing and transfer of treated materials to hydration basin by hydraulic backhoe.
- pH adjusted gravity separation of bulk and drummed industrial oil and solvent wastes. Segregation and storage of oil and solvent

materials in closed tankage prior to shipment off-site for energy recovery. Absorbent solidification of aqueous and sediment portions of oil and solvent wastes.

- o Neutralization and oxidative processing of bulk industrial wastewater. Discharge of processed waste to publicly-owned treatment works.

Typical waste receipts were:

- o Acid solutions from metal finishing processes.
- o Spent naphtha degreasing agent from manufacturer of automotive engine parts.
- o Wastewater treatment residue from manufacturer of power tools.

Facility Start-up Date: June 1, 1976

Facility Closure Date: February 1982

Total Industrial Waste Tonnage Managed by Facility
Since Start-up: 96,000 T.

Comments: During the operating life, approximately 5% of total waste receipts were managed by neutralization and oxidative processing, 15% were managed by oil and solvent recovery, and 80% were managed by absorbent solidification.

Facility Regulated By:

- o State of Maryland Water Resources Administration.
- o State of Maryland Department of Health and Mental Hygiene.
- o Baltimore County Health Department.

Legal Proceedings:

- o <u>Maryland Department of Health and Mental Hygiene</u> vs. <u>BFI of Maryland</u>

State of Maryland alleged commencement of construction of the CPC facility without an air quality permit. On June 22, 1979, the Department

of Health entered orders allowing operation of the facility so long as the vapor pressure of such materials did not exceed 0.1 psi. In March 1981, BFI entered into a Consent Secretarial Order resolving all matters relating to air quality and requiring evaluation of incoming waste streams and equipment to reduce possible hydrocarbon vapor emissions.

9.3.2 Facility Name: Browning-Ferris, Inc., Solley Road, Glen Burnie, Maryland

Browning-Ferris, Inc. Solley Road will close by January 1, 1982 pursuant to a settlement with Anne Arundel County of a zoning dispute described herein.

Facility Capability:

- Secure landfill disposal for bulk and drummed solid and semi-solid industrial wastes.

Typical Waste Receipts:

- Spent ore from chrome pigment production.
- Dewatered paint overspray from small electrical appliance manufacturing.
- Dewatered press residues from ceramic insulator production.
- Packaged asbestos insulation wastes from ship refitting operation.

Date of Facility Acquisition: January 1, 1972

Total Industrial Waste Tonnage Managed by Facility Since Acquisition: 1,171,000 T.

Facility Regulated By:

- State of Maryland Water Resources Administration.
- State of Maryland Department of Health and Mental Hygiene.
- Anne Arundel County Health Department.

Legal Proceedings:

- o Browning-Ferris, Inc. vs. Anne Arundel County

Browning-Ferris, Inc. instituted suit against Anne Arundel County, Maryland challenging the constitutionality of a zoning ordinance which imposed a county ban on privately owned hazardous waste sites. In addition to a declaratory order holding the ordinance to be unconstitutional, BFI sought $5 million in damages. To resolve this lawsuit the county agreed to allow BFI to operate the landfill until the earliest of the following dates: (1) January 1, 1983 or (2) the date on which the "permitted capacity" of the cell at the landfill being filled during the first five months of 1982 is exhausted. BFI, in turn, agreed that on the closure date of the landfill, BFI would permanently abandon operation of the site as a facility for disposal of wastes of any kind.

It is important to note that the dispute between BFI and Anne Arundel County involved a zoning ordinance and not an environmental matter.

- o State of Maryland Department of Health and Mental Hygiene vs. Browning-Ferris, Inc.

The State of Maryland sought injunctive relief and civil penalties in regard to two matters. On June 30, 1980, wastes were brought to BFI properly manifested in accordance with state and local law from the cleanup of contaminated soil associated with an unrelated abandoned waste disposal site in North Carolina. In accordance with federal and state regulations, BFI tested the wastes prior to agreeing to accept them. The wastes were classified as Class III under Maryland law, pursuant to the test. State laboratory tests showed that the waste contained minute quantities of trichlorophenol which is classified by Maryland law as a

Class II rather than Class III hazardous waste. Even though trichlorophenol appeared to be present only at 0.38 mg/kg, which is below the level of analytical variability (current analytical techniques are not accurate enough to confirm such low quantities), the State of Maryland brought suit on the basis that the Solley Road facility was not authorized to accept trichlorophenol. Because of the extremely low amount of the trichlorophenol reported by the state, BFI challenged the state's allegation.

The second matter complained that on July 31, 1980, the Solley Road landfill allegedly accepted "liquid" rather than semi-solid wastes. The Solley Road landfill is authorized by permit to accept only solid or semi-solid waste. The material accepted was a mixture consisting of 50% solid and 50% liquid material. Waste sludge, which is classified as a semi-solid, is considered to be a mixture of 50% solids and 50% liquid. If a semi-solid waste is found to be acceptable for disposal at the proposed Colorado facility, the waste will be mixed with reagent and solidified. This procedure will assure BFI that no free liquids are being disposed of in the secure landfill cell. BFI contested the state's claim on the basis that the waste was a semi-solid sludge in accordance with the permit.

In order to settle both of these matters without extensive litigation, BFI paid $30,000 to the State of Maryland with no admission of liability.

Prior to accepting wastes at Solley Road, BFI performs tests on the waste to assure, as far as reasonably possible, that the wastes meet the characteristics required by the landfill's permit; but there may be unavoidable discrepancies between BFI's test results and those of the State of

Maryland regarding the analytical composition or characteristics of the waste. In both of the above instances, the disputes arose from differences in interpretation and application of regulatory standards to test results.

9.3.3 Facility Name: Browning-Ferris Industries of Elizabeth, New Jersey, Inc.

Facility Capabilities:

- Roll-off box service for collection and transportation of bulk and drummed solid and semi-solid industrial wastes.
- Covered storage of mutually compatible bulk solid and semi-solid industrial wastes. Transfer of wastes by wheeled loader to dump trailers to a secure landfill for ultimate disposal.
- No hazardous waste disposal.

Typical Waste Receipts:

- Filter cake residue from manufacturer of surfactants.
- Wastewater treatment residue from manufacturer of business machines.

Date of Facility Start-up: January 15, 1974

Total Industrial Waste Tonnage Processed by Transfer Station Since Facility Start-up: 16,800 T.

Facility Regulated By:

- New Jersey Department of Environmental Protection.

Legal Proceedings:

- New Jersey Department of Environmental Protection vs. Browning-Ferris of Elizabeth, New Jersey, Inc.

The New Jersey Department of Environmental Protection alleged operation of a haul truck without proper registration number and alleged spillage of sludge. The alleged technical violations were corrected and all claims settled.

9.3.4 Facility Name: Browning-Ferris Industries of Illinois, Inc., - Rockford, Illinois

Facility Capability:

- o Secure landfill co-disposal for bulk and drummed solid and semi-solid industrial wastes with conventional solid waste.

Typical Waste Receipts:

- o Residue from lime treatment of pickling acids generated by the manufacturer of specialty alloys.
- o Wastewater treatment residue from electroplating operations.
- o Spent filter media from industrial painting operations.

Date of Facility Acquisition: December 16, 1976

Date of Commencement of Special Waste Management: March 1978

Total Special Waste Tonnage Managed by Facility
Since March 1978: 22,500 T. (Prior to March 1978, no differentiation of wastes was made by Illinois EPA. Currently, Illinois EPA classifies all industrial wastes, even if non-EPA hazardous, as "special wastes," requiring secure disposal.)

Facility Regulated By: Illinois EPA, U.S. EPA Region V

Legal Proceedings: None

9.3.5 Facility Name: Browning-Ferris Industries of Illinois, Inc., - Waukegan, Illinois

Facility Capability:

- o Secure landfill co-disposal for bulk and drummed solid and semi-solid industrial wastes with conventional solid waste.

Typical Waste Receipts:

- o Secondary treatment residue from publicly-owned treatment works.
- o Spent filter media from industrial painting operations.

Date of Facility Acquisition: August 30, 1976

Date of Commencement of Special Waste Management: March 1978 (Prior to March 1978, no differentiation of wastes was prescribed by Illinois EPA. Currently, Illinois EPA classifies all industrial wastes, even if non-EPA hazardous, as "special wastes," requiring secure disposal.)

Total Special Waste Tonnage Managed by Facility
Since March 1978: 45,000 T.

Facility Regulated By: Illinois EPA

Legal Proceedings:

- U. S. EPA, Region V In the Matter of BFI Illinois, Winthrop Harbor (Waukegan, Illinois)

A January 28, 1981, complaint alleges that at the time of facility inspection on November 28, 1980, a list of emergency equipment and personnel training records were not on-site as required by the newly effective RCRA interim status regulations, 40 CFR 265.52(e) and 265.16(d)(2).

In fact, the personnel training records were on-site and the list of emergency equipment was provided to U.S. EPA on February 17, 1981. Since BFI is in compliance with matters alleged in Complaint, U.S. EPA will take no further action.

9.3.6 Facility Name: Browning-Ferris Industries of Ohio, Inc., East Palestine, Ohio

Facility Capability:

- Open basin storage of mutually compatible aqueous industrial wastes.

Typical Past Waste Receipts:

- Spent pickling acid solutions.
- Waste carbide lime slurries.

Comment: Waste receipts were terminated at this facility in 1979. Closure operations are currently underway. On December 29, 1981, BFI of Ohio received a hazardous waste facility installation and operation permit.

Date of Facility Start-up: June 10, 1974

Total Industrial Waste Tonnage Managed by Facility Since Start-up: 650,000 T.

Facility Regulated By: Ohio EPA

Legal Proceedings:

- Ohio EPA vs. BFI of Ohio

On August 21, 1978, a verified complaint was filed by certain public officials and the Chamber of Commerce of East Palestine, Ohio, alleging that the site leased from Ecological Services by BFI of Ohio was causing air and water pollution. On August 22, 1980, the Ohio EPA verified that the Ohio Attorney General recommended that no action be taken on the verified complaint.

Although neither BFI nor the state agency has been able to prove the source of water contamination to be from the Ecological Services site, it has been speculated that the source of water contamination might be from the first basin, which was built by BFI's predecessor, or possibly from drainage from an abandoned coal mine. Despite lack of proof, BFI has been treating the runoff water which has high acidity.

BFI is now closing the site following procedures required by the Ohio EPA. The first two basins have been dewatered, filled, and planted to support vegetative cover. The third basin is in the process of being dewatered.

9.3.7 Facility Name: Browning-Ferris Industries of Ohio, Inc., Warren, Ohio

Facility Capability:

- o Segregation and storage of bulk and drummed liquid waste and drummed semi-solid and solid waste prior to shipment to properly permitted facilities for ultimate disposal.

Date of Facility Start-up: December 4, 1973

Total Industrial Waste Tonnage Managed by Facility Since Start-up: 32,500 T.

Comments: No industrial wastes are presently received at this facility. The facility is being closed pursuant to federal and state laws.

Facility Regulated By: Ohio EPA

Legal Proceedings: Along with approximately 16 other parties, Browning-Ferris Industries of Ohio was named as a potentially responsible party for the clean-up of a site (Laskin Greenhouse) owned by a third, unrelated party. The site is being cleaned up pursuant to the Comprehensive Environmental Response Compensation and Liability Act.

9.3.8 Facility Name: Browning-Ferris Industries, Inc. Clay County, Missouri

Facility Capabilities:

- o pH adjusted gravity separation of bulk industrial oil and solvent wastes. Segregation and storage of oil and solvent materials in closed tankage prior to shipment off-site for energy recovery. LIQWACON™ solidification of aqueous and sediment portions of oil and solvent wastes.

- o Open-basin pH adjustment and/or oxidative/reductive treatment of aqueous wastes followed by absorbent solidification of the treated wastes.

- o Open-basin LIQWACON™ treatment (solidification using cement and sodium silicate) of predominantly aqueous bulk liquid and semi-solid wastes using a trailer mounted mixing and treating unit. Pumping of treated wastes to hydration basin. Disposal of resulting solids in on-site landfill.

- o Open-basin absorbent solidification of bulk liquid and semi-solid wastes using cement kiln dust. Mixing accomplished by hydraulic backhoe. Treated materials hydrate in mixing basin and are then transferred to landfill disposal cell using a tracked loader.

- Landfill disposal of bulk industrial solids, semi-solids, and site-processed solids.

Typical Waste Receipts:

- Separator sediment from refinery processes.
- Spent lacquer thinner (solvent) from auto body painting.
- Contaminated metal and piping from demolition of agricultural chemicals plant.

Facility Start-up Date: October 11, 1974

Total Tonnage of Industrial Waste Managed by Facility
Since Start-up: 150,000 T.

Comments: Less than 1% of the total waste tonnage has been managed by oil/solvent recovery. Approximately 20% of the total waste tonnage has been managed by absorbent solidification followed by landfill disposal or direct landfill disposal. Approximately 80% of the total waste tonnage has been managed by pH adjustment and/or oxidative/reductive treatment, followed by LIQWACON™ solidification, followed by landfill disposal.

Facility Regulated By: Missouri Department of Natural Resources

Legal Proceedings:

- State of Missouri Department of Natural Resources vs. Browning-Ferris Industries of Kansas City and BFI, Inc.

On January 4, 1982, BFI of Kansas City (BFI KC) employed a surface impoundment to store wastes temporarily to protect receiving tanks, usually used for storage, from damage by expansion of contents due to freezing. The Missouri Department of Natural Resources (DNR) alleged that the temporary use of the surface impoundments was in violation of a condition of a variance granted BFI KC by DNR. The condition required that prior to use of the surface impoundment, the DNR approve the engineering report of the installation of a liner and BFI provide evidence of

non-sudden accidental environmental impairment insurance. The site operator understood from Missouri DNR that, since the liner was in fact in place and BFI had submitted insurance, although neither had been formally approved, emergency use of the impoundment was permitted. When the surface impoundment was put in use, BFI KC notified DNR who said such use was not approved. BFI KC promptly removed all material from the surface impoundment. It was specifically found by DNR that use of the impoundment, in fact, caused no harm. On May 5, 1982, the action by Missouri DNR was dismissed without prejudice to either party; without admission of liability by BFI KC with a donation by BFI KC to the Missouri City School District of $25,000.

- In the Matter of Browning-Ferris Industries of Kansas City, Inc., U.S. EPA Region VII, Proceedings under S3013 of RCRA

On June 22, 1982, Browning-Ferris Industries of Kansas City, Inc. (BFI KC) entered into an Order of Consent with U.S. EPA Region VII for BFI KC to conduct an investigation of the site hydrogeology to characterize the groundwater in the area and to provide a basis for a comprehensive groundwater monitoring progarm to determine whether contamination, if any, is migrating from the disposal site.

BFI KC has proceeded to develop the initial required hydrogeologic site investigation and is currently ahead of the agreed upon time schedule.

9.3.9 Facility Name: Browning-Ferris Industries Chemical Services, Inc., Livingston Parish, Louisiana

Facility Capabilities:

- Open-basin segregation and solidification of bulk liquid and semi-solid industrial wastes using cement kiln dust. Mixing accomplished with a hydraulic backhoe. Treated materials hydrate in mixing basins and are then loaded into dump trucks using the backhoe for transfer to secure landfill for disposal.

- o Secure landfill disposal of bulk and drummed industrial solid and semi-solid wastes, and site-solidified materials.

Typical Waste Receipts:

- o Bio-oxidation process lagoon residuals from the petro-chemical industry.
- o Pesticide contaminated earth in drums from spill cleanup.
- o Spent filter media from industrial spray painting.

Date of Facility Acquisition: May 19, 1978

Total Industrial Waste Tonnage Managed by Facility
Since Acquisition: 545,000 T.

Comments: Approximately 40% of the total waste tonnage is managed by solidification prior to secure landfill disposal. The remaining 60% is landfilled directly.

Facility Regulated By: Louisiana Department of Natural Resources

Legal Proceedings: The Livingston Parish Police Jury brought an action for injunctive relief alleging odors from the Livingston facility. No action has been taken on the request for preliminary injunction to date.

9.3.10 <u>Facility Name: Browning-Ferris Industries Chemical Services, Inc., Calcasieu Parish, Louisiana</u>

Facility Capabilities:

- o Open-basin pH adjusted gravity settling of predominately aqueous bulk industrial liquid wastes. Pump transfer of supernatant to open basin for chemical equilibration. Pump transfer to filter train followed by closed tank storage of filtrate. Disposal of filtrate by deep well injection.
- o Open-basin segregation and absorbent solidification of bulk liquid and semi-solid industrial wastes using cement kiln dust. Mixing accomplished with a hydraulic backhoe. Treated materials hydrate in mixing basins and are then loaded into dump trucks, using the backhoe, for transfer to secure landfill for disposal.
- o Secure landfill disposal of bulk and drummed industrial solid, semi-solid wastes, and site-solidified materials.

Typical Waste Receipts:

- o Spent acid and alkaline solutions from chemical cleaning or petrochemical process equipment.
- o Packaged asbestos wastes from ship refitting operations.

Date of Acquisition: September 29, 1972

Date of Injection Well Start-up: October 1976

Date of Solidification Facility and
Secure Landfill Start-up: September 1978

Total Industrial Waste Tonnage Processed by Facility
Since Acquisition: 630,000 T.

Comments: Approximately 65% of the total waste tonnage is managed by deep well injection. Approximately 12% of the total tonnage is managed by solidification followed by landfill disposal. Approximately 23% of the total tonnage is managed by direct landfill disposal.

Facility Regulated by:

- o Louisiana Department of Natural Resources.
- o Louisiana Department of Conservation, Geological Oil and Gas Division.

Legal Proceedings: None

9.3.11 Facility Name: Browning-Ferris Industries Chemical Services, Inc., Houston, Texas

The facility terminated receipt of wastes on June 30, 1980. Waste treatment/storage/solidification basins were closed out during August 1980. Such closure was approved by the Texas Department of Water Resources, the only agency with approval authority at that time.

Facility Capabilities:

- o Closed tank segregation and storage of bulk industrial liquid wastes prior to off-site shipment for ultimate disposal.
- o Open-basin pH adjusted gravity separation of bulk industrial oil and solvent wastes. Storage of oil and solvent materials in closed tankage prior to shipment off-site for energy recovery.
- o Open-basin pH adjusted and/or oxidative/reductive treatment of aqueous wastes.
- o Open-basin LIQWACON™ treatment (solidification using cement and sodium silicate) of predominantly aqueous bulk liquid and semi-solids wastes, and site-pretreated aqueous wastes, using a trailer mounted mixing and treating unit. Pumping of treated wastes to hydration basin. Off-site landfill disposal of resulting solids.

Typical Waste Receipts:

- o Spent cooling-lubricant (oil/water emulsion) liquids.
- o Spent acid solutions from steel pickling operations.
- o Spent chromic acid solutions from chrome plating operations.

Facility Start-up Date: August 1, 1973

Facility Closure: August 1980

Total Industrial Waste Tonnage Managed by Facility
Since Start-up: 34,000 T.

Comment: This facility is currently inactive.

Facility Regulated By: Texas Department of Water Resources

Legal Proceedings: None

9.3.12 <u>Facility Name: Browning-Ferris Industries Chemical Services, Inc., Odessa, Texas</u>

Facility Capabilities:

- o Collection and transportation of bulk liquid industrial wastes.

- Subsurface injection well disposal of filtered liquid industrial wastes.

Typical Waste Receipts:

- Spent chlorinated hydrocarbon degreaser solutions.
- Sodium hydroxide solution containing sulfide ion.

Total Industrial Waste Tonnage Managed by Facility Since Acquisition: 21,000 T.

Date of Facility Acquisition: July 12, 1979

Facility Regulated By: Texas Department of Water Resources

Legal Proceedings: None

9.3.13 Facility Name: Browning-Ferris Industries Chemical Services, Inc., Port Arthur, Texas

Facility Capabilities:

- Closed tank segregation and storage of bulk liquid and semi-solid industrial waste prior to shipment off-site to properly permitted facilities for ultimate disposal.
- Open-basin absorbent solidification of mutually compatible bulk liquid and semi-solid industrial wastes using cement kiln dust. Mixing accomplished with dragline. Treated materials hydrate in mixing basins and are then loaded into dump trailers using the dragline for off-site shipment to secure landfill for ultimate disposal.
- Landfill disposal of non-hazardous industrial solid wastes.

Typical Waste Receipts:

- Spent acid and alkaline solutions resulting from chemical cleaning of petrochemical process equipment.
- Waste lubricating oils from oil/water separators.
- Waste wood and concrete from building demolition.

Date of Facility Acquisition: September 27, 1972

Date of Landfill Start-up: May 1978

Date of Solidification Facility Start-up: June 1979

Total Industrial Waste Tonnage Managed by Facility
Since Acquisition: 70,000 T.

Comments: At present, segregation, storage and solidification of liquid and semi-solid wastes have been suspended. Disposal of non-EPA hazardous industrial wastes is anticipated upon approval by Texas Department of Water Resources. Landfill disposal of construction/demolition debris will continue to occur at the facility. In 1980, approximately 15% of the total waste tonnage was managed by absorbent solidification. Approximately 85% of the total waste tonnage was managed by segregation, storage, and transfer to off-site disposal.

Facility Regulated By:

- Texas Department of Water Resources
- Texas Air Control Board
- Texas Railroad Commission

Legal Proceedings:

- State of Texas vs. Browning-Ferris Chemical Services; Texas Department of Water Resources vs. Browning-Ferris Chemical Services

These proceedings arise from an emergency order issued by the Texas Water Commission without a hearing, on May 4, 1979, to Browning-Ferris Industries Chemical Services, Inc., a subsidiary of BFI, requiring, among

other things, that the subsidiary remove all hazardous materials previously deposited in eight areas in east Texas. Although the proceeding is technically still pending, the subsidiary believes that it has completed its obligations under the order. Related to this matter, the subsidiary is a defendant in an action seeking civil penalties and in several other civil lawsuits seeking damages.

Due to the large volume of information pertaining to these lawsuits, anyone wishing to review these documents is welcome to do so at our office during regular business hours. Our office is located at:

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