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To: Steve Pullen **Date:** November 30, 2000

Subject: Groundwater Monitoring Final Waiver Request Drawings **Via: Fed X UPS US Mail**

Steve,

Enclosed is a CD-ROM containing Adobe Acrobat pdf files and AutoCAD files for all figures (except Figure 3-5) included in the Groundwater Monitoring Final Waiver Request (Montgomery Watson, 2000). Also enclosed are two hard copies of Figure 3-5 that were unable to be converted to electronic format. The disc also contains three pages from Appendices that were scanned and converted to pdf format. The names of the pdf files and a description of the drawings are found below.

File Name	Description
APPA-FIG Model (1).pdf	Appendix A Water Quality Data Tables
GAN-DHLOC Model (1).pdf	Figure 1-1
GANDY-FIG3-1 Model (1).pdf	Figure 3-1
gandy-fig3-2 Layout1 (1).pdf	Figure 3-2
gandy-fig3-3 Layout1 (1).pdf	Figure 3-3
gandy-fig3-4 Layout1 (1).pdf	Figure 3-4
gandY-fig3-6 Model (1).pdf	Figure 3-6
gandy-fig4-1 Model (1).pdf	Figure 4-1
gandy-fig4-2 Model (1).pdf	Figure 4-2
gandy-figB-1Layout1 (1).pdf	Figure B-1 (Appendix B)
GANDY-FIGB-2 Model (1).pdf	Figure B-2 (Appendix B)
GANDY-FIGB-3 Model (1).pdf	Figure B-3 (Appendix B)
GANDY-FIGB-4 Model (1).pdf	Figure B-4 (Appendix B)
GANDY-FIGB-5 Model (1).pdf	Figure B-5 (Appendix B)
TRAIL1-VTRN Model (1).pdf	Trial 1 Ntrnspt (last page of Trial 1-Appendix C)
TRAIL2-VTRN Model (1).pdf	Trial 2 Ntrnspt (last page of Trial 2-Appendix C)

Please let us know if you have any questions concerning the drawings.

Regards,

Leah Wolf

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Prepared for:

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GROUNDWATER MONITORING WAIVER REQUEST

TRIASSIC PARK WASTE DISPOSAL FACILITY

Final

January 2000

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TABLE OF CONTENTS

Section No. **Page No.**

1.0 INTRODUCTION **1**

2.0 REGULATORY REQUIREMENTS **3**

3.0 GEOLOGY **4**

3.1 REGIONAL STRATIGRAPHY 4
3.1.1 Quaternary *4*
3.1.2 Tertiary *4*
3.1.3 Triassic *6*
3.1.4 Permian *9*
3.2 SITE STRATIGRAPHY 9
3.2.1 Quaternary *9*
3.2.2 Triassic *12*
3.3 STRUCTURAL SETTING 14

4.0 HYDROLOGY **16**

4.1 SURFACE WATER 16
4.2 GROUNDWATER 16
4.2.1 Regional Aquifers *16*
4.2.1.1 Ogallala Aquifer 16
4.2.1.2 Lower Dockum Aquifer 17
4.2.2 Site Groundwater *17*
4.2.2.1 Ogallala Aquifer 19
4.2.2.2 Lower Dockum - “Uppermost Aquifer” 19
4.2.2.3 Upper Dockum - Perched Water 22
4.3 GENERAL DESCRIPTION 23
4.4 CONTAINMENT SYSTEMS 23
4.4.1 Landfill *23*
4.4.1.1 Liner Systems for Landfill 23
4.4.1.2 Landfill Leachate Collection and Removal System (LCRS) 24
4.4.1.3 Landfill Leak Detection and Removal System (LDRS) 24
4.4.2 Evaporation Pond *24*
4.4.2.1 Evaporation Pond Liner System 24
4.4.2.2 Leak Detection and Removal System 25
4.5 MONITORING SYSTEMS 25
4.5.1 General *25*
4.5.2 Vadose Zone Sump *25*
4.5.3 Vadose Zone/Perched Groundwater Monitoring Holes *26*

5.0 TECHNICAL JUSTIFICATION **27**

5.1 WATER BALANCE 27
5.2 CONTAMINANT TRANSPORT MODELING 28
5.2.1 Previous Unsaturated Flow Modeling *28*
5.2.2 Alternative Modeling Approach *29*
5.2.3 Discussion of Modeling Results *30*
5.3 VADOSE ZONE MONITORING 31

6.0 SUMMARY AND CONCLUSIONS **32**

7.0 REFERENCES 32

LIST OF TABLES

Table No.	Title	Page No.
5.1	Assumptions Used to Develop Alternative Modeling Approach	29
5.2	Simulation Results	30

LIST OF FIGURES

Figure No.	Title	Page No.
1-1	Dill Hole Locations	2
3-1	Stratigraphic Column	5
3-2	Basin Paleomap for Triassic Period	7
3-3	Triassic Period Sand Accumulation in Paleobasin	8
3-4	Surface Geology - Project Area	10
3-5	Stratigraphic Cross Section	11
3-6	Structure Contour - Top of Lower Dockum	13
3-7	Seismic Activity Map	15
4-1	Water Wells – 10 Miles Radius	18
4-2	Upper Dockum – Perched Water	20

APPENDICES

Appendix	Title
A	Water Quality Data
B	Previous Unsaturated Flow Modeling Results
C	Multimed Flow Modeling Results
D	Certification of Suspension Request Demonstration

1.0 INTRODUCTION

The Gandy-Marley Corporation is requesting that the Hazardous and Radioactive Materials Bureau (HRMB) of the New Mexico Environment Department (NMED) grant a Groundwater Monitoring Waiver for its proposed Triassic Park Waste Disposal Facility. This request is based on a demonstration that the site-specific geologic and hydrologic conditions at the site combined with the engineered barriers in the regulated units at the Facility will prevent migration of liquids unit to the uppermost aquifer.

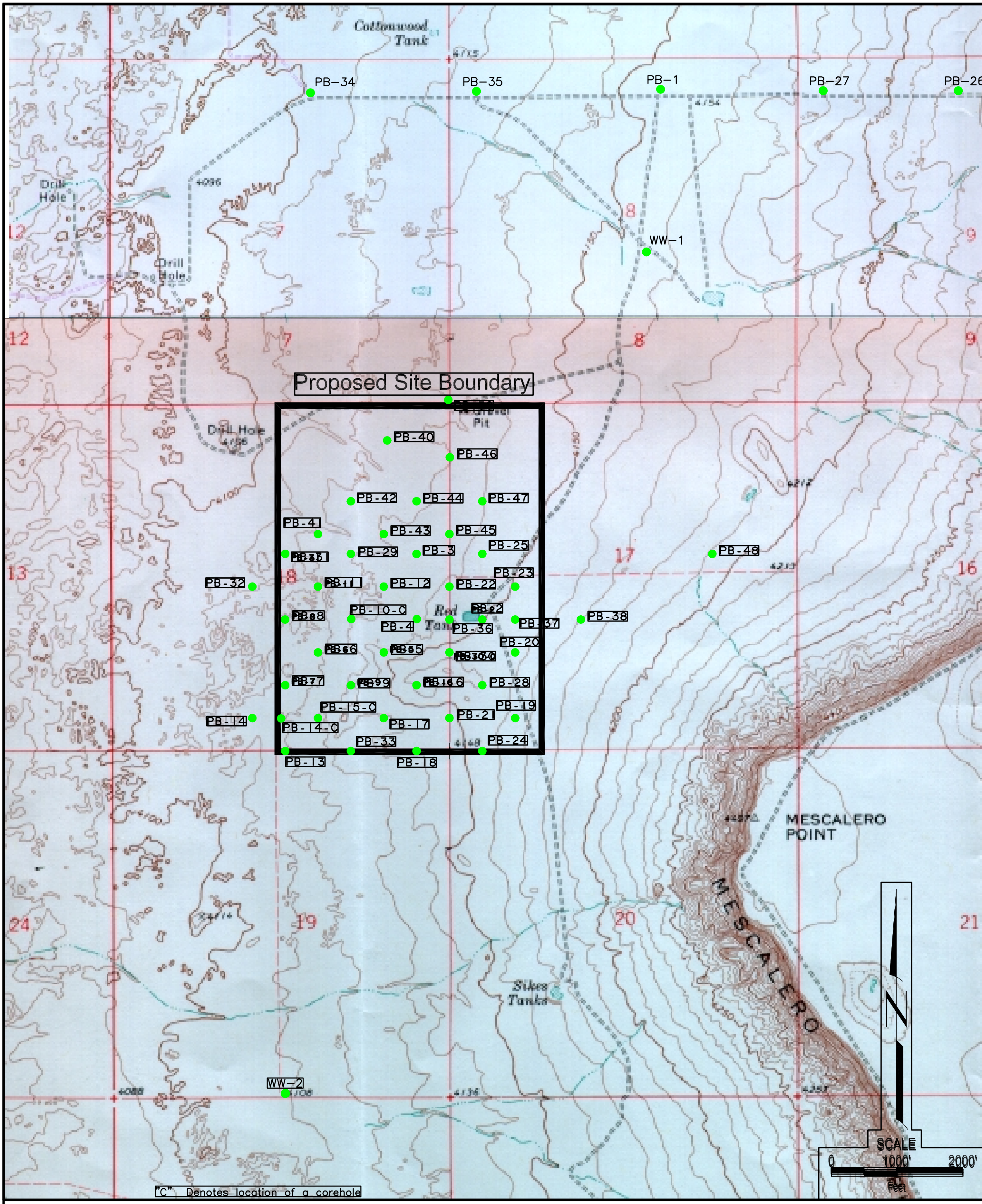
An alternative to groundwater monitoring is also presented in this document. The proposed alternative monitoring system is a Vadose Zone Monitoring System (VZMS) that will be superior to traditional groundwater monitoring for detecting potential leaks from the facility in a timely manner. The VZMS is proposed because it will be more protective of human health and the environment than groundwater monitoring of the upper most aquiter.

Triassic sediments in eastern Chaves County, New Mexico were identified as host rocks for this proposed Facility because they (1) contain thick sequences of low permeability clays; (2) occur in remote, unpopulated areas; and (3) locally produce no groundwater. These sediments have been characterized by drilling programs in 1993, 1994, 1995 and 1999. Fifty (50) drill holes have been completed on the proposed site (Figure 1-1, Drill Hole Locations), with lithologic and geophysical logs recorded for each of these holes. Data obtained from these drilling programs have been incorporated into this demonstration.

This demonstration or justification will evaluate the potential for migration of hazardous waste or hazardous waste constituents from the facility to the uppermost aquifer, through:

- A geologic and hydrologic characterization of host sediments,
- A water balance of precipitation, evapotranspiration, runoff, and infiltration; and
- Unsaturated zone contaminant transport modeling

The following sections provide a summary of the regulatory authority to allow modification of the groundwater monitoring requirements and the technical justifications required to support the groundwater monitoring waiver.



DRILL HOLE LOCATIONS

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 1-1

AutoCAD FILE: GAN-DHLOC.DWG

2.0 REGULATORY REQUIREMENTS

NMED's authority to grant a groundwater monitoring waiver lies in the New Mexico Hazardous Waste Management Regulations (20 NMAC 4.1.500), which adopts by reference 40 CFR § 264.90(b)(4). The relevant regulation states that the owner or operator of regulated units is not subject to regulations of 40 CFR 264.90 for releases into the uppermost aquifer under this part if:

The Regional Administrator finds that there is no potential for migration of liquid from a regulated unit to the uppermost aquifer during the active life of the regulated unit (including the closure period) and the post-closure care period specified under § 264.117. This demonstration must be certified by a qualified geologist or geotechnical engineer. In order to provide an adequate margin of safety in the prediction of potential migration of liquid, the owner or operator must base any predictions made under this paragraph on assumptions that maximize the rate of liquid migration.

3.0 GEOLOGY

This section describes the regional and geologic setting of the proposed facilities. The proposed facilities will be founded in unsaturated materials consisting of Quaternary alluvial sediments, Upper Dockum interbedded siltstones and mudstones, and Lower Dockum mudstone and thinly interbedded siltstone.

3.1 REGIONAL STRATIGRAPHY

The geologic formations present within the region range in age from Quaternary through Triassic. Those include Quaternary alluvium, Tertiary Ogallala Formation, and the Triassic Dockum Group. Permian sediments do not outcrop in this region but, because they underlie the proposed host sediments, they are also discussed in this section. The stratigraphic relationship of the formations discussed in this section is illustrated in Figure 3-1, Stratigraphic Column. Information concerning formation tops and thicknesses was obtained from well logs from the New Mexico OCD office in Hobbs, New Mexico.

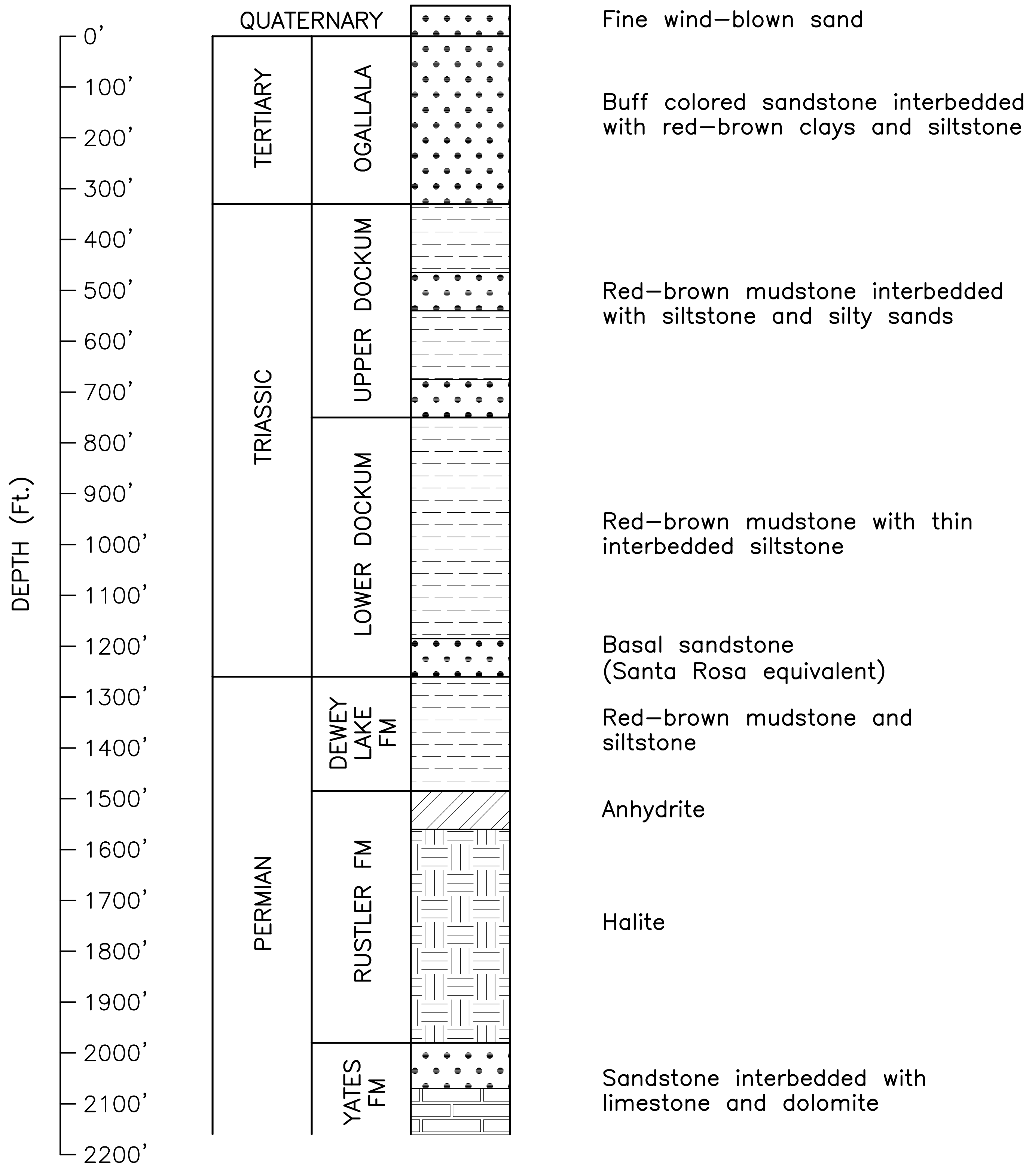
3.1.1 Quaternary

The surface throughout the project area is covered by alluvial deposits of Quaternary age. These deposits are comprised of fine-grained, red-brown sands, interbedded with red-brown silts and clays. A major source of these sediments was the topographically higher Ogallala Formation, as evidenced by the abundant granitic cobbles, chert pebbles, and fragments of petrified wood found throughout this unit. The thickness of these alluvial deposits along the eastern flank of the Pecos River Basin in Chaves County varies from a few feet to as much as 50 feet.

3.1.2 Tertiary

The “Caprock,” which is the surface expression of the Tertiary Ogallala Formation, unconformably overlies Triassic sediments in southeastern New Mexico. This flat-lying sandstone and conglomeritic unit is approximately 300 to 400 feet thick. It consists of fluviatile sand, silt, clay, and gravel capped by caliche. The sand deposits of the Ogallala Formation consist of fine- to medium-grained quartz grains, which are silty and calcareous. Bedding features range from indistinctly bedded to massive to crossbedded. The formation varies from unconsolidated to weakly cohesive and contains local quartzite lenses. The sand intervals of the Ogallala Formation occur in various shades of gray and red.

Ogallala Formation silt and clay deposits are reddish brown, dusky red, and pink and contain caliche nodules. Gravels occur as basal conglomerates in intra-formational channel deposits and consist primarily of quartz, quartzite, sandstone, limestone, chert, igneous rock, and metamorphic rock. There are abundant petrified wood fragments throughout this unit.



STRATIGRAPHIC COLUMN

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-1

AutoCAD FILE: GANDY-FIG3-1

3.1.3 Triassic

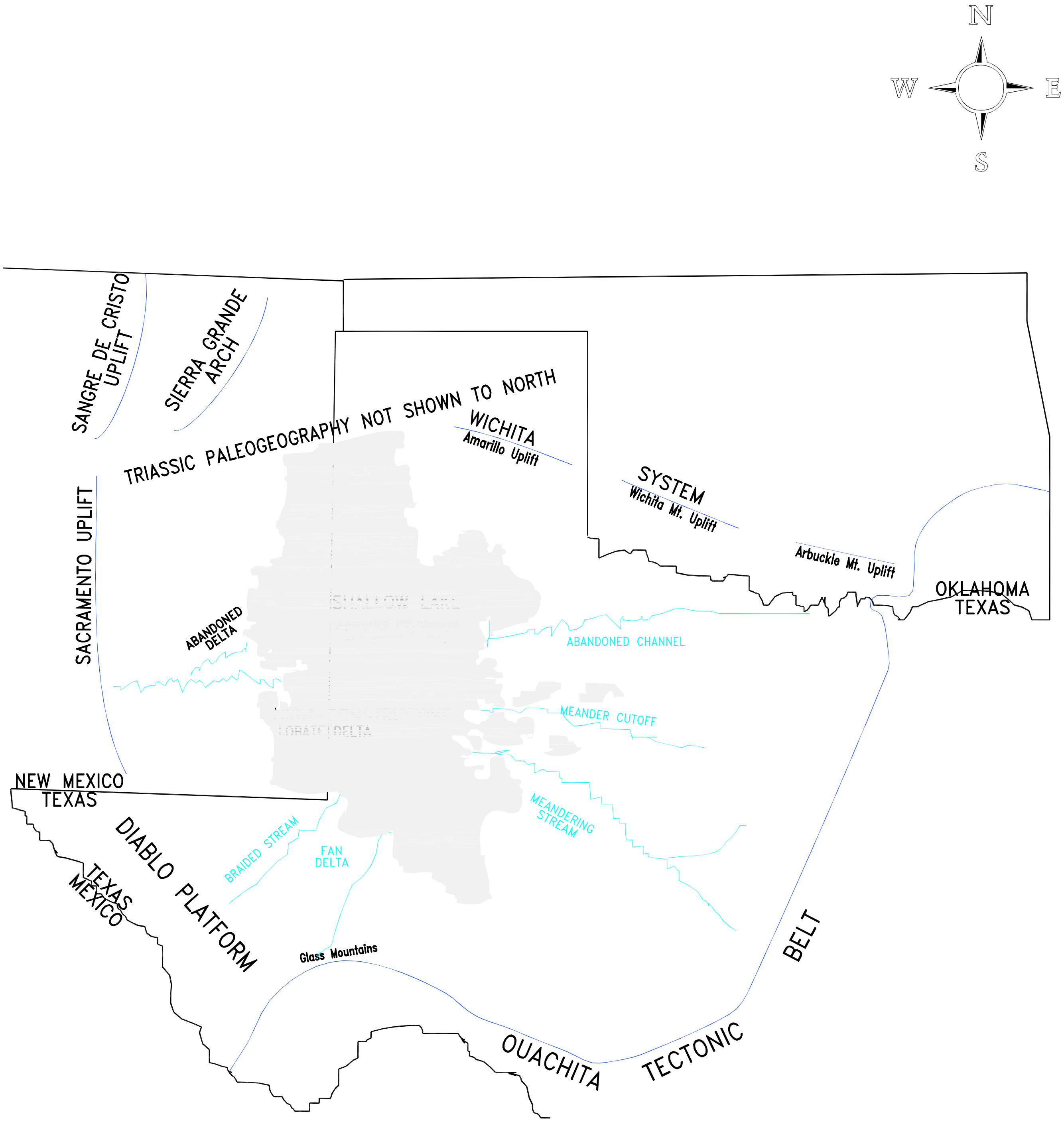
Triassic sediments are the potential host rocks for the proposed Facility and, as such, are described in more detail than the other formations. The Depositional Framework of the Lower Dockum Group (Triassic), Texas Bureau of Economic Geology, No. 97, 1979, by McGowen was used as a major reference for gathering information on the characteristics of Triassic sediments.

Triassic sediments unconformably overlie Permian sequences in Texas and New Mexico and have been classified as the Triassic Dockum Group. The Dockum Group is comprised of a complexly interrelated series of fluvial and lacustrine mudstone, siltstone, sandstone, and silty dolomite deposits that can be as much as 2,000 feet thick in this part of the Permian Basin. These sediments accumulated in a variety of continental depositional settings, including braided and meandering streams, alluvial fan deltas, lacustrine deltas, lacustrine systems, and mud flats.

The Triassic Dockum Group is divided into an Upper and Lower Unit. The Upper Dockum Unit is very near the surface within the project boundary, covered only by a thin veneer of Quaternary sediments. The character of this unit, also know as the Chinle Formation, is a series of fluvial sediments. These sediments conformably overlie the Lower Dockum Unit and consist of red-green micaceous mudstones, interbedded with thin, discontinuous lenses of siltstone and silty sandstones. A continental fluvial depositional environment predominated during Upper Dockum time, when the Triassic basin was filled with lacustrine sediments. The Chinle Formation is widespread in the southwestern United States.

The Lower Dockum accumulated in a fluvial lacustrine basin defined by the Amarillo Uplift on the north and the Glass Mountains on the south (Figure 3-2, Basin Paleomap for Triassic Period). These former tectonic belts were more than 200 miles away, and the regional slopes were relatively low. As presented in this basin map, the Lower Dockum represents sediments from a large, regional depositional system. For any given portion of this basin, these sediments tend to be very homogeneous and not subject to abrupt local changes. This basin was peripherally filled, receiving sediment from the east, south, and west. Chief sediment sources were Paleozoic sedimentary rocks. Lowlands to the east and west were traversed chiefly by meandering streams. Higher gradient streams with flashy discharge existed at northern and southern ends of the basin. The large shallow lake (or lakes) was the last portion of the basin to be filled. The lacustrine sediments that accumulated here consist primarily of low-energy mudstone. Surface exposures today in these areas consist of thick sequences of maroon-red-purple variegated mudstones with thin discontinuous layers of siltstones and silty sandstones.

The stratigraphy of the basal Lower Dockum varies significantly throughout eastern New Mexico. Figure 3-3, Triassic Period Sand Accumulation in Paleobasin, a subsurface sand percent map of this unit, was compiled from drill hole data from more than 1,500 oil wells throughout the basin. Thick sequences of sandstones at the northern and southern portions of the basin are shown projecting inward toward the center of the basin. In the New Mexico portion of this basin, these sand accumulations are related to the occurrence of the Santa Rosa Sandstones. This medium-to-coarse grained, white to buff sandstone represents the lowermost Triassic depositional unit and is a major aquifer in many portions of New Mexico.



Scale: 1"=80 Miles

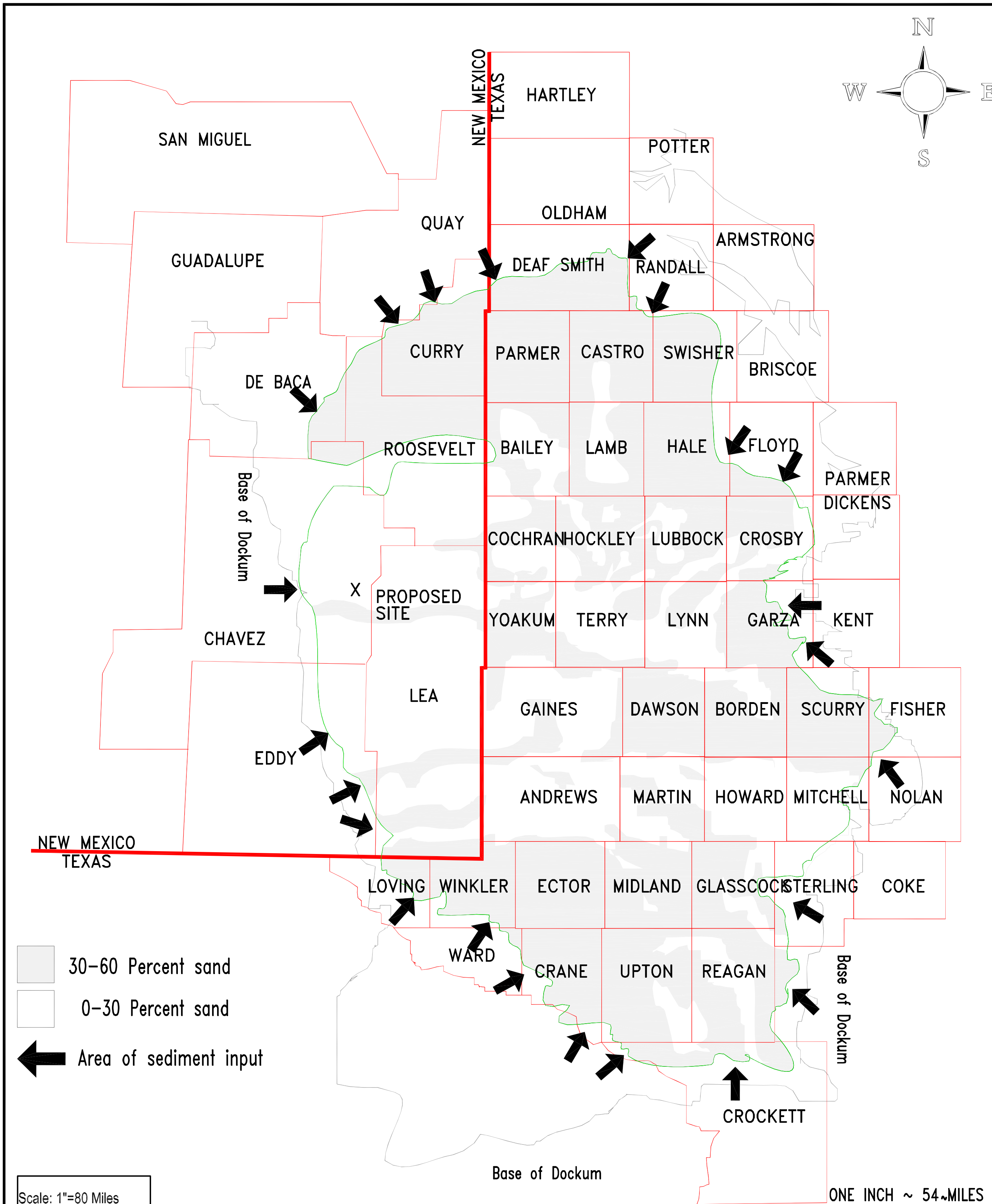
ONE INCH ~ 100 MILES

BASIN PALEOMAP FOR TRIASSIC PERIOD

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-2

AutoCAD FILE: *GANDY-FIG3-2*



TRIASSIC PERIOD SAND ACCUMULATION IN PALEOBASIN

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-3

AutoCAD FILE: *GANDY-FIG3-3*

3.1.4 Permian

Permian sediments are important to the geologic setting because they are immediately below the proposed Triassic host rocks. The deeper formations of Permian age were deposited in a restricted-marine environment and thus contain salt deposits, which make the groundwater produced from them too brackish for use.

Permian sediments underlying the Triassic units in the project area are assigned to the Artesia Group. Oil well logs from the New Mexico OCD in Hobbs, New Mexico, have provided sufficient data to identify the Dewey Lake Formation, Rustler Formation, and Yates Formation from the upper portion of this group. Geologic literature describes these Permian sediments to be gently dipping to the east. This fact was confirmed by using oil well log data to construct a graphic 3-point solution. These calculations indicate a north-south strike and a dip of less than 1° to the east. Consistent with the reported regional dip for Permian (and Triassic) sediments along the western flank of the Permian Basin.

Dewey Lake Formation - The uppermost Permian sediments underlying the Triassic sequence in the project area correlate to the Dewey Lake Formation. These sediments are predominately red to red-brown mudstones and siltstones and are virtually indistinguishable from the overlying Triassic sediments. Geologic literature reports a conformable relationship between these sediments and the overlying Triassic sediments. There are approximately 240 feet of Permian redbeds in this section.

Rustler Formation - The top of the Rustler Formation was identified on OCD well logs and corresponds to the top of a 40-foot bed of anhydrite. These anhydrites are visible in outcrop on the hills immediately east of the Pecos River drainage east of Roswell, New Mexico. Underlying the anhydrite are approximately 500 feet of halite (salt). The Rustler Formation represents the youngest anhydrite sequence in the Permian Basin.

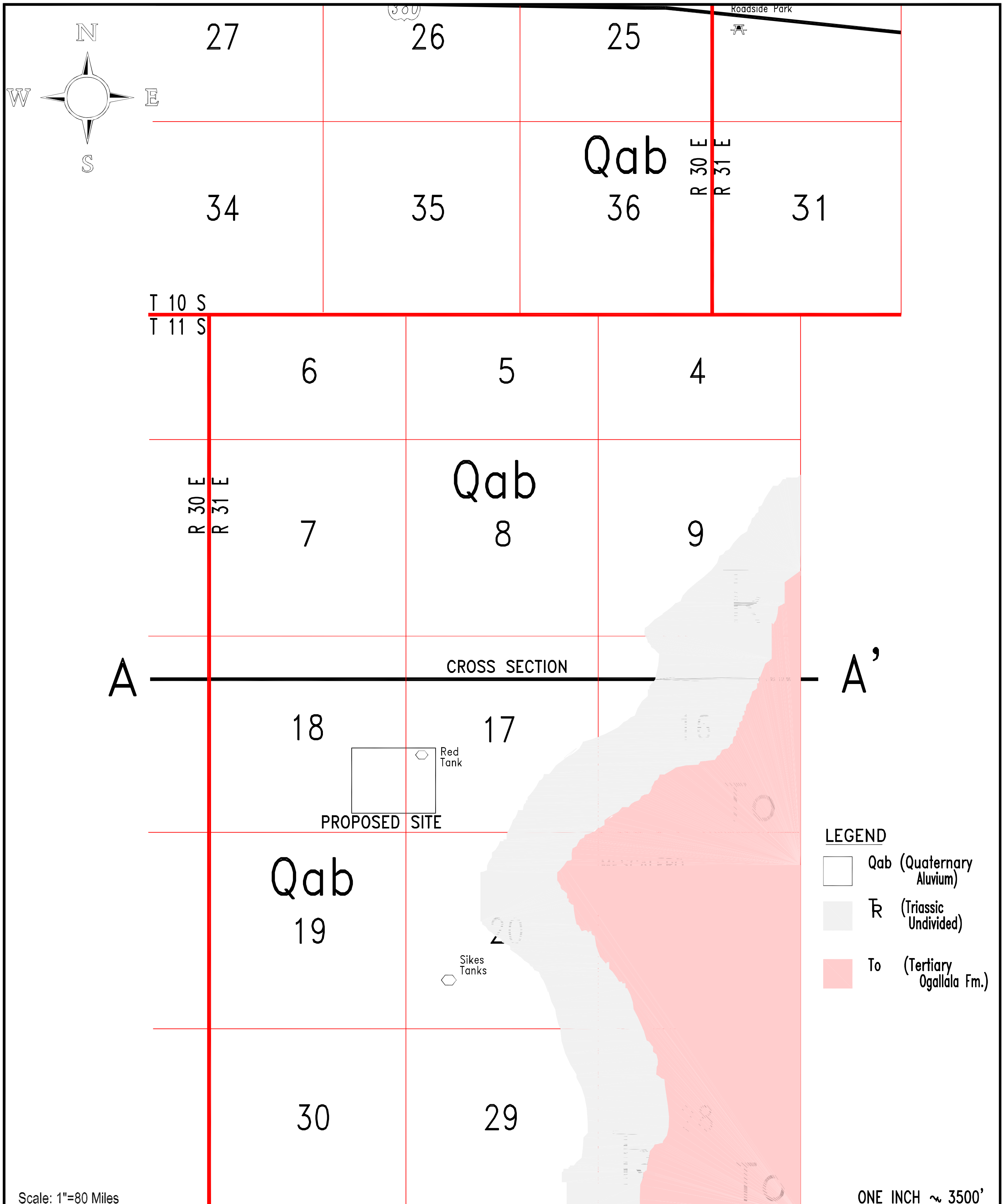
Yates Formation - Unconformably underlying the Rustler, the Yates Formation is composed primarily of interbedded sandstone with minor dolostone and limestone. The sands are light gray and fine to very fine grained. Limestone is white to very light gray microcrystalline lime mudstone with a chalky texture. Dolostone is pink to light gray and microcrystalline.

3.2 SITE STRATIGRAPHY

This section will provide detailed descriptions of the proposed Triassic host sediments and the Quaternary alluvium that overlies these sediments Figure 3-4, Surface Geology – Project Area, illustrates the surficial geology on and adjacent to the proposed site. Figure 3-5, Stratigraphic Cross Section, is a stratigraphic cross-section based on site drilling, illustrating relationships between the proposed Triassic host sediments and adjacent formations.

3.2.1 Quaternary

The thickness of Quaternary alluvial deposits at the site varies from less than 10 feet to 35 feet. The upper portion of these sediments consists of fine to very fine, wind-blown yellow-brown sands. Below this sand are varying thicknesses of red-brown to yellow-brown siltstones and silty mudstones. Scattered throughout these sediments are small chert pebbles and granitic cobbles derived from the Tertiary Ogallala Formation.



SURFACE GEOLOGY - PROJECT AREA

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-4

AutoCAD FILE: GANDY-FIG3-4

Insert Figure 3-5, Stratigraphic Cross Section

Montgomery Watson does not posses this figure electronically. The size of the figure was such that in order to reduce the image for electronic format, the clarity and detail of the figure would be lost.

A caliche zone (Mescalero Caliche) is present in most of this unit. The caliche is found immediately under the top wind-blown sands and coats and fills fractures within the more consolidated siltstones. Where the Quaternary alluvium is quite thin, this caliche is found coating Triassic sediments.

3.2.2 Triassic

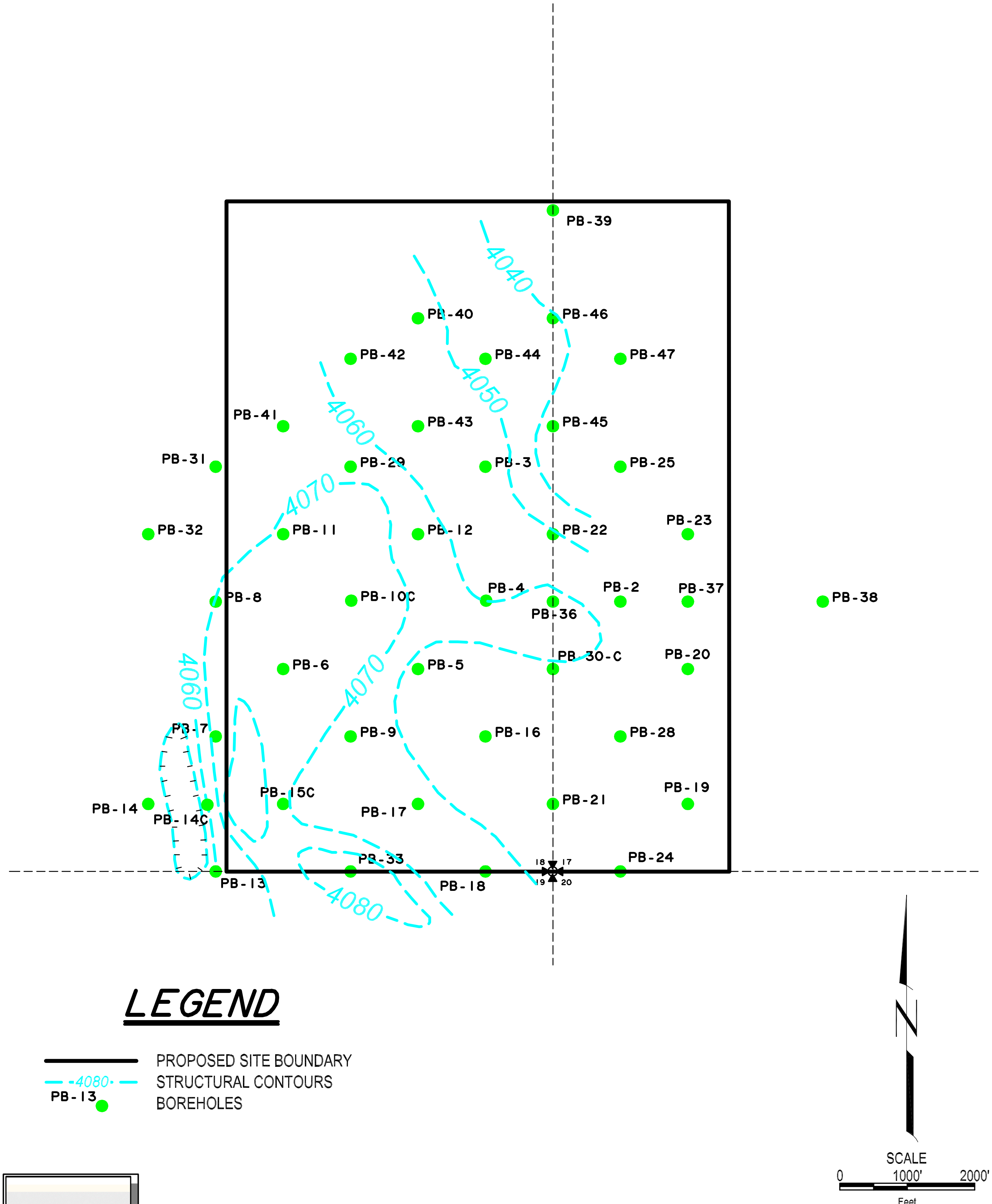
Drilling at the site has delineated 1,175 feet of Dockum sediments. Two distinct units can be identified in these sediments: the Upper Dockum (475 feet thick) and the Lower Dockum (700 feet thick). Within the proposed Facility boundary the thickness of the Upper Dockum unit never exceeds 100 feet. Upper Dockum sediments are in contact with the overlying Quaternary alluvium throughout the project area.

Upper Dockum - This unit consists of variegated (red-brown-green) mudstones interbedded with reddish gray siltstones and reddish-gray-green sandy siltstones. The siltstones are micaceous (predominantly muscovite), indicating they were part of a relatively active fluvial system capable of transporting material into the basin from distant source rocks. From examination of lithology and down-hole electric logs, it is estimated that 30 percent of the unit is comprised of mudstones. Lithologies of the remainder of the unit are evenly divided between siltstones and sandy siltstones. However, as the geotechnical properties of these two lithologies are very similar, this geologic discussion will simply refer to them both as siltstone. Mudstones were found to have an average permeability of 2.5×10^{-7} cm/s, and the siltstones average 1.2×10^{-5} cm/s.

These sediments were deposited in a fluvial environment. Mudstone and siltstone bodies are very lenticular and are found to pinch out abruptly. Accordingly, individual lithologies are not correlatable over significant distances (thousands of feet). The fluvial nature of the Upper Dockum Unit has led to the scouring of channels into the underlying Lower Dockum Unit. This scouring and the pinching-out of fluvial sediments have resulted in the local development of an undulatory surface on top of the Lower Dockum Unit (Figure 3-6, Structure Contour - Top of Lower Dockum).

Lower Dockum - The Lower Dockum Unit has a completely different character from the upper unit. The lower unit represents a time of relatively quiet lacustrine deposition, which resulted in the accumulation of thick sequences of predominantly mudstones interbedded with thin siltstones. These sediments are very homogeneous, in contrast with the abrupt facies changes present in the more active Upper Dockum depositional system.

Most of the close-spaced drilling within the proposed Facility boundary “bottomed” in Lower Dockum mudstones. These mudstones were consistently a moderate reddish brown color, which according to McGowen (1979), is associated with low stand lacustrine and mud flat deposition. Two deep holes (WW-1 and WW-2) were drilled adjacent to the proposed site to examine the total extent of the Lower Dockum mudstones. Results of this drilling, along with the examination of several oil well logs, demonstrated a consistent thickness of 600-650 feet of these sediments. Representative core samples of this material were sent for permeability analyses. The results of these analyses confirm the Lower Dockum to have a very low permeability (average permeability of 5.7×10^{-8} cm/s), capable of performing as a geologic barrier to downward migration of fluids from the proposed facilities.



STRUCTURE CONTOUR
TOP OF LOWER DOCKUM

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-6

AutoCAD FILE: GANDY-FIG-3-6

Underlying the thick sequence of mudstones, there is a basal sand unit in the Lower Dockum below the site. As illustrated in Figure 3-3, this sand unit is roughly equivalent to the Santa Rosa Formation. However, the major accumulation of Santa Rosa Sands that fills the northern portion of the Triassic paleobasin pinches out before reaching the Facility site. During the Lower Dockum time, the Facility site was part of a low-relief area with little fluvial deposition. The McGowen report specifies sand percentages of the Lower Dockum group in the Facility site area to be in the 10-20% range.

3.3 STRUCTURAL SETTING

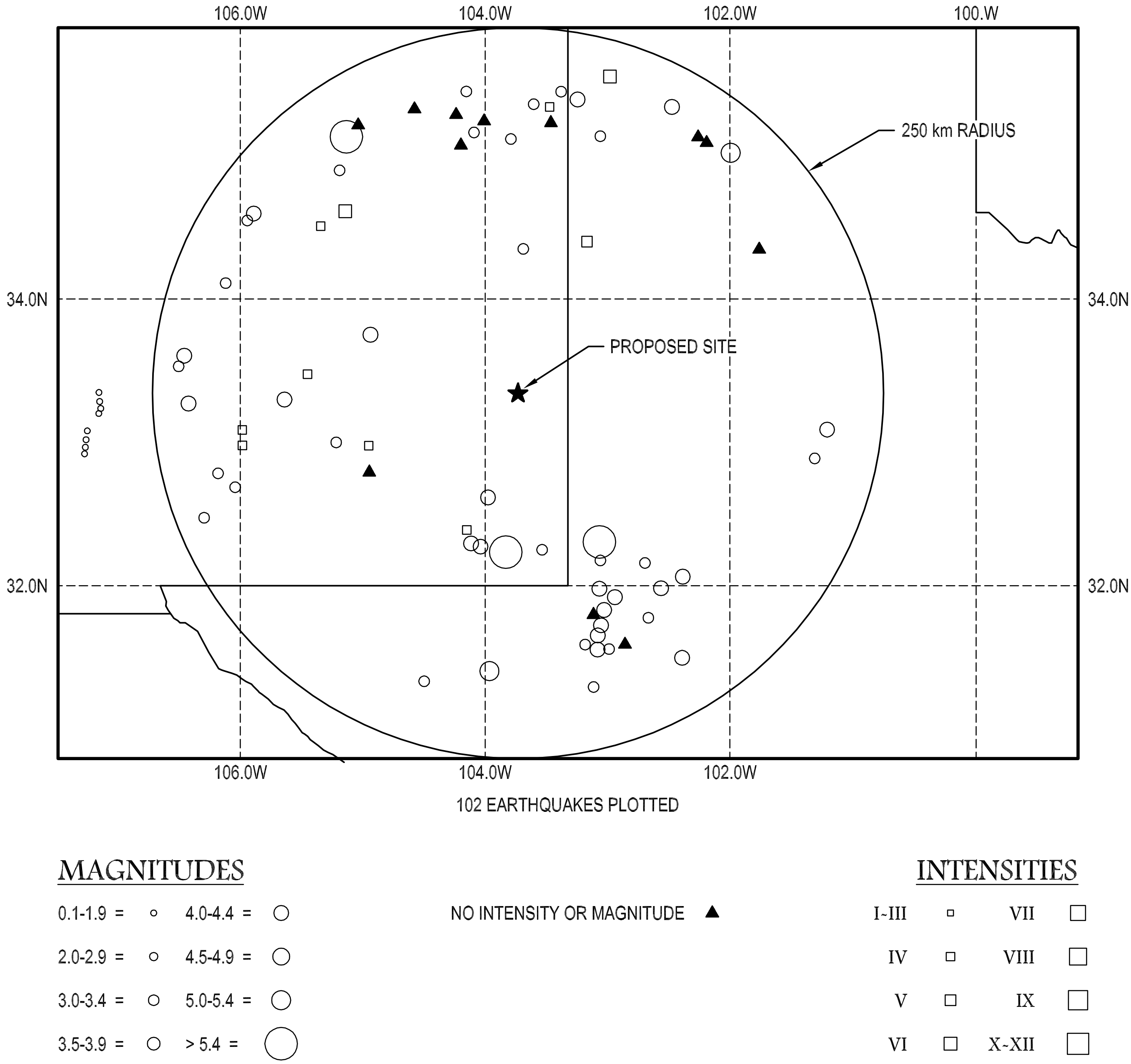
The proposed Facility site is located on the western flank of the Permian Basin of west Texas. Because of the distance from tectonic centers and the minimal seismic activity, this is considered one of the more geologically stable regions within the United States. Data obtained from the National Geophysical Data Center of NOAA indicate a total of 102 observed earthquakes within a 250-km (155-mile) radius of the proposed site. These data reflect observations made from 1930 to 1993.

As shown in Figure 3-7, there were no recorded earthquakes with a magnitude greater than 3.9 within 70 miles of the proposed site and no recorded seismic activity within a radius of 45 miles. The distance from any tectonic centers and the low-recorded seismic activity suggest that the proposed site is located in an extremely stable environment where activity is not expected. Consequently, little damage from earthquake activity is anticipated.

There are no identified faults within the project area. As previously discussed, the proposed site is located in a geologically stable area. There are no mapped faults on or adjacent to the project area. Color air photos of the area were examined for surface lineations, which can reflect faulting in the subsurface. All surface lineations observed on these photos were attributed to man-made features (i.e., fences, roads, etc.).

Subsurface drilling did not encounter displacement or repeating of geologic sequences that would be indicative of faulting. In the Upper Dockum Unit, there are abrupt changes in lithologies, but these are attributed to depositional processes associated with an active fluvial system. Due to the stable structural setting and the plasticity exhibited in Lower Dockum mudstones, the development of secondary permeabilities within this unit is not expected.

SEISMICITY WITHIN 250 KM OF 33.367N 103.850W



National Geophysical Data Center/NOAA Boulder, Colorado 80303

SEISMIC ACTIVITY MAP

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-7

AutoCAD FILE: *GANDY-FIG3-7*

4.0 HYDROLOGY

4.1 SURFACE WATER

There are no perennial stream drainages on or near the proposed site. The nearest surface drainage is the Pecos River, approximately 30 miles to the west.

There is one small stock tank (Red Tank) within the proposed Facility boundary and several additional tanks on adjacent lands. These tanks are approximately 200 feet by 200 feet and contain water for livestock. The tanks are clay-lined and retain water from run-off or receive water from an underground pipeline. Water in the underground pipeline is supplied from three water wells on the Marley Ranch located in Section 10, T11S, R31E. These wells are east of the Mescalero Rim and produce water from the Ogallala Formation. In the past, water from the springs along the Caprock excarpment was used in this pipeline, but now water is pumped from the Ogallala Formation. The pipeline is personally owned and maintained by the Marley Ranch to provide water to cattle operations below the Caprock.

It was observed in the 1999 drilling that "pooled" surface waters have the potential of migrating through the surface alluvial sediments. Once the site is designated as a disposal area, cattle operations on this property will cease and the Marley Ranch will stop using Red Tank. They will also re-route their personal pipeline, as appropriate, to avoid waste disposal facility operations and continue to supply water to their cattle operations below the Caprock. It should be noted that pits that could pool surface water over the alluvium will be backfilled and graded to drain as part of the initial construction activities prior to operations.

4.2 GROUNDWATER

This section describes regional and local aquifers.

4.2.1 Regional Aquifers

In the region surrounding the proposed site, there are two geologic units that have produced groundwater, the Triassic and the Tertiary Ogallala Formation. Very minor amounts of groundwater have been produced from Triassic sediments; but the Tertiary Ogallala Formation is a major aquifer in southeastern New Mexico, west Texas, and several other western states.

4.2.1.1 Ogallala Aquifer

The Ogallala Aquifer is the primary freshwater aquifer within the regional study area and serves as the principal source of groundwater in the Southern High Plains. The saturated thickness of the Ogallala Aquifer ranges from a few feet to approximately 300 feet in the Southern High Plains. Groundwater within the Ogallala Aquifer is typically under water table conditions, with a regional hydraulic gradient toward the southeast ranging from approximately 10 feet/mile to 15 feet/mile. The average hydraulic conductivity of the Ogallala Aquifer ranges from 1 foot/day to 27 feet/day.

The Ogallala Aquifer is recharged primarily through the infiltration of precipitation. The rate of recharge is believed to be less than 1 inch/year. Groundwater discharge from the Ogallala Aquifer occurs naturally through springs, underflow, evaporation, and transpiration, but groundwater is also removed artificially through pumpage and catchment. Currently, the rate of withdrawal exceeds the rate of recharge for much of the Ogallala Aquifer.

4.2.1.2 Lower Dockum Aquifer

The major aquifer within the Lower Dockum is the Santa Rosa Sandstone. This sandstone is present along the northern and southern flanks of the Permian Basin and is a principal source of groundwater in Roosevelt and Curry Counties, New Mexico. The Santa Rosa Sandstone is not mapped along the western flank of the Permian Basin, which includes the proposed site. Where the Santa Rosa Aquifer has been studied, hydrochemical analyses and groundwater oxygen isotopes indicate that it is distinctly different from the Ogallala Aquifer. The thick, impermeable clays within the Triassic section have been sufficiently impermeable to prevent hydraulic communication between these aquifers.

Figure 4-1 is a map of ten water wells developed in Triassic sediments within a 10-mile radius of the proposed site. This information was obtained from the New Mexico State Engineer's office and represents the results of a records search of six townships surrounding the proposed site (T11S - T13S, R29E & R30E). Six of these wells are shallow completions (100 feet or less) from the 1910's and 1940's and are used with windmills to supply water to livestock and wildlife. The numbers of these wells are RA-8585 through RA-8589 and RA-8363. These are included as wells penetrating Triassic sediments because of their surface locations. However, due to their shallow depths, the source of water could be from surface alluvial sediments.

The four other wells range in depth from 560 to 640 feet and have been completed within the past seven years. These wells would have penetrated the Lower Dockum sediments (including the Santa Rosa Sandstone equivalent). Following is a description of these wells:

- RA-8577 was drilled to a depth of 614 feet in 1992. It's initial production was 4 gallons per minute.

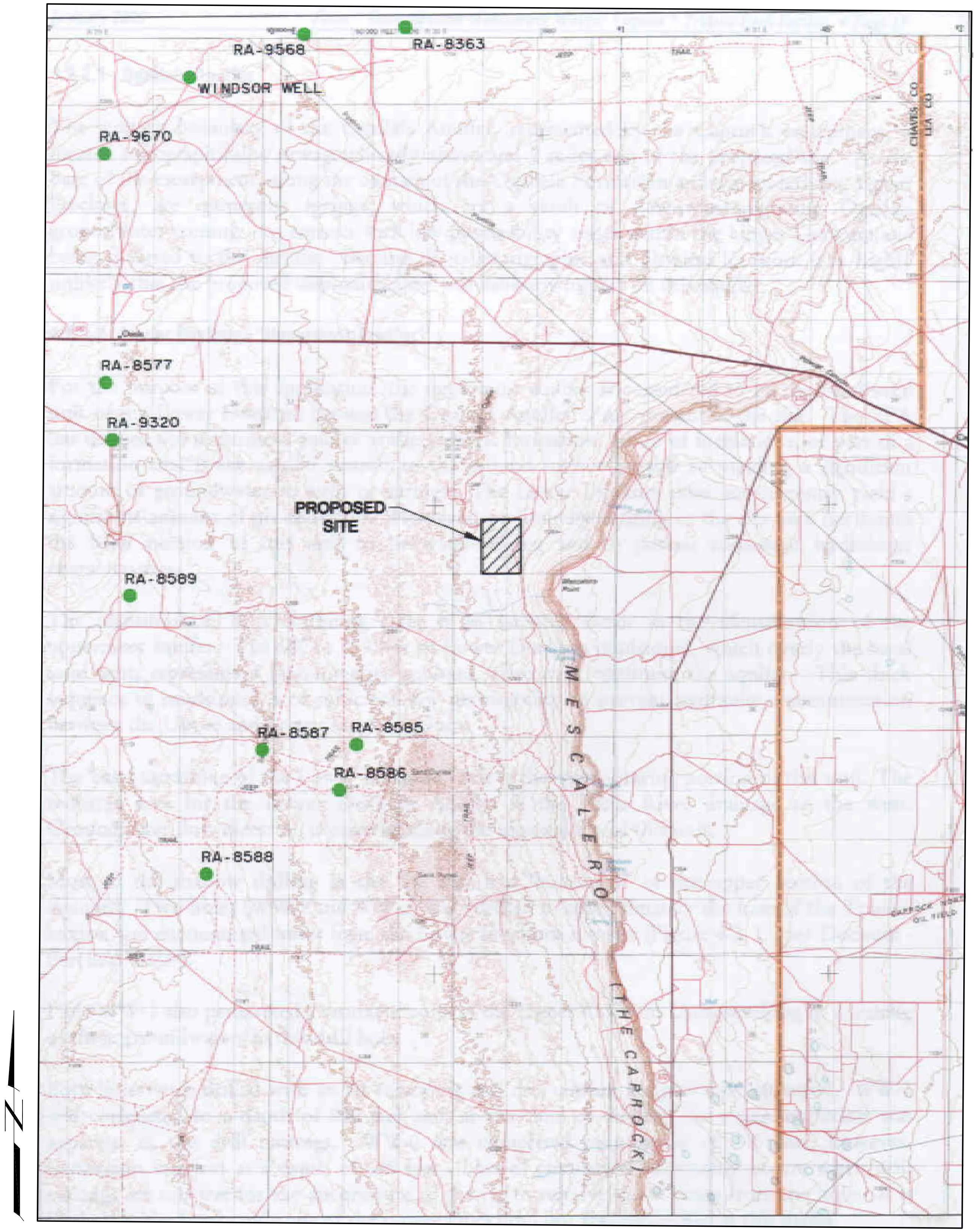
- RA-9320 was drilled in 1996 to a depth of 560. The estimated yield was 6 gallons per minute, however, the water was determined to be not potable. The well was plugged and abandoned on 11/25/96.

- RA-9568 was drilled to a depth of 640 feet in 1998. It was a dry hole and was plugged and abandoned on 08/14/98.

- RA-9670 was drilled in 1998 to a depth of 587. The estimated initial yield was 2 gallons per minute.

4.2.2 Site Groundwater

Potential Triassic host sediments within the proposed Facility boundary are unsaturated. Detailed drilling within this boundary has encountered no groundwater. Drilling outside the proposed Facility boundary has identified saturated zones in both the Upper and Lower Dockum Units. The following subsections contain descriptions of these saturated zones.



Scale: 1:100,000

WATER WELLS - 10 MILE RADIUS

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 4-1

AutoCAD FILE: *GANDY-FIG4-1*

4.2.2.1 Ogallala Aquifer

The western boundary of the Ogallala Aquifer, represented by the Caprock escarpment, is located topographically/stratigraphically above and 2 miles east of the proposed site. At the base of the escarpment, along the contact of the Ogallala Formation and the underlying Upper Dockum, are numerous springs, which are a result of downward-migrating Ogallala groundwater coming into contact with low permeability zones within the Upper Dockum and being diverted to the surface. Because of its stratigraphic and physical location, it is highly unlikely that the proposed disposal facility will have any impact on this aquifer.

4.2.2.2 Lower Dockum - "Uppermost Aquifer"

For the purpose of this application, the uppermost aquifer is considered to be the basal sand unit of the Lower Dockum because the Ogallala Aquifer is not present at the site. The EPA has defined the uppermost aquifer as the geologic formation, group of formations, or part of a formation that is the aquifer nearest to the ground surface capable of yielding a significant amount of groundwater to wells or springs. The Lower Dockum does not currently yield a significant amount of groundwater. However, preliminary drilling in the site area has found the basal portion of this unit to be water-bearing and to possess consistent hydrologic characteristics.

The identification of a confining layer is an essential factor in the identification of the uppermost aquifer. The 600 to 650 feet of Lower Dockum mudstones, which overly the basal sand unit, represents a high-integrity aquitard, effectively confining the aquifer. This thick sequence of mudstones is of sufficient low permeability to prevent hydraulic communication between the Upper and Lower Dockum Units.

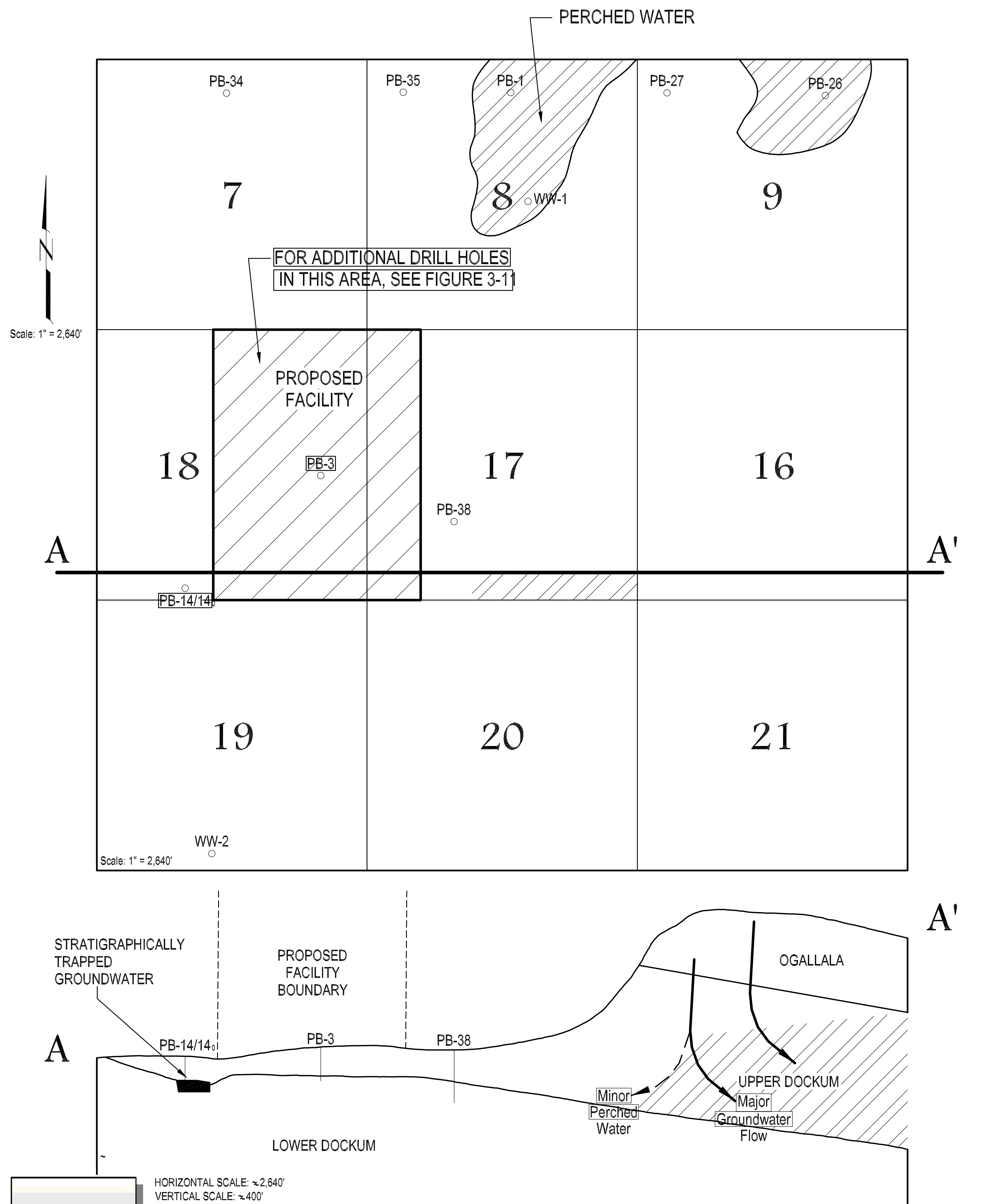
The basal sandstone of the Lower Dockum Unit is the water-bearing portion of this unit. The recharge area for the Lower Dockum Aquifer is the Pecos River drainage to the west. Groundwater flow direction is easterly, along the regional dip of this unit.

Most of the shallow drilling in the site area has "bottomed" in the upper portion of the aquitard. Two holes (WW-1 and WW-2) were drilled to approximately the base of the Triassic section and encountered water from the Lower Dockum Aquifer (Figure 4-2, Upper Dockum - Perched Water).

Hole WW-1 also penetrated a saturated zone in the Upper Dockum Unit, resulting in a mixing of these groundwaters in this drill hole.

Both holes were drilled with an air rotary rig and drill-cutting samples were collected. WW-1 was completed to a depth of 820 feet and, at the time of drilling, no water saturation was apparent in the drill cuttings. WW-2 was completed to a depth of 710 feet; however, circulation was lost at a depth of 645 feet. Loss of circulation commonly occurs when drill cuttings are too wet for the air pressure of the rig to remove the cuttings from the hole. It is likely that the basal sandstone of the Lower Dockum Unit was penetrated at this depth.

Water Level Measurements - Temporary plastic casing was placed in each of the two holes immediately after completion. In July 1994, geophysical logs were run for each hole, and water levels were identified. WW-1 had a water level of 155 feet. This level is 20 feet above the



UPPER DOCKUM - PERCHED WATER

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 4-2

AutoCAD FILE: GANDY-FIG4-2

Upper/Lower Dockum contact, and it is likely that groundwaters from both units are present in this drill hole. A water level of 467 feet was observed for WW-2. This finding indicates that there is a hydrostatic head pressure within the Lower Dockum Aquifer of 178 feet.

Both of these cased holes were pumped and allowed to recover. After a sufficient recovery period, a static water level (155 feet for WW-1 and 467 feet for WW-2) was maintained.

Water Quality - Two sources of data have been used to evaluate water quality data for the Lower Dockum, 1) United States Geological Survey (USGS) Multistation Analyses and 2) site-specific analyses.

The USGS works in conjunction with the State of New Mexico to establish sample and analyze ground water from monitoring wells throughout the state. A request for data was made to the USGS on water quality information from wells within 12 townships surrounding the proposed site. This request was made for data from wells below the Caprock (Ogallala Aquifer). The search area consisted of T9S through T12S and R29E through R31E.

Data from a total of nine monitoring wells within the search area were received. Of these nine wells, only two could be confirmed as being within Dockum sediments. The depths of these two wells were 258 feet (Beadle well) and 14 feet (Winsor well). The Winsor well is shown on Figure 4-1, while the Beadle well is an additional two miles to the northwest, outside the 10-mile search radius.

The Beadle and Winsor wells, as are many of the USGS monitor wells, are not registered with the State Engineer's office. Any existing water wells drilled in this region prior to the closing of the Roswell Extended Basin in 1993 were not required to file applications.

Ten separate analyses were conducted on samples from these wells. Total results can be reviewed in Appendix A. For this section, to be consistent with results of site specific analyses, only values for Total Dissolved Solids, Magnesium and Sodium are presented.

	Beadle well	Winsor well
Total Dissolved Solids	38,400 mg/L	14,000 mg/L
Sodium	11,000 mg/L	3,200 mg/L
Magnesium	625 mg/L	519 mg/L

Site specific analyses are presented only for WW-2. This drill hole encountered groundwater from the Lower Dockum. Because groundwater from the Upper Dockum and Lower Dockum was mixed in drill hole WW-1, preliminary water quality data from WW-1 do not accurately characterize either aquifer and are not presented. The results from WW-2 include the following:

Total Dissolved Solids	18,800 mg/L
Alkalinity	83 mg/L
Sodium	7,030 mg/L
Magnesium	87 mg/L

The extremely high TDS values are indicative of long formation retention times, which reflects low groundwater flow and low permeability conditions within the Lower Dockum aquifer. Water with TDS values of greater than 500 mg/L is considered to be unfit for human consumption. These available data, along with the documented abandonment of other water wells due to encountering non-potable water within Lower Dockum sediments, indicate that the water quality of this unit is very low.

4.2.2.3 Upper Dockum - Perched Water

Several springs are present where the Ogallala Formation crops out, two miles east of the Facility site, along the 200-foot high Caprock escarpment. None of these springs occur near the proposed facility. These springs are present where the Ogallala sands unconformably overlie impermeable Dockum mudstones and claystones and the groundwater moves laterally to the surface. Where these water-bearing Ogallala sands are in contact with more permeable units of the Upper Dockum, saturation of these underlying sediments may occur. The result is sporadic accumulation of perched water within some Upper Dockum siltstones. As shown in Figure 4-1, three holes to the northeast of the proposed site (PB-1, PB-26 and WW-1) haven encountered this perched water. Due to the great variability in lithologies of the fluvial Upper Dockum sediments and the need for permeable sediments to be in contact with Ogallala source rocks, the occurrence of saturation within these sediments is extremely unpredictable.

It is extremely significant that this saturation does not extend beneath the Facility site. All 40 drill holes within the site boundary, as shown on Figure 1-1, have been unsaturated. For this reason, there were no groundwater production tests conducted.

Exploratory drilling west of the proposed Facility boundary (updip), near the outcrop of the Upper Dockum Unit, the small sandy hills located along the section line between Section 18, T11S, R31E and Section 13, T11S, R30E, encountered an isolated occurrence of groundwater (Figure 4-1). In a single drill hole (PB-14), at a depth of 42 feet, a small accumulation of groundwater was found in a depression developed on the surface of the underlying Lower Dockum mudstones. This depression is consistent with the "scouring" of the Upper Dockum fluvial sediments into the Lower Dockum mudstones. Closer spaced drilling in the vicinity of this occurrence encountered no other such accumulations. This isolated "pooling" is most likely a result of surface run-off entering the subsurface from the nearby outcrop and being caught in a small "stratigraphic trap."

Water Quality - Preliminary water quality data were obtained from limited chemical analyses on a sample of the stratigraphically trapped groundwater from drill hole PB-14. These results include the following measurements:

Total Dissolved Solids	4,920 mg/l
Alkalinity	396 mg/l
Sodium	1,640 mg/l
Magnesium	103 mg/l

Although this represents only one sampling point, these preliminary data suggest that water from the Upper Dockum, has a different geochemical character than does water from the Lower Dockum.

4.3 GENERAL DESCRIPTION

The Facility will be a full-service Resource Conservation and Recovery Act (RCRA) Subtitle C waste treatment, storage, and disposal operation. The Facility will offer the following RCRA-regulated services, which are described in this permit application.

Two treatment processes will be used at the Facility. The first is an evaporation pond for managing wastewater that meet LDR standards and a stabilization process for treating liquids, sludges, and solids to ensure that no free liquids are present. In addition, the stabilization process will ensure that LDR standards are met prior to placing wastes in the landfill. Both treatment units will be clean closed as part of the closure operations.

Two container storage areas (roll-off storage area and drum handling unit) will be used to stage waste at the Facility for treatment or disposal. These units will ensure that waste is stored in compliance with RCRA requirements for permitted storage. Neither of the units will be used for long-term storage of waste and will be clean closed during closure operations.

Four aboveground storage tanks will be utilized to accumulate regulated bulk liquid hazardous wastes prior to stabilization. Both of these units will be clean closed during closure operations.

A landfill will be utilized for final disposal of waste that meets LDR standards. The landfill will be the only unit that will remain after closure and will contain hazardous waste.

Support units and structures include a chemical laboratory, administration building, weigh scale area, maintenance shop, truck wash unit, clay processing area, clay liner material stockpiles, daily cover stockpiles, and a stormwater retention basin.

The facilities that pose the largest threat to release of large volumes of liquids to the subsurface are the evaporation ponds and the landfill. The evaporation ponds will store free liquids during operation of the facility. However, after operations have been completed the ponds will be removed and closed as clean facilities. The landfill is the only disposal facility that will include the permanent disposal of hazardous materials. The landfill will not accept any free liquids and will be covered after closure. However, since hazardous waste will remain in place after closure, it is a potential long-term source of release from the facility. All other facilities will be clean closed as part of the closure operations.

4.4 CONTAINMENT SYSTEMS

Since these two facilities pose the largest threat for release of hazardous material to the surface, we have described the engineered containment systems and leachate collection and removal systems for both facilities. These include the landfill and evaporation ponds.

4.4.1 Landfill

4.4.1.1 Liner Systems for Landfill

The liner system will be installed to cover all surrounding earth that may come in contact with waste or leachate. The primary system will consist of, from top to bottom, a 2-foot layer of protective soil, a geocomposite drainage layer, and a HDPE geomembrane liner. The secondary system will consist of a geocomposite drainage layer, HDPE geomembrane liner, geosynthetic clay layer (GCL), and 6 inches of prepared subgrade. Both the primary and secondary systems will extend over the floor and slope areas of the landfill.

The primary and secondary geomembrane liners will be constructed of HDPE. This material will have sufficient strength and thickness to prevent failure as a result of pressure gradients, physical contact with waste or leachate, climatic conditions, stress of installation, and stress of daily operations. The liner systems and geosynthetic drainage layers will rest upon a prepared subgrade capable of providing support to the geosynthetics and preventing failure due to settlement, compression, or uplifting.

4.4.1.2 Landfill Leachate Collection and Removal System (LCRS)

The LCRS will be located above the primary liner system. A filtered LCRS layer consisting of a geocomposite drainage material will be constructed. Within the floor area of the LCRS layer will be the primary leachate collection piping, which is used to remove leachate from the landfill during the active life and post-closure care period.

The LCRS is sloped so that any leachate above the primary liner will drain to one of three sumps. The sumps and liquid removal methods will be of sufficient size to collect and remove liquids from the sumps and prevent liquids from backing up into the drainage layer.

The sump will be lined with the same liner system components as elsewhere in the landfill except that the drainage layer will expand to include gravel and a compacted clay liner material beneath the primary and secondary geomembranes which will fill the sump area. Leachate that collects in the sumps will be pumped through a pipe to the surface of the landfill where it will be collected in temporary storage tanks.

4.4.1.3 Landfill Leak Detection and Removal System (LDRS)

The design of the LDRS is similar to the design of the LCRS. The LDRS will be capable of detecting, collecting, and removing leaks of hazardous constituents through areas of the primary liner during the active life and post-closure care period. A filtered LDRS layer consisting of a geocomposite will be constructed below the primary geomembrane. Within the LDRS layer will be the LDRS piping, which will be used to detect and remove liquid from between the primary and secondary liners.

4.4.2 Evaporation Pond

4.4.2.1 Evaporation Pond Liner System

The liner system will include a primary (top) geomembrane liner above a geonet layer and a secondary (bottom) geomembrane liner, supported by 3 feet of compacted clay liner material with a hydraulic conductivity of no more than 1 x 10^{-7} cm/sec. Soil liner leachate compatibility tests (EPA 9090) will be conducted prior to construction. In addition, a test fill will be constructed, as per the procedures outlined in the CQA Plan.

Design and operating practices, together with the geologic setting of the Facility, will prevent the migration of any hazardous constituent to adjacent subsurface soil, surface water, or groundwater. The top liner is designed to minimize the migration of hazardous constituents through the liner system during the active life. A 60-mil HDPE geomembrane material will be used for the primary liner component. HDPE liners have been shown to be chemically resistant to landfill leachates based on operational performance and on EPA 9090 compatibility tests conducted on actual landfill leachates and synthetically generated leachates.

4.4.2.2 Leak Detection and Removal System

The LDRS consists of a geonet layer of cross-linked ribbed HDPE, a sump, and associated detection and liquid removal pipes. A pump located in the LDRS pipe will be used to remove leachate accumulating in the leachate collection systems. When leachate accumulates, it will be pumped to a tanker truck and either returned to the evaporation pond, stabilized in the onsite treatment unit, or stored in one of the liquid waste storage tanks.

The LDRS unit will have the following characteristics:

- be constructed with a bottom slope of 1% or more;
- be constructed of synthetic or geonet drainage materials with a minimum transmissivity of 5 x 10^{-3} m^2/sec;
- be constructed of materials that are chemically resistant to the waste managed in the evaporation pond and any leachate generated in the landfill;
- of sufficient strength and thickness to prevent collapse under pressure exerted by overlying wastes, and equipment used at the evaporation pond;
- designed and operated to minimize clogging during the active life and closure period of the evaporation pond; and,
- constructed with sump and liquid removal methods.

The collection system has been designed to be of sufficient size to collect and remove liquids from the sump and prevent liquid from backing up into the drainage layer. A sump pump and associated piping will be installed in the lower portion of the sump. The sump system will be covered with gravel to bring the area to the level of the evaporation pond floor. The gravel will serve as an expanded drainage layer providing space for the piping. In addition, the sump system will be provided with a method for measuring and recording the volume of liquids present and the volume of liquid removed. All pumpable liquids in the sump will be removed in a timely manner to maintain the head on the bottom liner below 12 inches.

4.5 MONITORING SYSTEMS

4.5.1 General

The monitoring systems proposed for the Triassic Park facility has been developed to provide early detection for any release from the site. In addition, the systems are focused on the facilities that have the largest potential for releases to the subsurface. The monitoring systems include vadose zone sumps in the landfill and the evaporation pond and a series of vadose zone/perched groundwater monitoring wells that will be installed along the east side of the facility. Each of these systems is described in more detail below.

4.5.2 Vadose Zone Sump

The vadose zone monitoring sump serves as a detection system for leakage in the secondary LDRS system. Located directly beneath the LDRS sump, leakage through the secondary liner system will flow into the vadose sump, allowing it to be detected and removed. The vadose pipe and gravel arrangement is similar to the LCRS and LDRS arrangements.

The evaporation pond vadose monitoring sump serves as a detection system for leakage of the LDRS sump. Leakage through the secondary liner system will flow into the vadose sump. This will allow the leakage to be detected and moved. The vadose pipe and gravel arrangement is similar to the LDRS arrangement.

4.5.3 Vadose Zone/Perched Groundwater Monitoring Holes

In the unlikely event that the release of liquids from any of the facilities is not detected by the leak detection systems or the vadose zone sumps, a series of vadose zone/perched groundwater monitoring wells will be installed along the eastern site boundary. The vadose zone/perched groundwater monitoring wells will be installed at or just below the contact between the Upper and Lower Dockum units. The intent of these wells is to detect any liquids that would be migrating down dip along the contact.

5.0 TECHNICAL JUSTIFICATION

This section presents technical data to support the Gandy Marley request for a Groundwater Monitoring Waiver. This data consists of water balance calculations for the region to establish hydrologic components and the results of contaminant transport modeling.

Gandy Marley recognizes the need for an effective release monitoring system for the protection of human health and the environment. Due to the unique geologic setting of the proposed Triassic Park Disposal Facility, an alternative release monitoring system is recommended. Because of the unsaturated nature of the proposed host rocks, technical data supports the implementation of a vadose zone monitoring system in lieu of traditional groundwater monitoring. For this environment, a vadose zone monitoring system is superior for detecting and characterizing potential releases.

5.1 WATER BALANCE

The purpose of this water balance is to provide a conceptual understanding of the hydrologic components at the site. This water balance analysis estimates groundwater recharge from direct precipitation, surface water bodies, and irrigation at the proposed landfill site. This information is useful for assessing the potential migration of contaminants released at or near the surface to groundwater. Groundwater recharge rate is directly related to the potential for contaminants spilled or leaked at the surface to reach groundwater. In areas with little or no groundwater recharge, there is less potential for groundwater contamination from releases of hazardous substances than in high recharge areas because the mechanisms to transport potential contamination are limited.

A water balance requires quantification of the hydrologic components, which can result in changes in the amount of water stored in the area of interest. Often, water balances are calculated for an entire watershed to understand the relative importance of the hydrologic components within that area. For this analysis, the water balance was performed to estimate groundwater recharge at the proposed landfill site.

Groundwater recharge at the proposed site can be estimated by summing precipitation, infiltration from surface water bodies, and irrigation at the site and subtracting evapotranspiration and surface run-off. As no natural surface water bodies or irrigation occur at the site, groundwater recharge is estimated as the difference between direct precipitation and evapotranspiration. This assumes no surface run-off at the site.

Precipitation data collected at the Roswell weather station indicate that mean annual precipitation is 10.61 inches. This annual mean is used as the average precipitation at the proposed site.

Evapotranspiration refers to the processes that return water to the atmosphere by a combination of direct evaporation and transpiration by plants and animals. It is the largest item in the water budget because most of the precipitation that falls in the area returns almost immediately to the atmosphere without becoming part of the surface water or groundwater systems. On unirrigated rangeland, much of the precipitation that does not evaporate immediately is taken up fairly rapidly by plants and transpired. In a regional water balance conducted in southeastern New Mexico, it was estimated that approximately 96 percent of total precipitation is lost to evapotranspiration (Hunter, 1985). This number corresponds to data presented for the Rio Grande Basin by Todd (1983), that estimated that 95.4 percent of total precipitation was being lost to evapotranspiration.

Assuming a mean annual precipitation rate of 10.61 inches, of which 96 percent is lost to evapotranspiration, the net recharge to groundwater is estimated as 0.42 inch per year. This low groundwater recharge rate significantly reduces the potential for groundwater contamination from spills or leaks at the proposed Facility.

The amount of groundwater recharge is a reflection of the arid climate of the region. The net recharge estimate of 0.42 inch per year (based on average hydrologic components) represents the expected long-term annual conditions at the site. The relatively low recharge rate appears to be reasonable given the unsaturated conditions of the Upper Dockum within the site boundaries. Using the highest recorded annual precipitation value of 32.92 inches yields only a slightly higher recharge rate of 1.32 inches (assuming an evapotranspiration rate of 0.96). This short-term (1 year) increase in recharge is unlikely to have a significant impact on the unsaturated flow regime at the proposed site.

5.2 CONTAMINANT TRANSPORT MODELING

The geologic and hydrologic characteristics of the Lower Dockum sediments, as described in Sections 3.0 and 4.0, were used to estimate contaminant transport rates to the basal sand unit of the Lower Dockum referred as the Santa Rosa Formation (i.e. the upper most aquifer). Two different assessments of potential contaminant transport rates through the Lower Dockum are presented in this section.

5.2.1 Previous Unsaturated Flow Modeling

Previous unsaturated flow modeling for the site was reported in TerraMatrix/Montgomery Watson (1997). These calculations used a steady-state solution for unsaturated flow as reported in Bumb and McKee (1988). The modeling was based on the following steps.

- Estimate effective saturation using the Bumb and McKee model and HELP model predictions of leakage rates
- Determine unsaturated hydraulic conductivities using the Brooks-Corey model
- Estimate flow rates using Darcy's Law with a unit hydraulic gradient
- Calculate travel times using the interstitial velocity

The results from these calculations indicated that travel times from a hypothetical leak through the Lower Dockum would be on the order of millions of years. A more complete summary of this model analysis is presented in Appendix B.

5.2.2 Alternative Modeling Approach

Numerous discussions were held with NMED regarding the modeling requirements for a waiver demonstration. Based on these discussions, the following criteria for the modeling effort were developed.

- A one-dimensional flow and transport model, MULTIMED, should be used to evaluate the potential travel times through the Lower Dockum.
- A travel time of 800 years should be considered as a minimum to justify a waiver from groundwater monitoring.
- Conservative input parameters should be utilized for all modeling runs. During this discussion, the most conservative assumptions and parameters will be highlighted in the text using the initials **MCA** (Most Conservative Assumption).

Based on the criteria discussed above, a one-dimensional flow and transport model, MULTIMED, was used to evaluate potential travel times through the lower Dockum as well as travel times along the Upper Dockum/Lower Dockum contact to an assumed perched aquifer 3600 feet east of the landfill. The approach presented in this sections differs from the previous model in several areas and was developed to be as conservative as possible (i.e. to predict the maximum transport rate and the minimum transport time through the Lower Dockum). Because of the different approach used in the current calculations, the results are not directly comparable to those reported in Section 5.2.1. Several important assumptions were changed in the current model as shown below in Table 5.1.

TABLE 5.1
ASSUMPTIONS USED TO DEVELOP ALTERNATIVE MODELING APPROACH

Assumption	Current Model	Previous Model	Justification
Flow dimensionality	1-dimensional flow	3-dimensional flow	A one dimensional flow simulation will require less water to reach a given depth and is therefore more conservative although the 3-d approach is more physically correct **(MCA)**.
Saturated hydraulic conductivity	6.8 X 10^{-8} cm/s	5.7 x 10^{-8} cm/s	The hydraulic conductivity value used in the previous model was the average value based on core measurements. The value used in the current model was obtained by taking the maximum measured value (6.8 x 10^{-8} cm/s) from core measurements **(MCA)**.
Saturation	Based on MULTIMED modeling	Based on Bumb and McKee model (1988) and HELP model predictions	The previous model used an exact steady-state solution to estimate saturation. The current model used a completely saturated system **(MCA)**. Completely saturated conditions are considered highly unlikely given the arid conditions at the site but were used to present a maximum bound on the calculations.
Unsaturated hydraulic conductivity	Van Genuchten Model	Brooks-Corey Model	The Van Genuchten and Brooks-Corey Model are commonly used to estimate unsaturated conductivity.
Hydraulic gradient	Assumed to be unity	Assumed to be unity	This assumption ignores artesian conditions in the Santa Rosa Formation, which would result in a lower gradient and is therefore conservative.

The computer transport model MULTIMED was used to analyze the hypothetical leak into the subsurface below the landfill. The semi-analytical model consists of a number of modules, which predict contaminant transport through the Lower Dockum. A steady state, one-dimensional, semi-analytical module simulates flow in the unsaturated zone. The output from the unsaturated zone model is expressed as water saturation as a function of depth. This output is then used as input for the one-dimensional, unsaturated transport module, which can calculate transient and steady state contaminant concentrations. The results from both of these models are input into the one-dimensional flow and transport saturated zone module. The boundary conditions, input parameters, and MULTIMED output for each simulation is located in Appendix C.

Two MULTIMED simulations calculated the travel times through the Lower Dockum using different infiltration rates as boundary conditions:

- Assumes an infiltration rate equal to the saturated hydraulic conductivity of 0.84 in/yr **(MCA)**. This approach is considered the most conservative and assumes that the formation has access to as much leachate as it can physically accept.

- Assumes as infiltration rate equal to the net recharge of 0.42 in/yr. for this site. This is based on a regional water balance assessment that does not account for any of the liner or cover barrier layers in the landfill. This approach more accurately models the long-term annual conditions at the site, but is still considered conservative.

A MULTIMED simulation also calculated the travel time to the east along the Upper Dockum/Lower Dockum contact to a perched aquifer approximately 3,600 feet downgradient of the proposed landfill. This simulation assumed an infiltration rate of 0.60 in/yr. Note that the MULTIMED output from this simulation reported a warning that the amount of infiltration input into the model was slightly more than the system could accept. This supports that the most conservative approach would require a slightly smaller infiltration rate and would generate a greater travel time.

The results from these simulations are shown below in Table 5.2

TABLE 5.2
SIMULATION RESULTS

Infiltration Rate in/yr (cm/s)	Travel Time (years)	Description
0.84 (6.8×10^{-8}) – Trial 1	1606	Assumes vertical migration through the entire section of Lower Dockum sediments. Utilizes maximum infiltration rate in Lower Dockum sediments **(MCA)**. This is considered very conservative
0.42 (3.4×10^{-8}) – Trial 2	3211	Assumes vertical migration through the entire section of Lower Dockum sediments. Utilizes realistic but still conservative infiltration rate.
0.60 (4.76×10^{-8}) – Trial 3	3600[1]	Assumes lateral migration to nearest potential aquifer to the east. Permeability is representative of Upper Dockum sediments.

Note: [1]Travel time to receptor well 3600 feet east of the landfill

5.2.3 Discussion of Modeling Results

Two different approaches have been presented for evaluating the potential releases from the landfill to impact groundwater. Both of these evaluations have concluded that it would require an extremely long time for potential leaks to reach groundwater (over a thousand years). Extremely conservative assumptions were used in the most recent evaluation of transport time to groundwater and these are assumptions that are not likely to occur during the lifetime of the facility or the extended future (greater than 1,000 years). The factors contributing to the long periods of time for potential release from the facility to reach the Santa Rosa Formation include the low permeability of the Lower Dockum, the thickness of the unit (600 feet) and the arid conditions at the site. These conditions combine to make the Gandy Marley facility an ideal location for the proposed landfill activities.

5.3 VADOSE ZONE MONITORING

Due to the extremely long travel times in the Lower Dockum and along the Upper Dockum/Lower Dockum contact, groundwater monitoring data from the Santa Rosa formation or the perched aquifer downgradient of the site will not provide meaningful information concerning potential releases from the proposed facility. It is therefore recommended that a Vadose Zone Monitoring System (VZMS) be used to detect potential release from the facility. The VZMS will provide the most effective method for detecting potential releases from the facility in a timely manner. Before potential contaminants can reach the uppermost aquifer, these systems can detect leaks and help to initiate corrective actions for preventing impacts to the environment.

6.0 SUMMARY AND CONCLUSIONS

Site drilling has established the basal sand of the Lower Dockum (Santa Rosa Sandstone equivalent) to be the uppermost aquifer for the proposed Triassic Park Disposal Facility. Within a four-mile radius of the Facility, there is no water currently being produced from this unit. Water quality from this aquifer is considered to be poor, with water analyses at the site showing Total Dissolved Solids to be 18,800 mg/l.

Overlying this aquifer are 600-650 feet of unsaturated, low-permeability mudstones. Analyses of site core samples indicate that the average permeability of these mudstones are 5.7×10^{-8} cm/s. The base of the hazardous waste landfill is designed to rest on the top of this thick mudstone sequence. The low-permeability mudstone provides over 600 feet of excellent protection against potential transport of leakage from the facility to groundwater. The combination of the thick mudstone sequence and the lack of potable water resources make the proposed facility an excellent location for the safe disposal of hazardous waste. Conservative unsaturated transport modeling indicate that it would take thousands to millions of years for contaminants to travel from the base of the landfill to this aquifer.

The Gandy Marley Corporation considers the monitoring of the Lower Dockum aquifer not to be protective of human health and the environment and requests a waiver from these monitoring requirements for the following reasons:

- A VZMS will be implemented to detect potential leaks more effectively and in a more timely manner than monitoring wells installed in the Lower Dockum Formation

- The thick sequence (600-650 feet) of unsaturated, low permeability Lower Dockum mudstones provide an excellent geologic barrier to the downward migration of contaminants.

- The installation of monitoring wells in the Lower Dockum aquifer would potentially violate the integrity of geologic barrier provided by the thick sequence of mudstones and possibly create an avenue for contaminant migration.

- The Lower Dockum aquifer has artesian characteristics as demonstrated through a site specific investigation.

- A commitment exists from Gandy Marley to construct hazardous waste management units (HWMU) with leachate and release monitoring and retrieval systems.

This groundwater monitoring wavier has been prepared by qualified individuals and the proper certification is included in Appendix D.

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APPENDIX A
WATER QUALITY DATA

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES			
Local Identifier	Station Number	Date	Time
09S.29E.22. Bozart Well	333132103574701	07/15/40	--09S.29E.22.
09S.29E.22. Jess Beadle	333133103574801	06/19/40	--09S.29E.22.
09S.29E.35. Winsor Well	332857103564501	07/15/40	--09S.29E.35.
09S.29E.36. J Beadle WL	332857103554301	03/11/40	--09S.29E.36.
09S.30E.36. J Beadle	332858103554401	07/13/38	--09S.30E.36 J
09S.31E.26. Camino Well	333014103442201	08/13/82	1415 09S.31E.26.
09S.31E.26.440	333000103442401	05/25/70	1400 09S.31E.26.4
12S.30E.07. Culp Ranch	331705103574801	08/13/82	1015 12S.30E.07.
12S.30E.31. Culp Ranch Well	331803103542101	08/46/82	1210 12S.30E.31.C

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES						
Local Identifier	Date	Site	Geological Unit	Tempera ture Water (Deg C) (00010)	Agency Collecting Sample (Code Number) (00027)	Agency Analyzing Sample (Code Number) (00028)
09S.29E.22. Bozart	07/15/40	GW	--	--	1028	1028
09S.29E.22. Jess B	06/19/40	GW	231DCKM	--	1028	1028
09S.29E.35 Winsor	07/15/40	GW	231DCKM	--	1028	1028
09S.29E.36. J Beadle	03/11/40	GW	--	--	1028	1028
09S.30E.36. J Beadle	07/13/38	GW	--	--	1028	1028
09S.31E.26. Camino	08/13/82	GW	--	19.0	80020	80020
09S.31E.26.440	05/25/70	GW	231SNRS	--	--	--
12S.30E.07. Culp Ranch	08/13/82	GW	--	20.0	80020	80020
12S.30E.31. Culp Ranch Well	08/13/82	GW	--	18.5	80020	80020

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES						
Local Identifier	Date	PH Water Whole Lab (Standard Units) (00403)	Carbon Dioxide Dissolved (MG/L as CO2) (00405)	ANC Water Unfltrd Fet Field MG/L as CACO3 (00410)	ANC Water Unfltrd Fet Field MG/L as HCO3 (00440)	ANC Unfltrd Carb. Fet Field MG/L as CO3 (00445)
09S.29E.22. Bozart	07/15/40	--	--	--	880	28
09S.29E.22. Jess Beadle	06/19/40	--	--	--	160	0
09S.29E.35 Winsor	07/15/40	--	--	--	220	0
09S.29E.36. J Beadle	03/11/40	--	--	--	300	27
09S.30E.36 J Beadle	07/13/38	--	--	--	370	104
09S.31E.26. Camino	08/13/82	8.5	5.7	--	--	--
09S.31E.26.440	05/25/70	--	2.3	189	230	0
12S.30E.07. Culp Ranch	08/13/82	8.1	12	--	--	--
12S.30E.31. Culp Ranch Well	08/13/82	8.3	8.6	--	--	--

APPENDIX A

Figure APP-A

AutoCAD FILE: APPA-FIG

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES						
Local Identifier	Date	Calcium Dissolved (MG/L as CA (00915)	Magnesium Dissolved (MG/L as MG) (00925)	Sodium Dissolved (MG/L as NA) (00930)	Sodium Adsorption Ratio (00931)	Sodium Percent
09S.29E.22. Bozart	07/15/40	61	145	--	--	--
09S.29E.22. Jess Beadle	0619/40	1500	625	--	--	--
09S.29E.35. Winsor	07/15/40	480	519	--	--	--
09S.29E.36. J Beadle	03/11/40	360	808	--	--	--
09S.30E.36. J Beadle	07/13/38	200	840	--	--	--
09S.31E.26. Camino	08/13/82	23	5.9	140	7	78
09S.31E.26.440	05/25/70	23	5.5	--	7	--
12S.30E.07. Culp Ranch	08/13/82	77	28	120	3	46
12S.30E.31. Culp Ranch Well	08/13/82	50	8.9	13	.5	15

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES						
Local Identifier	Date	Sulfate Dissolved (MG/L as SO4) (00945)	Fluoride Dissolved (MG/L as F) (00950)	Silica Dissolved MG/L as SIO2) (00955))	Arsenic Dissolved (UG/L as AS) (01000)	Barium Dissolved (UG/L as BA) (01005)
09S.29E.22. Bozart	07/15/40	2400	--	--	--	--
09S.29E.22. Jess Beadle	0619/40	3600	--	--	--	--
09S.29E.35. Winsor	07/15/40	7400	--	--	--	--
09S.29E.36. J Beadle	03/11/40	11000	--	--	--	--
09S.30E.36. J Beadle	07/13/38	17000	--	--	--	--
09S.31E.26. Camino	08/13/82	110	.90	18	6	24
09S.31E.26.440	05/25/70	110	1.1	18	--	--
12S.30E.07. Culp Ranch	08/13/82	200	1.3	28	2	67
12S.30E.31. Culp Ranch Well	08/13/82	26	.30	31	5	140

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULIPLE STATION ANALYSES						
Local Identifier	Date	Iron Dissolved (UG/L as FE) (01046)	Lead Dissolved (UG/L as PB) (01049)	Manganese Dissolved (UG/L as AG) (01075)	Silver Dissolved (UG/L as AG) (01075)	Zinc Dissolved (UG/L as ZN) (01090)
09S.29E.22. Bozart	07/15/40	--	--	--	--	--
09S.29E.22. Jess Beadle	0619/40	--	--	--	--	--
09S.29E.35. Winsor	07/15/40	--	--	--	--	--
09S.29E.36. J Beadle	03/11/40	--	--	--	--	--
09S.30E.36. J Beadle	07/13/38	--	--	--	--	--
09S.31E.26. Camino	08/13/82	7.0	<1.0	1.0	<1.0	13
09S.31E.26.440	05/25/70	.0	--	--	--	--
12S.30E.07. Culp Ranch	08/13/82	8.0	<1.0	9.0	<1.0	240
12S.30E.31. Culp Ranch Well	08/13/82	19	<1.0	3.0	<1.0	150

APPENDIX A

Figure APP-A-sheet2

AutoCAD FILE: APPA-sheet2-FIG

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES						
Local Identifier	Date	Nitrogen Nitrate Dissolved (MG/L as N03) (71581)	Mercury Dissolved (UG/L as HG) (71890)	Elev. Of Land Surface Datum (Ft. Above NGVD) (72000)	Depth of Hole Total (Feet) (72001)	Depth Below Land Surface (Water Level) (Feet 72019)
09S.29E.22. Bozart	07/15/40	--	--	--	50	--
09S.29E.22. Jess Beadle	0619/40	--	--	--	258	--
09S.29E.35. Winsor	07/15/40	--	--	--	14	--
09S.29E.36. J Beadle	03/11/40	--	--	--	--	--
09S.30E.36. J Beadle	07/13/38	--	--	--	12	--
09S.31E.26. Camino	08/13/82	--	<.1	--	--	--
09S.31E.26.440	05/25/70	.00	--	--	271	115.00
12S.30E.07. Culp Ranch	08/13/82	--	<.1	3860	--	--
12S.30E.31. Culp Ranch Well	08/13/82	--	<.1	3970	--	--

APPENDIX A

Figure APP-A-sheet3

AutoCAD FILE: APPA-sheet3-FIG

APPENDIX B
PREVIOUS UNSATURATED FLOW MODELING RESULTS

B-1 Unsaturated Flow Modeling

Unsaturated flow modeling was performed to simulate potential leakage or infiltration from the proposed hazardous waste facilities. Site characterization data indicate unsaturated conditions in the strata underlying the proposed facilities. The unsaturated flow model developed by McKee and Bumb (1988) predicts the extent of wetting fronts emanating from leakage sources on the base of the landfill. Leakage rates were based on preliminary HELP (Hydrologic Evaluation of Landfill Performance) modeling results presented in Tables B-1, Triassic Park HELP Model Results Summary for Cell Floor and B-2, Triassic Park HELP Model Results Summary for Cell Slope. The modeling results help illustrate how the natural hydrological conditions at the site inhibit subsurface fluid flow. [Note: These HELP modeling results should not be confused with those presented in the engineering report in Volumes III and VI, which support the current landfill design.] The following simulation was performed to account for the heterogeneities at the site. The simulation predicts the soil moisture distribution in the Lower Dockum from leakage sources at the base of the landfill. The predicted wetting fronts led to the estimation of unsaturated hydraulic conductivities, darcy flux rates, interstitial water velocities and approximate contaminant travel times to the nearest aquifers. The primary modeling objectives include the following:

- prediction of the effective saturation distribution (wetting front) emanating from the landfill source; and,
- determination of the unsaturated hydraulic conductivity and advective transport rates.

TABLE B-1
TRIASSIC PARK HELP MODEL RESULT SUMMARY FOR CELL FLOOR

Time (years)	LCRS Operational Beyond 30 Years Post Closure			LCRS Not Operational Beyond 30 Years Post Closure		
	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)
0	1.3781	NA	0.1410	1.3781	NA	0.1410
20	0.9400	0.0454	0.1222	.9400	0.0454	0.1222
30	0.2735	0.0430	0.1181	0.2735	0.0430	0.1181
50	0.1927	0.0450	0.1125	3.4579	0.0450	0.1125
70	0.1329	0.0450	0.1087	8.0071	0.0450	0.1098
90	0.1007	0.0439	0.1059	9.1465	0.0439	0.1083
100	0.0775	0.0442	0.1049	8.5811	0.0442	0.1076
120	0.0744	0.0453	0.1029	8.8612	0.0453	0.1062
140	0.0629	0.0461	0.1013	8.6989	0.0461	0.1048
160	0.0547	0.0442	0.0999	8.5494	0.0442	0.1034
180	0.0482	0.0442	0.0987	8.4178	0.0442	0.1021
200	0.0431	0.0431	0.0976	8.2818	0.0442	0.1008

NA - Not Applicable
LCRS= Leakage collection and recovery system

TABLE B-2
TRIASSIC PARK HELP MODEL RESULT SUMMARY FOR CELL SLOPE[1]

Time (years)	LCRS Operational Beyond 30 Years Post Closure			LCRS Not Operational Beyond 30 Years Post Closure		
	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)	Liner Leakage (gal/acre/day)	Cap Leakage (gal/acre/day)	Final Waste Moisture Content (vol/vol)
0	173.0000	NA	0.1410	173.0000	NA	0.1414
20	123.0000	0.0453	0.1221	123.0000	0.0453	0.1223
30	53.5373	0.0442	0.1182	53.5373	0.0442	0.1182
50	37.0011	0.0453	0.1152	37.0282	0.0453	0.1152
70	24.5001	0.0461	0.1087	24.5114	0.0452	0.1087
90	18.0529	0.0442	0.1059	18.0583	0.0449	0.1059
100	13.6143	0.0425	0.1049	13.6174	0.0430	0.1049
120	12.9000	0.0443	0.1029	12.9032	0.0450	0.1029
140	10.7627	0.0439	0.1013	10.7642	0.0450	0.1013
160	9.2002	0.0457	0.0999	9.2030	0.0439	0.0999
180	8.0161	0.0462	0.0987	8.0178	0.0457	0.0987
200	7.0994	0.0461	0.0976	7.1002	0.0462	0.0976

Notes: [1]Initial HELP Modeling Results were based on landfill liner system without double liner system on side slopes. These should not be confused with HELP results presented in the Engineering Report.
NA - Not Applicable
LCRS = Leakage collection and recovery system.

B-2 Modeling Methodology

Unsaturated flow modeling was performed using the exact steady state solution developed by McKee and Bumb (1988) and Bump and McKee et al. (1988). The steady state solution derived from the Richards equation (1931) of unsaturated flow provides more conservative results in lieu of transient based solutions. The McKee and Bumb (1988) and Bumb and McKee et al. (1988) steady state solution for a continuous point source in an infinite isotropic medium is governed by the following equations.

(EQ. 1)

$$\Delta h_{\infty} = \frac{Q^{\exp\left[\frac{a}{2}\left(z-z'-\sqrt{r^2+(z-z')^2}\right)\right]}}{4p\sqrt{r^2+(z-z')^2}}$$

(EQ. 2)

where

$$r = \sqrt{(x-x')-(y-y')^2}$$

(EQ. 3)

Δh = hydraulic potential

$$S = S_r + (S_m - S_r)(a h / K_o)^{1/n}$$

(EQ. 4)

or

$$S_e = \left(ah / K_o\right)^{1/n}$$

At the Facility site, the evapotranspiration rate is high with respect to precipitation (TerraMatrix/Montgomery Watson, 1997). According to McKee and Bumb (1988), the soils in semi-arid regions of the western United States are at or below residual saturation (Sr). Therefore, the observed initial moisture contents are probably at or near the residual moisture content. Generally, fluid flow is inhibited at soil moisture contents at or below the residual moisture content. The amount of saturation above the residual moisture content is referred to as the effective saturation. Unsaturated hydraulic conductivity is a function of the effective saturation and is expressed in the following equation (McKee and Bumb, 1988; Bumb and McKee et al., 1988):

(EQ. 5)

$$K(q) = K_0 S_e^n$$

Brooks and Corey (1964) correlated the *n* exponent with the pore size distribution index α. McKee and Bumb (1988) by confirmation of theoretical derivations by Irmay (1954) suggest an optimal value of 3 for η.

Under steady state conditions flow is driven by the force of gravity as the matric potential approaches unity (Hillel, 1980). Therefore, under steady state conditions the unsaturated hydraulic conductivity is equal to the darcy flux which in turn is multiplied by the unit area to obtain a leakage or discharge rate (Q). The following equations express these relationships:

(EQ. 6)

$$q(q\ ) = K(q\ );$$

(EQ. 7)

$$Q = \frac{q(q\ )}{\mathrm{A}}$$

The average interstitial water velocity (v) was used to estimate advective transport rates of non-reactive conservative solutes. Approximate travel times to the nearest aquifers can be estimated from the interstitial water velocity using the following expression:

$$v = q / q$$ (EQ. 8)

In summary, modeling assumptions include steady state unsaturated flow in an infinite domain, a continuous leakage source, flow through porous medium, complete saturation of the soil beneath the source, and initial uniform saturation of the medium. The modeling does not account for secondary permeability features such as faults, fractures and macropores.

B-3 Input Parameters

Input parameters and initial boundary conditions were based on observed field conditions, landfill design specification, and preliminary HELP modeling results [Note: These preliminary HELP modeling results were based on a landfill liner design which did not incorporate a double liner system on the side slope areas. These results should not be confused with the HELP modeling results presented in the engineering report in Volume III and VI. The results presented in the engineering report support the currently proposed landfill design which incorporates a double liner in all areas and does not indicate any leakage from the landfill.] Average hydraulic parameters for the Lower Dockum and landfill design specifications are presented in this section. Input parameters used for the unsaturated flow modeling are presented in Table B-3, Input Parameters for Unsaturated Flow Modeling.

Modeled source coordinates correspond to the basal dimensions of the proposed landfill. Conservative average leakage rates from the preliminary HELP modeling were used as source terms along the base (8.58 gpd) of the landfill to provide conservative “worst case” estimate of unsaturated flow. The leakage rate for the floor of the landfill was based on HELP modeling simulations between 70 and 200 years. The initial leakage rates for the first 50 years of HELP modeling were excluded from the average because these rates were extremely low and probably not representative of steady state conditions. These simulated leakage rates are based on extreme conditions such as waste moisture content conditions which exceed the field capacity of the waste and a termination of leachate pumping following the 30-year post-closure period.

Average site-specific saturated hydraulic conductivity values for the Lower Dockum (5.68×10^{-8} cm/s) were used as initial conditions for the modeling simulations. The effective saturation values for the Lower Dockum simulation was based on site-specific average initial moisture contents (TerraMatrix/Montgomery Watson, 1997). The bubbling pressures for the Lower Dockum simulation was based on average values of similar types of geologic materials reported by Bumb and McKee et al. (1988). Initial boundary conditions are presented in Figure B-1, which shows a schematic of the proposed landfill and surrounding hydrostratigraphy. As displayed in Figure B-2, the Lower Dockum Aquifer is approximately 600 feet (200 meters) below the site.

B-4 Modeling Results

The steady state unsaturated flow modeling results are presented in Figures B-2 through B-5. The Lower Dockum results are presented as a function of depth from the source. The results of the modeling simulations are in reference to the landfill source.

Figure B-2 displays the effective saturation at various distances from the source. As the wetting front disperses from the landfill source the chart shows abrupt decreases in saturation. Although the effective saturation dissipates less rapidly in the Lower Dockum, moisture contents decrease by nearly one order of magnitude at approximately 200 meters from the landfill source. The modeling results indicate that the Lower Dockum maintains saturation because fluid movement is driven primarily by gravitational forces; therefore fluid migration is greatest in the vertical direction.

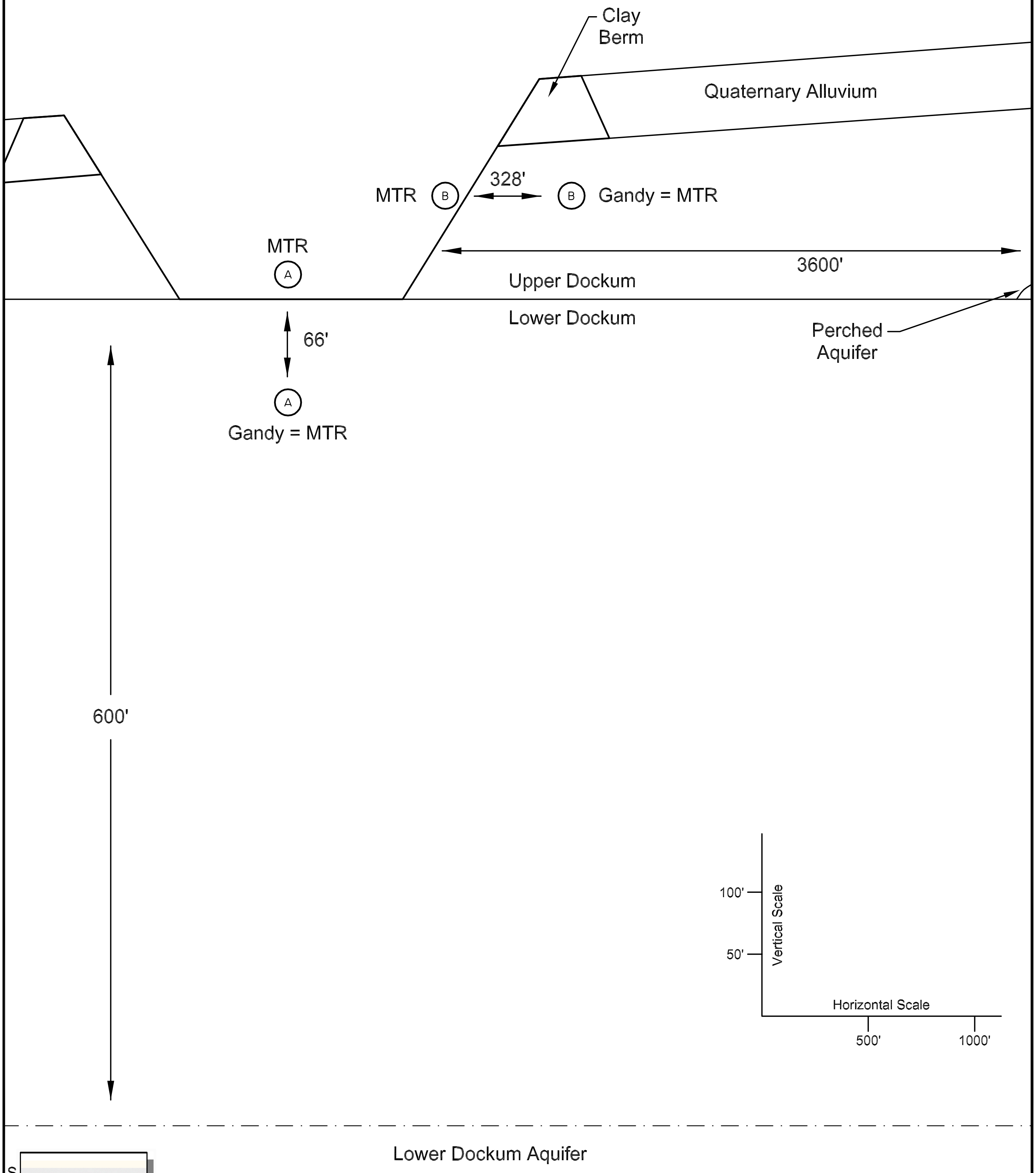
Figures B-3 and B-4 display the unsaturated hydraulic conductivity and interstitial water velocity results, respectively. Comparison of these data to the effective saturation distributions (Figure B-2) show the high degree of correlation between unsaturated flow and soil moisture content. Figures B-3 and B-4 show abrupt decreases in unsaturated hydraulic conductivity and interstitial water velocity, respectively, at relatively short distances from the source. Although Figure B-4 shows that the interstitial water velocities decrease exponentially over distance, gross travel times may be estimated. The simulated interstitial water velocities were used to compute the contaminant travel time for a non-reactive solute from the base of the landfill to the Lower Dockum Aquifer, located approximately 200 meters (600 feet) below the site, as at 4,084,674 years.

TABLE B-3
INPUT PARAMETERS FOR UNSATURATED FLOW MODELING

	b	Ko			Q		a	Source Coordinates (m)		
Unit	**(m)**	**(m/day)**	**Sr**	**Sm**	**(m^3/day)**	**n**	**1/m**	**x[1]**	**y[1]**	**z[1]**
Lower Dockum	0.373	4.90E-05	0.279	1	8.00E-05	3	8.042	0, 33, 66, 99, 132, 165, 193, 231, 264, 297, 330, 363, 396, 429, 462	0	0
Upper Dockum	0.2076	1.05E-02	0.161	1	3.80E-05	3	14.45	5.5, 11, 16.5, 22, 27.5, 33, 38.5, 44, 49.5, 55, 60.5, 66, 71.5, 77	0	24.5, 22.6, 20.72, 18.84, 16.96, 15.07, 13.19, 11.31, 9.42, 7.54, 5.65, 3.77, 1.88, 0
Clay Berm	0.37	8.64E-05	0.126[a]	1	3.80E-05	3	8.108	0, 5.5, 11	0	3.77, 1.88, 0
Quaternary Alluvium	0.0726[a]	8.64E-02	0.0458[a]	1	3.80E-05	3	41.32	0, 5.5, 11	0	3.77, 1.88, 0

Key:

b = bubbling pressure; typical values reported by Bumb and Mckee et al. (1988)
Ko = saturated hydraulic conductivity; site-specific means values
Sm = maximum saturation; assumed
Sr = residual saturation; site-specific mean values
Q = leakage rate; based on HELP modeling results
n = curve fitting parameter based on pre size index (Mckee and Bumb, 1988)
a = n/*b*
1 = Typical values reported by Bumb and Mckee et al (1988)
a = typical values reported by Bumb and Mckee et al. (1988)
b = assumed values

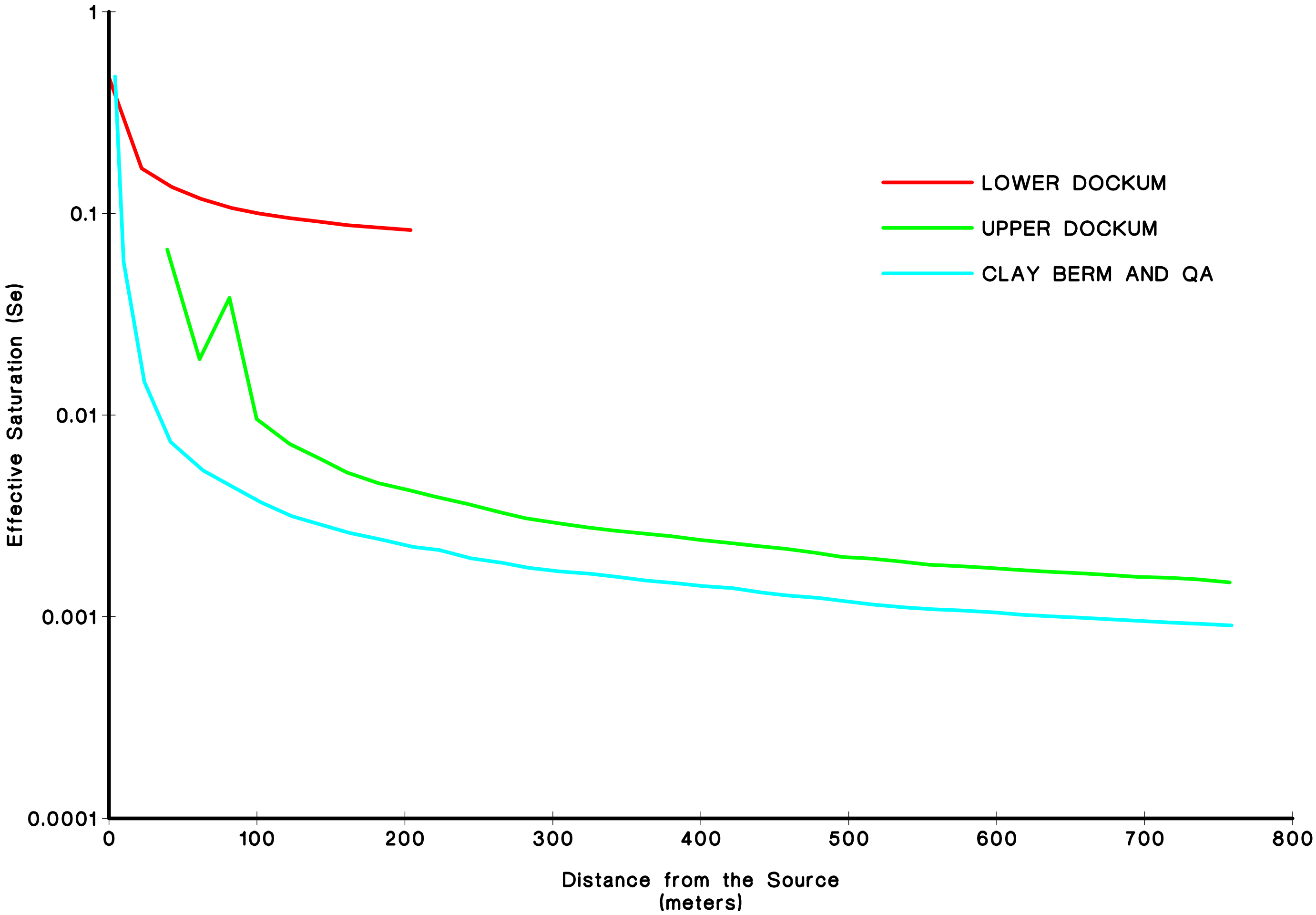


LANDFILL PROFILE

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure B-1

AutoCAD FILE: *GANDY-FIGB-1*

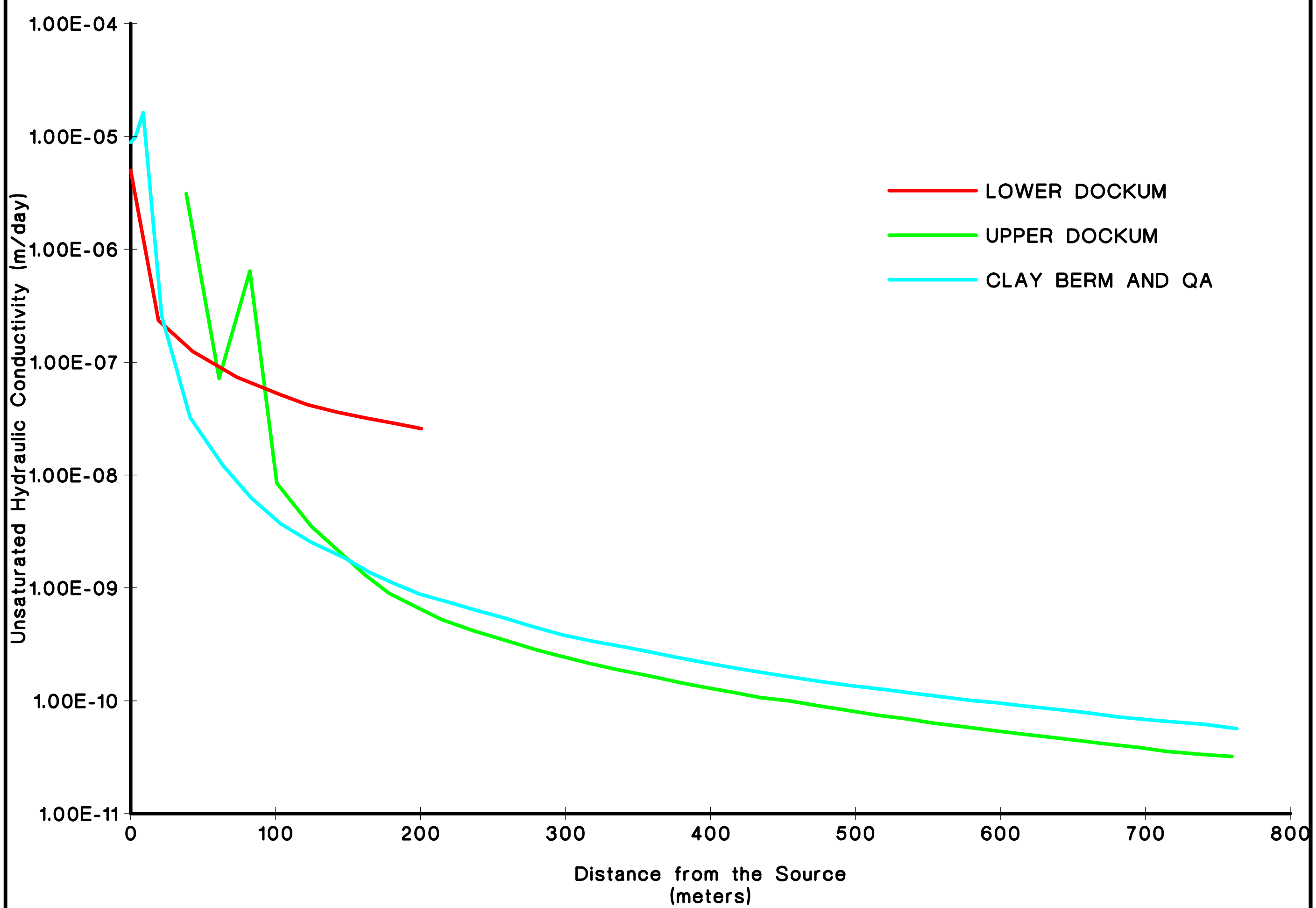


STEADY STATE EFFECTIVE SATURATION vs. DISTANCE FROM SOURCE

Figure B-2

TRIASSIC PARK WASTE DISPOSAL FACILITY

AutoCAD FILE: GANDY-FIGB-2

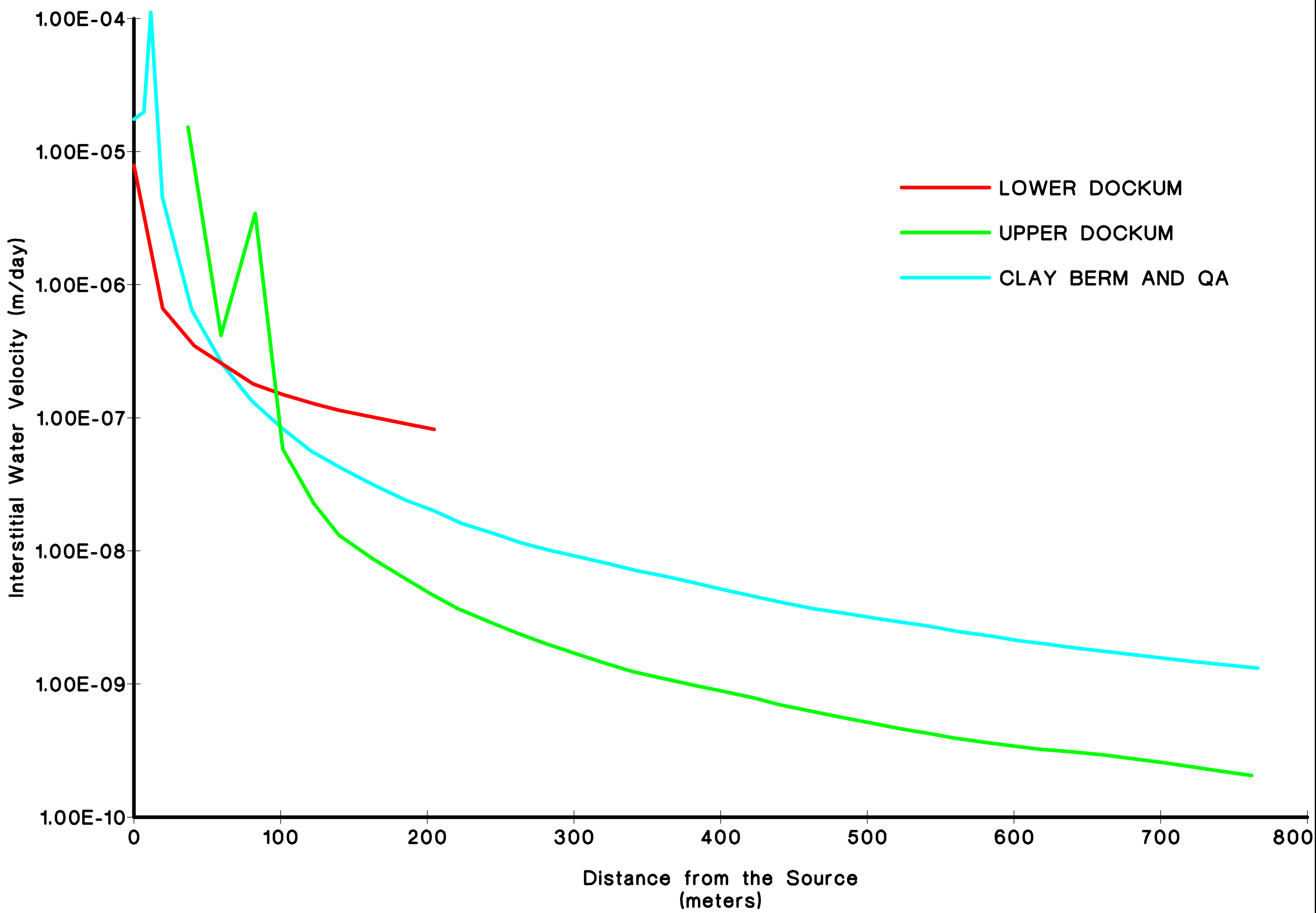


STEADY STATE UNSATURATED HYDRAULIC CONDUCTIVITY vs. DISTANCE FROM SOURCE

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure B-3

AutoCAD FILE: GANDY-FIGB-3

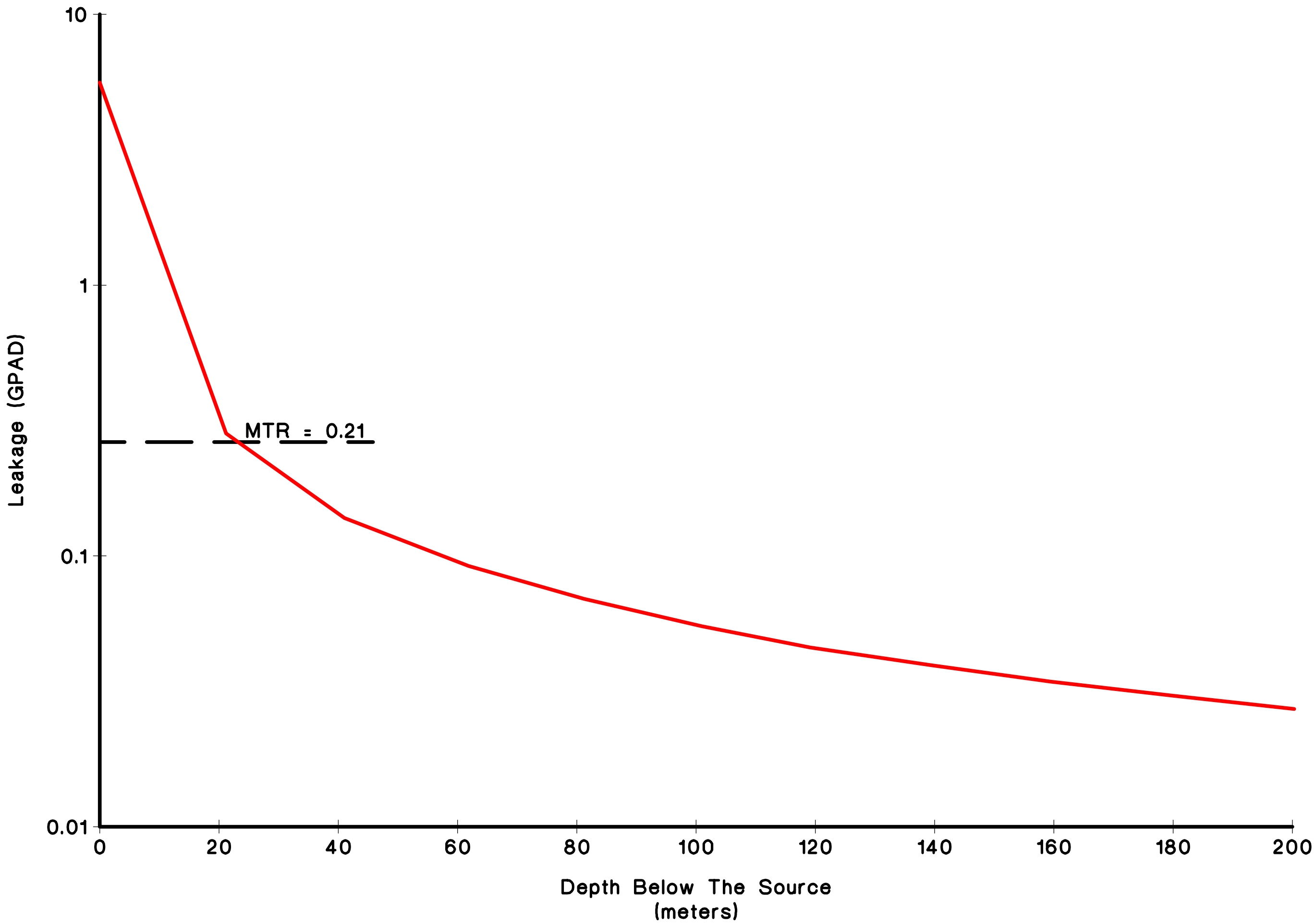


INTERSTITIAL WATER VELOCITY vs. DISTANCE FROM SOURCE

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure B-4

AutoCAD FILE: GANDY-FIGB-4



STEADY STATE LEAKAGE INTO LOWER DOCKUM vs.DISTANCE FROM SOURCE

Figure B-5

TRIASSIC PARK WASTE DISPOSAL FACILITY

AutoCAD FILE: GANDY-FIGB-5

APPENDIX C
MULTIMED FLOW MODELING RESULTS

C-1 MULTIMED Boundary Conditions

Model boundary condition are important for successful simulations since they define the theoretical constraints of the model and reflect inherent assumptions necessary to translate a real physical system into the virtual mathematical system of the computer model. The boundary conditions used for the model are described below in Table C-1, Triassic Park MULTIMED Model Boundary Conditions.

TABLE C-1
TRIASSIC PARK MULTIMED MODEL BOUNDARY CONDITIONS

Parameter	Parameter Value	Justification
Recharge	0.0 m/yr – all Trials	To keep infiltrating contaminants over the area outside the landfill from being diluted by rainfall **(MCA)**. This condition will result in more conservative contaminant concentrations at the receptor well
Leachate Infiltration Rate	0.84 in/yr – Trial 1 0.42 in/yr – Trial 2 0.60 in/yr – Trial 3	Equal to the unsaturated hydraulic conductivity **(MCA)** – Trial 1 Equal to the net recharge rate – Trial 2 Maximum infiltration rate that model will accept – Trial 3
Area of Waste Disposal Unit	9.00 m^2 – all Trials	This is the size of the hypothetical liner flaw in the vicinity of the leachate sump. Due to construction quality assurance programs, a liner flaw of this magnitude is highly improbable **(MCA)**.
Contaminant Concentration	1.0 ppm – all Trials	This condition implies that the contaminant mass in the system will not be depleted by setting it to a constant 1.0 ppm during the entire transport simulation period
Contaminant Decay	0.00 – all Trials	To allow the maximum concentration of leachate to travel through the subsurface **(MCA)**
Retardation	0.00 – all Trials	To allow the fastest possible contaminant transport through the subsurface **(MCA)**
Groundwater Table Mixing Zone	0.1 m – all Trials	To reduce the dilution effects of the untainted groundwater on the contaminant concentration

C-2 MULTIMED Unsaturated and Saturated Zone Input Parameters

Since the model simulates flow and transport in the unsaturated and saturated zones, geologic characteristics of the subsurface are necessary as input to the model. These variables, derived from published literature and the site-specific geologic investigation are discussed below in Table C-2, Triassic Park MULTIMED Unsaturated Zone Input Parameters and Table C-3, Triassic Park MULTIMED Saturated Zone Input Parameters.

TABLE C-2 TRIASSIC PARK MULTIMED UNSATURATED ZONE INPUT PARAMETERS		
Parameter	**Parameter Value**	**Justification**
Saturated Hydraulic Conductivity	6.8×10^{-8} cm/s – Trial 1 6.8×10^{-8} cm/s – Trial 2 1.0×10^{-5} cm/s - Trial 3	Maximum value obtained from core samples of Lower Dockum tested in the lab **(MCA)** – Trials 1 & 2 Maximum value obtained from core samples of Upper Dockum tested in the lab – Trial 3
Effective Porosity	0.23 – Trial 1 0.23 – Trial 2 0.30 – Trial 3	50% of literature value for siltstones (Dean et al. 1989) for the most conservative value– Trials 1 & 2 Estimated literature value for aquifer-type materials –Trial 3
Residual Water Content	0.116– all Trials	Average in-situ moisture content of the Chinle Formation claystones as measured in 10 core samples (Weaver et al, 1997)
Air Entry Pressure	1.00 m – all Trials	Selected from published literature value for siltstone (Weaver et al., 1997)
Van Genuchten Alpha (α) coefficient	0.005 – all Trials	Selected from published literature value for silty clays and clayey silts (Weaver et al., 1997)
Van Genuchten Beta (β) coefficient	1.09 – all Trials	Selected from published literature value for silty clays and clayey silts (Weaver et al., 1997)
Thickness of Layer	183 m – Trial 1 183 m – Trial 2 1.0 m – Trial 3	Thickness of vadose zone in Lower Dockum – Trial 1 Thickness of vadose zone in Lower Dockum – Trial 1 To create a lateral simulation to a perched water table along the Upper Dockum/Lower Dockum contact
Longitudinal Dispersivity	1.00 – all Trials	To avoid excessively high dispersion as suggested in the MULTIMED program documentation

TABLE C-3 TRIASSIC PARK MULTIMED SATURATED ZONE INPUT PARAMETERS		
Parameter	**Parameter Value**	**Justification**
Saturated Hydraulic Conductivity	30.0 m/yr – Trial 1 30.0 m/yr – Trial 2 3.15 m/yr - Trial 3	Estimated value for Lower Dockum aquifer – Trial 1 Estimated value for Lower Dockum aquifer – Trial 2 Estimated value for lateral travel along Upper/Lower Dockum contact – Trial 3
Aquifer Thickness	30.0 – Trial 1 30.0 – Trial 2 3.00 – Trial 3	Estimated value for Lower Dockum aquifer – Trial 1 Estimated value for Lower Dockum aquifer – Trial 2 Estimated value for perched aquifer along Upper/Lower Dockum contact – Trial 3
Hydraulic Gradient	.01 – all	Estimated value for site
Distance to Receptor Well	1.00 m – Trial 1 1.00 m – Trial 2 1120 m – Trial 3	To obtain point of compliance for upper aquifer – Trial 1 To obtain point of compliance for upper aquifer – Trial 2 To perched aquifer approx. 1120 m from the landfill

TRIAL 1
MULTIMED INPUT AND OUTPUT FILES

```
DEFAULT
CASE


GENERAL DATA

***  CHEMICAL NAME FORMAT(80A1)
DEFAULT CHEMICAL

***    ISOURC                            ROUTE      NT       IYCHK   PALPH
APPTYP
***OPTION   OPTAIR  RUN              MONTE    ISTEAD     IOPEN     IZCHK
LANDF   COMPLETE
    2    0    0     DETERMINISTIC    500    1    0   25    1    0    0 90.0    0
1    1


***   XST


*** TIME STEPPING PARAMETERS FOR SATURATED ZONE MODEL
 1600.00   1625.00   1650.00   1675.00   1700.00   1725.00   1750.00   1775.00
1800.00   1825.00
 1850.00   1875.00   1900.00   1925.00   1950.00   1975.00   2000.00   2025.00
2050.00   2075.00
 2100.00   2125.00   2150.00   2175.00   2200.00

END GENERAL

CHEMICAL SPECIFIC VARIABLE DATA
ARRAY VALUES
***      CHEMICAL SPECIFIC VARIABLES

***            VARIABLE NAME               UNITS              DISTRIBUTION
PARAMETERS            LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Solid phase decay coeff (1/yr)                                    -1      -
999.     -999.     0.000E+00 0.100E+11
 2 Diss phase decay coeff (1/yr)                                     -1      -
999.     -999.     0.000E+00 0.100E+11
 3 Overall chem dcy coeff (1/yr)                                     -1      -
999.     -999.     0.000E+00 0.100E+11
 4 Acid cataly hydrol rte(l/M-yr)                                     0
0.000E+00 -999.     0.000E+00 -999.
 5 Neutral hydrol rate cons(1/yr)                                     0
0.000E+00 -999.     0.000E+00 -999.
 6 Base cataly hydrol rte(l/M-yr)                                     0
0.000E+00 -999.     0.000E+00 -999.
 7 Reference temperature (C)                                          0
20.0     -999.     0.000E+00  100.
 8 Normalized distrib coeff(ml/g)                                     0
0.000E+00 -999.     0.000E+00 -999.
```

```
 9 Distribution coefficient                                            -1      -
999.     -999.     0.000E+00 0.100E+11
10 Biodegrad coef(sat zone)(1/yr)                                       0
0.000E+00 -999.     0.000E+00 -999.
11 Air diffusion coeff (cm2/s)                                          0
0.000E+00 -999.     0.000E+00  10.0
12 Ref temp for air diffusion (C)                                       0
20.0     -999.     0.000E+00  100.
13 Molecular weight (g/mole)                                            0
0.000E+00 -999.     0.000E+00 -999.
14 Mole fraction of solute                                              0
0.000E+00 -999.     0.100E-08  1.00
15 Solute vapor pressure (mm Hg)                                        0
0.000E+00 -999.     0.000E+00  100.
16 Henry`s law cons (atm-m^3/M)                                         0
0.000E+00 -999.     0.100E-09  1.00
17 Not in use                                                           0      -
999.     -999.     0.000E+00  1.00
18 Not in use                                                           0      -
999.     -999.     0.000E+00  1.00
19 Not in use                                                           0      -
999.     -999.     0.000E+00  1.00
END ARRAY

END CHEMICAL SPECIFIC VARIABLE DATA



SOURCE SPECIFIC VARIABLE DATA
ARRAY VALUES
***         SOURCE SPECIFIC VARIABLES

***              VARIABLE NAME                UNITS               DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Infiltration rate (m/yr)                                             0
0.214E-01 -999.     0.100E-09 0.100E+11
 2 Area of waste disp unit (m^2)                                        0
9.00     -999.     0.100E-01 -999.
 3 Duration of pulse (yr)                                               0
0.100E+04 -999.     0.100E-08 -999.
 4 Spread of contaminant srce (m)                                      -1      -
999.     -999.     0.100E-08 0.100E+11
 5 Recharge rate (m/yr)                                                 0
0.000E+00 -999.     0.000E+00 0.100E+11
 6 Source decay constant (1/yr)                                         0
0.000E+00 -999.     0.000E+00 -999.
 7 Init conc at landfill (mg/l)                                         0
1.00     -999.     0.000E+00 -999.
 8 Length scale of facility (m)                                        -1      -
999.     -999.     0.100E-08 0.100E+11
 9 Width scale of facility (m)                                         -1      -
999.     -999.     0.100E-08 0.100E+11
```

```
END ARRAY

END SOURCE SPECIFIC VARIABLE DATA



VFL   UNSATURATED FLOW MODEL PARAMETERS


CONTROL PARAMETERS
***    DUMMY     NMAT      KPROP     DUMMY    NVFLAY
         7         1         1         1         1


END CONTROL PARAMETERS
SATURATED MATERIAL PROPERTY PARAMETERS
ARRAY VALUES
***   SATURATED MATERIAL   VARIABLES

***            VARIABLE NAME                UNITS               DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Sat hydraulic conduct (cm/hr)                                    0
0.245E-03 -999.     0.100E-10 0.100E+05
 2 Unsaturated zone porosity                                        0
0.230     -999.     0.100E-08 0.990
 3 Air entry pressure head (m)                                      0
0.100     -999.     0.000E+00 -999.
 4 Depth of the unsat zone (m)                                      0
183.     -999.     0.100E-08 -999.
END ARRAY

END MATERIAL  1
END
SOIL MOISTURE PARAMETERS
***   FUNCTIONAL COEFFICIENTS
ARRAY VALUES
***   FUNCTIONAL COEFFICIE VARIABLES

***            VARIABLE NAME                UNITS               DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Residual water content                                           0
0.116     -999.     0.100E-08  1.00
 2 Brooks and Corey exponent, EN                                    0      -
999.     -999.     0.000E+00  10.0
 3 ALFA van Genuchten coefficient                                   0
0.500E-02 -999.     0.000E+00  1.00
```

```
 4 BETA Van Genuchten coefficient                                    0
1.09     -999.      1.00      5.00
END ARRAY

END MATERIAL  1
END
END UNSATURATED FLOW




VTP    UNSATURATED TRANSPORT MODEL
CONTROL PARAMETERS
***   NLAY     DUMMY      IADU      ISOL         N      NTEL     NGPTS       NIT
DUMMY     DUMMY
         1        20         1         1        18         3       104         2
1         1
***  WTFUN
     1.200


END CONTROL PARAMETERS
TRANSPORT PARAMETER
ARRAY VALUES
***   UNSATURATED TRANSPOR VARIABLES

***            VARIABLE NAME                UNITS               DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Thickness of layer (m)                                            0
183.     -999.     0.100E-08 -999.
 2 Longit disper of layer (m)                                       -1
1.00     -999.     0.100E-02 0.100E+05
 3 Percent organic matter                                            0
0.000E+00 -999.     0.000E+00  100.
 4 Bulk dens of soil layer (g/cc)                                    0
1.83     -999.     0.100E-01  5.00
 5 Biological decay coeff (1/yr)                                     0
0.000E+00 -999.     0.000E+00 -999.
END ARRAY

END LAYER  1
END UNSATURATED TRANSPORT PARAMETERS
END TRANSPORT MODEL
AQUIFER SPECIFIC VARIABLE DATA
ARRAY VALUES
***       AQUIFER SPECIFIC VARIABLES

***            VARIABLE NAME                UNITS               DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX
```

```
********************************************************************************
****************************************
 1 Particle diameter (cm)                                                0
0.500E-01 -999.     0.100E-08  100.
 2 Aquifer porosity                                                      0
0.300     -999.     0.100E-08 0.990
 3 Bulk density (g/cc)                                                   0
1.70     -999.     0.100E-01  5.00
 4 Aquifer thickness (m)                                                 0
30.0     -999.     0.100E-08 0.100E+06
 5 Mixing zone depth (m)                                                -1
0.100     -999.     0.100E-08 0.100E+06
 6 Hydraulic conductivity (m/yr)                                         0
30.0     -999.     0.100E-06 0.100E+09
 7 Hydraulic Gradient                                                    0
0.100E-01 -999.     0.100E-07 -999.
 8 Grndwater seep velocity (m/yr)                                       -1      -
999.     -999.     0.100E-09 0.100E+09
 9 Retardation coefficient                                              -1
1.00     -999.      1.00     0.100E+09
10 Longitudinal dispersivity (m)                                        10
1.00     -999.     -999.     -999.
11 Transverse dispersivity (m)                                          10      -
999.     -999.     0.100E-02 0.100E+05
12 Vertical dispersivity (m)                                            10      -
999.     -999.     -999.     -999.
13 Temperature of aquifer (C)                                            0
20.0     -999.     0.000E+00  100.
14 pH                                                                    0
7.00     -999.     0.300      14.0
15 Organic carbon content (fract)                                        0
0.000E+00 -999.     0.100E-05  1.00
16 Receptor distance from site(m)                                        0
1.00     -999.      1.00     -999.
17 Angle off center (degree)                                             0
0.000E+00 -999.     0.000E+00  360.
18 Z-dist from watertable (fract)                                        0
0.000E+00 -999.     0.000E+00  1.00
END ARRAY

END AQUIFER SPECIFIC VARIABLE DATA



END ALL DATA
```

1

U. S. E N V I R O N M E N T A L P R O T E C T I O N A G E N C Y

E X P O S U R E A S S E S S M E N T

M U L T I M E D I A M O D E L

MULTIMED (Version 1.01, June 1991)

1

Run options
--- -------

DEFAULT

CASE

Chemical simulated is DEFAULT CHEMICAL

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration input by user
Run was transient
Reject runs if Y coordinate outside plume
Reject runs if Z coordinate outside plume
Gaussian source used in saturated zone model

1
1
UNSATURATED ZONE FLOW MODEL PARAMETERS
(input parameter description and value)

```
NP      - Total number of nodal points                  240
NMAT    - Number of different porous materials            1
KPROP   - Van Genuchten or Brooks and Corey               1
IMSHGN  - Spatial discretization option                   1
NVFLAYR - Number of layers in flow model                  1
```

OPTIONS CHOSEN
------- ------
Van Genuchten functional coefficients
User defined coordinate system
1

Layer information

LAYER NO.	LAYER THICKNESS	MATERIAL PROPERTY
1	183.00	1

DATA FOR MATERIAL 1
---- --- --------
VADOSE ZONE MATERIAL VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Saturated hydraulic conductivity	cm/hr	CONSTANT	0.245E-03	-999.	0.100E-10	0.100E+05
Unsaturated zone porosity	--	CONSTANT	0.230	-999.	0.100E-08	0.990
Air entry pressure head	m	CONSTANT	0.100	-999.	0.000E+00	-999.
Depth of the unsaturated zone	m	CONSTANT	183.	-999.	0.100E-08	-999.

DATA FOR MATERIAL 1
---- --- --------
VADOSE ZONE FUNCTION VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	LIMITS

```
MEAN     STD DEV      MIN         MAX
           -----------------------------------------------------------------------
---------------------------------------------------
           Residual water content                  --         CONSTANT
0.116     -999.       0.100E-08   1.00
           Brook and Corey exponent,EN             --         CONSTANT
-999.     -999.       0.000E+00   10.0
           ALFA coefficient                       1/cm        CONSTANT
0.500E-02 -999.       0.000E+00   1.00
           Van Genuchten exponent, ENN             --         CONSTANT
1.09     -999.        1.00       5.00
1

 UNSATURATED ZONE TRANSPORT MODEL PARAMETERS

 NLAY   - Number of different layers used                1
 NTSTPS - Number of time values concentration calc      40
 DUMMY  - Not presently used                             1
 ISOL   - Type of scheme used in unsaturated zone        1
 N      - Stehfest terms or number of increments        18
 NTEL   - Points in Lagrangian interpolation             3
 NGPTS  - Number of Gauss points                       104
 NIT    - Convolution integral segments                  2
 IBOUND - Type of boundary condition                     2
 ITSGEN - Time values generated or input                 1
 TMAX   - Max simulation time              --           0.0
 WTFUN  - Weighting factor                 --           1.2


 OPTIONS CHOSEN
 ------- ------
 Stehfest numerical inversion algorithm
 Nondecaying pulse source
 Computer generated times for computing concentrations
1

                                                     DATA FOR LAYER   1
                                                     ---- --- -----
                                                     VADOSE TRANSPORT VARIABLES


           -----------------------------------------------------------------------
---------------------------------------------------
                       VARIABLE NAME                UNITS      DISTRIBUTION
PARAMETERS              LIMITS

MEAN     STD DEV      MIN         MAX
           -----------------------------------------------------------------------
---------------------------------------------------
           Thickness of layer                      m          CONSTANT
183.     -999.       0.100E-08  -999.
           Longitudinal dispersivity of layer      m          DERIVED
1.00     -999.       0.100E-02  0.100E+05
           Percent organic matter                  --         CONSTANT
0.000E+00 -999.       0.000E+00   100.
```

Bulk density of soil for layer	g/cc	CONSTANT	1.83	-999.	0.100E-01	5.00
Biological decay coefficient	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.

1

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Solid phase decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Base catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Reference temperature	C	CONSTANT	20.0	-999.	0.000E+00	100.
Normalized distribution coefficient	ml/g	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Distribution coefficient	--	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00	-999.	0.000E+00	10.0
Reference temperature for air diffusion	C	CONSTANT	20.0	-999.	0.000E+00	100.
Molecular weight	g/M	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Mole fraction of solute	--	CONSTANT	0.000E+00	-999.	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00	-999.	0.000E+00	100.
Henry`s law constant	atm-m^3/M	CONSTANT	0.000E+00	-999.	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00

1

SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.214E-01	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	9.00	-999.	0.100E-01	-999.
Duration of pulse	yr	CONSTANT	0.100E+04	-999.	0.100E-08	-999.
Spread of contaminant source	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.000E+00	-999.	0.000E+00	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Initial concentration at landfill	mg/l	CONSTANT	1.00	-999.	0.000E+00	-999.
Length scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Width scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Particle diameter	cm	CONSTANT	0.500E-01	-999.	0.100E-08	100.
Aquifer porosity	--	CONSTANT	0.300	-999.	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.70	-999.	0.100E-01	5.00
Aquifer thickness	m	CONSTANT	30.0	-999.	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	m	DERIVED	0.100	-999.	0.100E-08	0.100E+06
Conductivity (hydraulic)	m/yr	CONSTANT	30.0	-999.	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.100E-01	-999.	0.100E-07	-999.
Groundwater seepage velocity	m/yr	DERIVED	-999.	-999.	0.100E-09	0.100E+09

```
            Retardation coefficient                   --          DERIVED
1.00     -999.        1.00      0.100E+09
            Longitudinal dispersivity                 m           FUNCTION OF X
1.00     -999.       -999.      -999.
            Transverse dispersivity                   m           FUNCTION OF X
-999.     -999.       0.100E-02  0.100E+05
            Vertical dispersivity                     m           FUNCTION OF X
-999.     -999.       -999.      -999.
            Temperature of aquifer                    C           CONSTANT
20.0     -999.       0.000E+00   100.
            pH                                        --          CONSTANT
7.00     -999.       0.300       14.0
            Organic carbon content (fraction)                     CONSTANT
0.000E+00 -999.       0.100E-05   1.00
            Well distance from site                   m           CONSTANT
1.00     -999.        1.00      -999.
            Angle off center                       degree         CONSTANT
0.000E+00 -999.       0.000E+00   360.
            Well vertical distance                    m           CONSTANT
0.000E+00 -999.       0.000E+00   1.00
1
```

TIME	CONCENTRATION
----	-------------
0.160E+04	0.00000E+00
0.162E+04	0.18903E-01
0.165E+04	0.43355E-01
0.167E+04	0.67807E-01
0.170E+04	0.93490E-01
0.172E+04	0.12078E+00
0.175E+04	0.14807E+00
0.177E+04	0.17521E+00
0.180E+04	0.20227E+00
0.182E+04	0.22900E+00
0.185E+04	0.25506E+00
0.187E+04	0.28085E+00
0.190E+04	0.30624E+00
0.192E+04	0.33150E+00
0.195E+04	0.35680E+00
0.197E+04	0.38238E+00
0.200E+04	0.40832E+00
0.202E+04	0.43455E+00
0.205E+04	0.46138E+00
0.207E+04	0.48841E+00
0.210E+04	0.51584E+00
0.212E+04	0.54321E+00
0.215E+04	0.57044E+00
0.217E+04	0.59721E+00
0.220E+04	0.62307E+00

Vtrnspt

CONCENTRATION AT BOTTOM OF VADOSE ZONE
RUN NO. 1

```
AT TIME = 0.1385E+04  CONC = -.4778E-01
AT TIME = 0.1505E+04  CONC = -.5522E-02
AT TIME = 0.1606E+04  CONC = 0.7461E-01
AT TIME = 0.1689E+04  CONC = 0.1696E+00
AT TIME = 0.1759E+04  CONC = 0.2580E+00
AT TIME = 0.1817E+04  CONC = 0.3311E+00
AT TIME = 0.1865E+04  CONC = 0.3897E+00
AT TIME = 0.1905E+04  CONC = 0.4373E+00
AT TIME = 0.1939E+04  CONC = 0.4767E+00
AT TIME = 0.1967E+04  CONC = 0.5097E+00
AT TIME = 0.2017E+04  CONC = 0.5701E+00
AT TIME = 0.2067E+04  CONC = 0.6326E+00
AT TIME = 0.2117E+04  CONC = 0.6964E+00
AT TIME = 0.2167E+04  CONC = 0.7598E+00
AT TIME = 0.2217E+04  CONC = 0.8200E+00
AT TIME = 0.2267E+04  CONC = 0.8739E+00
AT TIME = 0.2317E+04  CONC = 0.9186E+00
AT TIME = 0.2367E+04  CONC = 0.9517E+00
AT TIME = 0.2417E+04  CONC = 0.9715E+00
AT TIME = 0.2467E+04  CONC = 0.9773E+00
AT TIME = 0.2517E+04  CONC = 0.9692E+00
AT TIME = 0.2567E+04  CONC = 0.9477E+00
AT TIME = 0.2617E+04  CONC = 0.9145E+00
AT TIME = 0.2667E+04  CONC = 0.8710E+00
AT TIME = 0.2717E+04  CONC = 0.8194E+00
AT TIME = 0.2767E+04  CONC = 0.7617E+00
AT TIME = 0.2817E+04  CONC = 0.6998E+00
AT TIME = 0.2867E+04  CONC = 0.6356E+00
AT TIME = 0.2917E+04  CONC = 0.5708E+00
AT TIME = 0.2967E+04  CONC = 0.5067E+00
AT TIME = 0.2995E+04  CONC = 0.4717E+00
AT TIME = 0.3028E+04  CONC = 0.4307E+00
AT TIME = 0.3069E+04  CONC = 0.3834E+00
AT TIME = 0.3117E+04  CONC = 0.3297E+00
AT TIME = 0.3175E+04  CONC = 0.2703E+00
AT TIME = 0.3244E+04  CONC = 0.2069E+00
AT TIME = 0.3328E+04  CONC = 0.1424E+00
AT TIME = 0.3428E+04  CONC = 0.8091E-01
AT TIME = 0.3548E+04  CONC = 0.2785E-01
AT TIME = 0.5804E+04  CONC = 0.6340E-02
```

1 UNSATURATED ZONE TRANSPORT RESULTS

SERIAL NUMBER	TIME	DEPTH	CONCENTRATION	NORMALIZED CONCENTRATION

TRAIL1-VTRN

Figure TRAIL-1

AutoCAD FILE: TRAIL1-VTRN

TRIAL 2
MULTIMED INPUT AND OUTPUT FILES

```
DEFAULT
CASE


GENERAL DATA

***  CHEMICAL NAME FORMAT(80A1)
DEFAULT CHEMICAL

***    ISOURC                            ROUTE      NT       IYCHK   PALPH
APPTYP
***OPTION   OPTAIR  RUN              MONTE    ISTEAD     IOPEN     IZCHK
LANDF   COMPLETE
    2    0    0     DETERMINISTIC    500    1    0   25    1    0    0 90.0    0
1    1


***   XST


*** TIME STEPPING PARAMETERS FOR SATURATED ZONE MODEL
 2000.00   2100.00   2200.00   2300.00   2400.00   2500.00   2600.00   2700.00
2800.00   2900.00
 3000.00   3100.00   3200.00   3300.00   3400.00   3500.00   3600.00   3700.00
3800.00   3900.00
 4000.00   4100.00   4200.00   4300.00   4400.00

END GENERAL

CHEMICAL SPECIFIC VARIABLE DATA
ARRAY VALUES
***      CHEMICAL SPECIFIC VARIABLES

***            VARIABLE NAME               UNITS              DISTRIBUTION
PARAMETERS            LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Solid phase decay coeff (1/yr)                                 -1      -
999.     -999.     0.000E+00 0.100E+11
 2 Diss phase decay coeff (1/yr)                                  -1      -
999.     -999.     0.000E+00 0.100E+11
 3 Overall chem dcy coeff (1/yr)                                  -1      -
999.     -999.     0.000E+00 0.100E+11
 4 Acid cataly hydrol rte(l/M-yr)                                  0
0.000E+00 -999.     0.000E+00 -999.
 5 Neutral hydrol rate cons(1/yr)                                  0
0.000E+00 -999.     0.000E+00 -999.
 6 Base cataly hydrol rte(l/M-yr)                                  0
0.000E+00 -999.     0.000E+00 -999.
 7 Reference temperature (C)                                       0
20.0     -999.     0.000E+00  100.
 8 Normalized distrib coeff(ml/g)                                  0
0.000E+00 -999.     0.000E+00 -999.
```

```
 9 Distribution coefficient                                              -1      -
999.     -999.     0.000E+00 0.100E+11
10 Biodegrad coef(sat zone)(1/yr)                                         0
0.000E+00 -999.     0.000E+00 -999.
11 Air diffusion coeff (cm2/s)                                            0
0.000E+00 -999.     0.000E+00  10.0
12 Ref temp for air diffusion (C)                                         0
20.0     -999.     0.000E+00  100.
13 Molecular weight (g/mole)                                              0
0.000E+00 -999.     0.000E+00 -999.
14 Mole fraction of solute                                                0
0.000E+00 -999.     0.100E-08  1.00
15 Solute vapor pressure (mm Hg)                                          0
0.000E+00 -999.     0.000E+00  100.
16 Henry`s law cons (atm-m^3/M)                                           0
0.000E+00 -999.     0.100E-09  1.00
17 Not in use                                                             0      -
999.     -999.     0.000E+00  1.00
18 Not in use                                                             0      -
999.     -999.     0.000E+00  1.00
19 Not in use                                                             0      -
999.     -999.     0.000E+00  1.00
END ARRAY

END CHEMICAL SPECIFIC VARIABLE DATA



SOURCE SPECIFIC VARIABLE DATA
ARRAY VALUES
***        SOURCE SPECIFIC VARIABLES

***             VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Infiltration rate (m/yr)                                               0
0.107E-01 -999.     0.100E-09 0.100E+11
 2 Area of waste disp unit (m^2)                                          0
9.00     -999.     0.100E-01 -999.
 3 Duration of pulse (yr)                                                 0
0.100E+04 -999.     0.100E-08 -999.
 4 Spread of contaminant srce (m)                                        -1      -
999.     -999.     0.100E-08 0.100E+11
 5 Recharge rate (m/yr)                                                   0
0.000E+00 -999.     0.000E+00 0.100E+11
 6 Source decay constant (1/yr)                                           0
0.000E+00 -999.     0.000E+00 -999.
 7 Init conc at landfill (mg/l)                                           0
1.00     -999.     0.000E+00 -999.
 8 Length scale of facility (m)                                          -1      -
999.     -999.     0.100E-08 0.100E+11
 9 Width scale of facility (m)                                           -1      -
999.     -999.     0.100E-08 0.100E+11
```

```
END ARRAY

END SOURCE SPECIFIC VARIABLE DATA



VFL   UNSATURATED FLOW MODEL PARAMETERS


CONTROL PARAMETERS
***     DUMMY     NMAT      KPROP     DUMMY    NVFLAY
          7         1         1         1         1


END CONTROL PARAMETERS
SATURATED MATERIAL PROPERTY PARAMETERS
ARRAY VALUES
***   SATURATED MATERIAL   VARIABLES

***            VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Sat hydraulic conduct (cm/hr)                                       0
0.170E-03 -999.     0.100E-10 0.100E+05
 2 Unsaturated zone porosity                                           0
0.230     -999.     0.100E-08 0.990
 3 Air entry pressure head (m)                                         0
0.100     -999.     0.000E+00 -999.
 4 Depth of the unsat zone (m)                                         0
183.     -999.     0.100E-08 -999.
END ARRAY

END MATERIAL  1
END
SOIL MOISTURE PARAMETERS
***   FUNCTIONAL COEFFICIENTS
ARRAY VALUES
***   FUNCTIONAL COEFFICIE VARIABLES

***            VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Residual water content                                              0
0.116     -999.     0.100E-08  1.00
 2 Brooks and Corey exponent, EN                                       0      -
999.     -999.     0.000E+00  10.0
 3 ALFA van Genuchten coefficient                                      0
0.500E-02 -999.     0.000E+00  1.00
```

```
 4 BETA Van Genuchten coefficient                                    0
1.09     -999.      1.00      5.00
END ARRAY

END MATERIAL  1
END
END UNSATURATED FLOW




VTP    UNSATURATED TRANSPORT MODEL
CONTROL PARAMETERS
***   NLAY     DUMMY      IADU      ISOL         N      NTEL     NGPTS       NIT
DUMMY     DUMMY
         1        20         1         1        18         3       104         2
1         1
***  WTFUN
     1.200


END CONTROL PARAMETERS
TRANSPORT PARAMETER
ARRAY VALUES
***   UNSATURATED TRANSPOR VARIABLES

***            VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Thickness of layer (m)                                            0
183.     -999.     0.100E-08 -999.
 2 Longit disper of layer (m)                                       -1
1.00     -999.     0.100E-02 0.100E+05
 3 Percent organic matter                                            0
0.000E+00 -999.     0.000E+00  100.
 4 Bulk dens of soil layer (g/cc)                                    0
1.83     -999.     0.100E-01  5.00
 5 Biological decay coeff (1/yr)                                     0
0.000E+00 -999.     0.000E+00 -999.
END ARRAY

END LAYER  1
END UNSATURATED TRANSPORT PARAMETERS
END TRANSPORT MODEL
AQUIFER SPECIFIC VARIABLE DATA
ARRAY VALUES
***       AQUIFER SPECIFIC VARIABLES

***            VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX
```

```
*********************************************************************************
****************************************
 1 Particle diameter (cm)                                                 0
0.500E-01 -999.     0.100E-08  100.
 2 Aquifer porosity                                                       0
0.300     -999.     0.100E-08 0.990
 3 Bulk density (g/cc)                                                    0
1.70     -999.     0.100E-01  5.00
 4 Aquifer thickness (m)                                                  0
30.0     -999.     0.100E-08 0.100E+06
 5 Mixing zone depth (m)                                                 -1
0.100     -999.     0.100E-08 0.100E+06
 6 Hydraulic conductivity (m/yr)                                          0
30.0     -999.     0.100E-06 0.100E+09
 7 Hydraulic Gradient                                                     0
0.100E-01 -999.     0.100E-07 -999.
 8 Grndwater seep velocity (m/yr)                                        -1      -
999.     -999.     0.100E-09 0.100E+09
 9 Retardation coefficient                                               -1
1.00     -999.      1.00     0.100E+09
10 Longitudinal dispersivity (m)                                         10
1.00     -999.     -999.     -999.
11 Transverse dispersivity (m)                                           10      -
999.     -999.     0.100E-02 0.100E+05
12 Vertical dispersivity (m)                                             10      -
999.     -999.     -999.     -999.
13 Temperature of aquifer (C)                                             0
20.0     -999.     0.000E+00  100.
14 pH                                                                     0
7.00     -999.     0.300      14.0
15 Organic carbon content (fract)                                         0
0.000E+00 -999.     0.100E-05  1.00
16 Receptor distance from site(m)                                         0
1.00     -999.      1.00     -999.
17 Angle off center (degree)                                              0
0.000E+00 -999.     0.000E+00  360.
18 Z-dist from watertable (fract)                                         0
0.000E+00 -999.     0.000E+00  1.00
END ARRAY

END AQUIFER SPECIFIC VARIABLE DATA



END ALL DATA
```

1

U. S.   E N V I R O N M E N T A L   P R O T E C T I O N   A G E N C Y

E X P O S U R E   A S S E S S M E N T

M U L T I M E D I A   M O D E L

MULTIMED (Version 1.01, June 1991)

1

Run options
--- -------

DEFAULT

CASE

Chemical simulated is DEFAULT CHEMICAL

Option Chosen   Saturated and unsaturated zone models
Run was   DETERMIN
Infiltration input by user
Run was transient
Reject runs if Y coordinate outside plume
Reject runs if Z coordinate outside plume
Gaussian source used in saturated zone model

1
1
UNSATURATED ZONE FLOW MODEL PARAMETERS
(input parameter description and value)

NP	- Total number of nodal points	240
NMAT	- Number of different porous materials	1
KPROP	- Van Genuchten or Brooks and Corey	1
IMSHGN	- Spatial discretization option	1
NVFLAYR	- Number of layers in flow model	1

OPTIONS CHOSEN
------- ------
Van Genuchten functional coefficients
User defined coordinate system
1

Layer information

LAYER NO.	LAYER THICKNESS	MATERIAL PROPERTY
1	183.00	1

DATA FOR MATERIAL 1
---- --- --------
VADOSE ZONE MATERIAL VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Saturated hydraulic conductivity	cm/hr	CONSTANT	0.170E-03	-999.	0.100E-10	0.100E+05
Unsaturated zone porosity	--	CONSTANT	0.230	-999.	0.100E-08	0.990
Air entry pressure head	m	CONSTANT	0.100	-999.	0.000E+00	-999.
Depth of the unsaturated zone	m	CONSTANT	183.	-999.	0.100E-08	-999.

DATA FOR MATERIAL 1
---- --- --------
VADOSE ZONE FUNCTION VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS	LIMITS

```
MEAN     STD DEV      MIN         MAX
           --------------------------------------------------------------------
---------------------------------------------------
           Residual water content                      --         CONSTANT
0.116     -999.       0.100E-08   1.00
           Brook and Corey exponent,EN                 --         CONSTANT
-999.     -999.       0.000E+00   10.0
           ALFA coefficient                           1/cm        CONSTANT
0.500E-02 -999.       0.000E+00   1.00
           Van Genuchten exponent, ENN                 --         CONSTANT
1.09     -999.        1.00       5.00
1

 UNSATURATED ZONE TRANSPORT MODEL PARAMETERS

 NLAY   - Number of different layers used                 1
 NTSTPS - Number of time values concentration calc       40
 DUMMY  - Not presently used                              1
 ISOL   - Type of scheme used in unsaturated zone         1
 N      - Stehfest terms or number of increments         18
 NTEL   - Points in Lagrangian interpolation              3
 NGPTS  - Number of Gauss points                        104
 NIT    - Convolution integral segments                   2
 IBOUND - Type of boundary condition                      2
 ITSGEN - Time values generated or input                  1
 TMAX   - Max simulation time               --           0.0
 WTFUN  - Weighting factor                  --           1.2


 OPTIONS CHOSEN
 ------- ------
 Stehfest numerical inversion algorithm
 Nondecaying pulse source
 Computer generated times for computing concentrations
1

                                                      DATA FOR LAYER   1
                                                      ---- --- -----
                                                      VADOSE TRANSPORT VARIABLES


           --------------------------------------------------------------------
---------------------------------------------------
                       VARIABLE NAME                UNITS      DISTRIBUTION
PARAMETERS              LIMITS

MEAN     STD DEV      MIN         MAX
           --------------------------------------------------------------------
---------------------------------------------------
           Thickness of layer                         m           CONSTANT
183.     -999.       0.100E-08  -999.
           Longitudinal dispersivity of layer         m           DERIVED
1.00     -999.       0.100E-02  0.100E+05
           Percent organic matter                      --         CONSTANT
0.000E+00 -999.       0.000E+00   100.
```

VARIABLE NAME	UNITS	DISTRIBUTION	MEAN	STD DEV	MIN	MAX
Bulk density of soil for layer	g/cc	CONSTANT	1.83	-999.	0.100E-01	5.00
Biological decay coefficient	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.

1

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Solid phase decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Base catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Reference temperature	C	CONSTANT	20.0	-999.	0.000E+00	100.
Normalized distribution coefficient	ml/g	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Distribution coefficient	--	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00	-999.	0.000E+00	10.0
Reference temperature for air diffusion	C	CONSTANT	20.0	-999.	0.000E+00	100.
Molecular weight	g/M	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Mole fraction of solute	--	CONSTANT	0.000E+00	-999.	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00	-999.	0.000E+00	100.
Henry`s law constant	atm-m^3/M	CONSTANT	0.000E+00	-999.	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00

1

SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.107E-01	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	9.00	-999.	0.100E-01	-999.
Duration of pulse	yr	CONSTANT	0.100E+04	-999.	0.100E-08	-999.
Spread of contaminant source	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.000E+00	-999.	0.000E+00	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Initial concentration at landfill	mg/l	CONSTANT	1.00	-999.	0.000E+00	-999.
Length scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Width scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Particle diameter	cm	CONSTANT	0.500E-01	-999.	0.100E-08	100.
Aquifer porosity	--	CONSTANT	0.300	-999.	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.70	-999.	0.100E-01	5.00
Aquifer thickness	m	CONSTANT	30.0	-999.	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	m	DERIVED	0.100	-999.	0.100E-08	0.100E+06
Conductivity (hydraulic)	m/yr	CONSTANT	30.0	-999.	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.100E-01	-999.	0.100E-07	-999.
Groundwater seepage velocity	m/yr	DERIVED	-999.	-999.	0.100E-09	0.100E+09

```
           Retardation coefficient                    --          DERIVED
1.00     -999.        1.00      0.100E+09
           Longitudinal dispersivity                  m           FUNCTION OF X
1.00     -999.       -999.      -999.
           Transverse dispersivity                    m           FUNCTION OF X
-999.     -999.       0.100E-02  0.100E+05
           Vertical dispersivity                      m           FUNCTION OF X
-999.     -999.       -999.      -999.
           Temperature of aquifer                     C           CONSTANT
20.0     -999.       0.000E+00   100.
           pH                                         --          CONSTANT
7.00     -999.       0.300       14.0
           Organic carbon content (fraction)                      CONSTANT
0.000E+00 -999.       0.100E-05   1.00
           Well distance from site                    m           CONSTANT
1.00     -999.        1.00      -999.
           Angle off center                        degree         CONSTANT
0.000E+00 -999.       0.000E+00   360.
           Well vertical distance                     m           CONSTANT
0.000E+00 -999.       0.000E+00   1.00
1
```

TIME	CONCENTRATION
----	-------------
0.200E+04	0.00000E+00
0.210E+04	0.00000E+00
0.220E+04	0.00000E+00
0.230E+04	0.00000E+00
0.240E+04	0.00000E+00
0.250E+04	0.00000E+00
0.260E+04	0.00000E+00
0.270E+04	0.00000E+00
0.280E+04	0.00000E+00
0.290E+04	0.00000E+00
0.300E+04	0.00000E+00
0.310E+04	0.00000E+00
0.320E+04	0.00000E+00
0.330E+04	0.32510E-01
0.340E+04	0.70180E-01
0.350E+04	0.11146E+00
0.360E+04	0.15214E+00
0.370E+04	0.19039E+00
0.380E+04	0.22435E+00
0.390E+04	0.25200E+00
0.400E+04	0.27285E+00
0.410E+04	0.28643E+00
0.420E+04	0.29290E+00
0.430E+04	0.29275E+00
0.440E+04	0.28668E+00

Vtrnspt

```
CONCENTRATION AT BOTTOM OF VADOSE ZONE
 RUN NO.     1
     AT TIME = 0.2771E+04   CONC = -.5497E-01
     AT TIME = 0.3011E+04   CONC = -.2357E-01
     AT TIME = 0.3211E+04   CONC = 0.6788E-01
     AT TIME = 0.3378E+04   CONC = 0.1819E+00
     AT TIME = 0.3517E+04   CONC = 0.2889E+00
     AT TIME = 0.3633E+04   CONC = 0.3765E+00
     AT TIME = 0.3730E+04   CONC = 0.4432E+00
     AT TIME = 0.3811E+04   CONC = 0.4921E+00
     AT TIME = 0.3878E+04   CONC = 0.5272E+00
     AT TIME = 0.3934E+04   CONC = 0.5522E+00
     AT TIME = 0.3984E+04   CONC = 0.5710E+00
     AT TIME = 0.4034E+04   CONC = 0.5864E+00
     AT TIME = 0.4084E+04   CONC = 0.5984E+00
     AT TIME = 0.4134E+04   CONC = 0.6072E+00
     AT TIME = 0.4184E+04   CONC = 0.6126E+00
     AT TIME = 0.4234E+04   CONC = 0.6149E+00
     AT TIME = 0.4284E+04   CONC = 0.6142E+00
     AT TIME = 0.4334E+04   CONC = 0.6107E+00
     AT TIME = 0.4384E+04   CONC = 0.6046E+00
     AT TIME = 0.4434E+04   CONC = 0.5960E+00
     AT TIME = 0.4484E+04   CONC = 0.5853E+00
     AT TIME = 0.4534E+04   CONC = 0.5725E+00
     AT TIME = 0.4584E+04   CONC = 0.5580E+00
     AT TIME = 0.4634E+04   CONC = 0.5420E+00
     AT TIME = 0.4684E+04   CONC = 0.5246E+00
     AT TIME = 0.4734E+04   CONC = 0.5062E+00
     AT TIME = 0.4784E+04   CONC = 0.4868E+00
     AT TIME = 0.4834E+04   CONC = 0.4667E+00
     AT TIME = 0.4884E+04   CONC = 0.4461E+00
     AT TIME = 0.4934E+04   CONC = 0.4252E+00
     AT TIME = 0.4990E+04   CONC = 0.4015E+00
     AT TIME = 0.5057E+04   CONC = 0.3730E+00
     AT TIME = 0.5137E+04   CONC = 0.3391E+00
     AT TIME = 0.5234E+04   CONC = 0.2995E+00
     AT TIME = 0.5350E+04   CONC = 0.2542E+00
     AT TIME = 0.5489E+04   CONC = 0.2041E+00
     AT TIME = 0.5656E+04   CONC = 0.1512E+00
     AT TIME = 0.5856E+04   CONC = 0.9867E-01
     AT TIME = 0.6097E+04   CONC = 0.5080E-01
     AT TIME = 0.1036E+05   CONC = 0.3151E-02

1                               UNSATURATED ZONE TRANSPORT RESULTS
```

TRAIL2-VTRN

Figure TRAIL-2

AutoCAD FILE: TRAIL2-VTRN

TRIAL 3
MULTIMED INPUT AND OUTPUT FILES

```
DEFAULT
CASE


GENERAL DATA

***  CHEMICAL NAME FORMAT(80A1)
DEFAULT CHEMICAL

***    ISOURC                              ROUTE      NT       IYCHK   PALPH
APPTYP
***OPTION   OPTAIR  RUN              MONTE    ISTEAD     IOPEN     IZCHK
LANDF   COMPLETE
    2    0    0     DETERMINISTIC    500    1    0   25    1    0    0 90.0    0
1    1


***   XST


*** TIME STEPPING PARAMETERS FOR SATURATED ZONE MODEL
 2500.00   2550.00   2600.00   2650.00   2700.00   2750.00   2800.00   2850.00
2900.00   2950.00
 3000.00   3050.00   3100.00   3150.00   3200.00   3250.00   3300.00   3350.00
3400.00   3450.00
 3500.00   3550.00   3600.00   3650.00   3700.00

END GENERAL

CHEMICAL SPECIFIC VARIABLE DATA
ARRAY VALUES
***      CHEMICAL SPECIFIC VARIABLES

***            VARIABLE NAME               UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Solid phase decay coeff (1/yr)                                   -1      -
999.     -999.     0.000E+00 0.100E+11
 2 Diss phase decay coeff (1/yr)                                    -1      -
999.     -999.     0.000E+00 0.100E+11
 3 Overall chem dcy coeff (1/yr)                                    -1      -
999.     -999.     0.000E+00 0.100E+11
 4 Acid cataly hydrol rte(l/M-yr)                                    0
0.000E+00 -999.     0.000E+00 -999.
 5 Neutral hydrol rate cons(1/yr)                                    0
0.000E+00 -999.     0.000E+00 -999.
 6 Base cataly hydrol rte(l/M-yr)                                    0
0.000E+00 -999.     0.000E+00 -999.
 7 Reference temperature (C)                                         0
20.0     -999.     0.000E+00  100.
 8 Normalized distrib coeff(ml/g)                                    0
0.000E+00 -999.     0.000E+00 -999.
```

```
 9 Distribution coefficient                                         -1      -
999.     -999.     0.000E+00 0.100E+11
10 Biodegrad coef(sat zone)(1/yr)                                    0
0.000E+00 -999.     0.000E+00 -999.
11 Air diffusion coeff (cm2/s)                                       0
0.000E+00 -999.     0.000E+00  10.0
12 Ref temp for air diffusion (C)                                    0
20.0     -999.     0.000E+00  100.
13 Molecular weight (g/mole)                                         0
0.000E+00 -999.     0.000E+00 -999.
14 Mole fraction of solute                                           0
0.000E+00 -999.     0.100E-08  1.00
15 Solute vapor pressure (mm Hg)                                     0
0.000E+00 -999.     0.000E+00  100.
16 Henry`s law cons (atm-m^3/M)                                      0
0.000E+00 -999.     0.100E-09  1.00
17 Not in use                                                        0      -
999.     -999.     0.000E+00  1.00
18 Not in use                                                        0      -
999.     -999.     0.000E+00  1.00
19 Not in use                                                        0      -
999.     -999.     0.000E+00  1.00
END ARRAY

END CHEMICAL SPECIFIC VARIABLE DATA


SOURCE SPECIFIC VARIABLE DATA
ARRAY VALUES
***         SOURCE SPECIFIC VARIABLES

***              VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Infiltration rate (m/yr)                                          0
0.150E-01 -999.     0.100E-09 0.100E+11
 2 Area of waste disp unit (m^2)                                     0
9.00     -999.     0.100E-01 -999.
 3 Duration of pulse (yr)                                            0
0.100E+04 -999.     0.100E-08 -999.
 4 Spread of contaminant srce (m)                                   -1      -
999.     -999.     0.100E-08 0.100E+11
 5 Recharge rate (m/yr)                                              0
0.000E+00 -999.     0.000E+00 0.100E+11
 6 Source decay constant (1/yr)                                      0
0.000E+00 -999.     0.000E+00 -999.
 7 Init conc at landfill (mg/l)                                      0
1.00     -999.     0.000E+00 -999.
 8 Length scale of facility (m)                                     -1      -
999.     -999.     0.100E-08 0.100E+11
 9 Width scale of facility (m)                                      -1      -
999.     -999.     0.100E-08 0.100E+11
```

```
END ARRAY

END SOURCE SPECIFIC VARIABLE DATA



VFL   UNSATURATED FLOW MODEL PARAMETERS


CONTROL PARAMETERS
***    DUMMY     NMAT      KPROP     DUMMY    NVFLAY
         7         1         1         1         1


END CONTROL PARAMETERS
SATURATED MATERIAL PROPERTY PARAMETERS
ARRAY VALUES
***   SATURATED MATERIAL   VARIABLES

***            VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Sat hydraulic conduct (cm/hr)                                    0
0.360E-01 -999.     0.100E-10 0.100E+05
 2 Unsaturated zone porosity                                        0
0.300     -999.     0.100E-08 0.990
 3 Air entry pressure head (m)                                      0
0.100     -999.     0.000E+00 -999.
 4 Depth of the unsat zone (m)                                      0
1.00     -999.     0.100E-08 -999.
END ARRAY

END MATERIAL  1
END
SOIL MOISTURE PARAMETERS
***   FUNCTIONAL COEFFICIENTS
ARRAY VALUES
***   FUNCTIONAL COEFFICIE VARIABLES

***            VARIABLE NAME                UNITS              DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Residual water content                                           0
0.116     -999.     0.100E-08  1.00
 2 Brooks and Corey exponent, EN                                    0      -
999.     -999.     0.000E+00  10.0
 3 ALFA van Genuchten coefficient                                   0
0.500E-02 -999.     0.000E+00  1.00
```

```
 4 BETA Van Genuchten coefficient                                    0
1.09     -999.      1.00      5.00
END ARRAY

END MATERIAL  1
END
END UNSATURATED FLOW



VTP    UNSATURATED TRANSPORT MODEL
CONTROL PARAMETERS
***   NLAY     DUMMY      IADU      ISOL         N      NTEL     NGPTS       NIT
DUMMY     DUMMY
         1        20         1         1        18         3       104         2
1         1
***  WTFUN
     1.200


END CONTROL PARAMETERS
TRANSPORT PARAMETER
ARRAY VALUES
***   UNSATURATED TRANSPOR VARIABLES

***            VARIABLE NAME                UNITS               DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX

********************************************************************************
****************************************
 1 Thickness of layer (m)                                            0
1.00     -999.     0.100E-08 -999.
 2 Longit disper of layer (m)                                       -1
1.00     -999.     0.100E-02 0.100E+05
 3 Percent organic matter                                            0
0.000E+00 -999.     0.000E+00  100.
 4 Bulk dens of soil layer (g/cc)                                    0
1.70     -999.     0.100E-01  5.00
 5 Biological decay coeff (1/yr)                                     0
0.000E+00 -999.     0.000E+00 -999.
END ARRAY

END LAYER  1
END UNSATURATED TRANSPORT PARAMETERS
END TRANSPORT MODEL
AQUIFER SPECIFIC VARIABLE DATA
ARRAY VALUES
***       AQUIFER SPECIFIC VARIABLES

***            VARIABLE NAME                UNITS               DISTRIBUTION
PARAMETERS             LIMITS
***
MEAN      STD DEV    MIN      MAX
```

```
*******************************************************************************
****************************************
 1 Particle diameter (cm)                                                  0
0.500E-01 -999.     0.100E-08  100.
 2 Aquifer porosity                                                        0
0.300     -999.     0.100E-08 0.990
 3 Bulk density (g/cc)                                                     0
1.70     -999.     0.100E-01  5.00
 4 Aquifer thickness (m)                                                   0
3.00     -999.     0.100E-08 0.100E+06
 5 Mixing zone depth (m)                                                  -1
0.100     -999.     0.100E-08 0.100E+06
 6 Hydraulic conductivity (m/yr)                                           0
3.15     -999.     0.100E-06 0.100E+09
 7 Hydraulic Gradient                                                      0
0.100E-01 -999.     0.100E-07 -999.
 8 Grndwater seep velocity (m/yr)                                         -1      -
999.     -999.     0.100E-09 0.100E+09
 9 Retardation coefficient                                                -1
1.00     -999.      1.00     0.100E+09
10 Longitudinal dispersivity (m)                                          10
1.00     -999.     -999.     -999.
11 Transverse dispersivity (m)                                            10      -
999.     -999.     0.100E-02 0.100E+05
12 Vertical dispersivity (m)                                              10      -
999.     -999.     -999.     -999.
13 Temperature of aquifer (C)                                              0
20.0     -999.     0.000E+00  100.
14 pH                                                                      0
7.00     -999.     0.300      14.0
15 Organic carbon content (fract)                                          0
0.000E+00 -999.     0.100E-05  1.00
16 Receptor distance from site(m)                                          0
0.112E+04 -999.      1.00     -999.
17 Angle off center (degree)                                               0
0.000E+00 -999.     0.000E+00  360.
18 Z-dist from watertable (fract)                                          0
0.000E+00 -999.     0.000E+00  1.00
END ARRAY

END AQUIFER SPECIFIC VARIABLE DATA



END ALL DATA
```

1

U. S. E N V I R O N M E N T A L P R O T E C T I O N A G E N C Y

E X P O S U R E A S S E S S M E N T

M U L T I M E D I A M O D E L

MULTIMED (Version 1.01, June 1991)

1

Run options

--- -------

DEFAULT

CASE

Chemical simulated is DEFAULT CHEMICAL

Option Chosen	Saturated and unsaturated zone models
Run was	DETERMIN

Infiltration input by user

Run was transient

Reject runs if Y coordinate outside plume

Reject runs if Z coordinate outside plume

Gaussian source used in saturated zone model

```
1
1
 UNSATURATED ZONE FLOW MODEL PARAMETERS
 (input parameter description and value)
 NP      - Total number of nodal points                 240
 NMAT    - Number of different porous materials           1
 KPROP   - Van Genuchten or Brooks and Corey              1
 IMSHGN  - Spatial discretization option                  1
 NVFLAYR - Number of layers in flow model                 1


 OPTIONS CHOSEN
 ------- ------
 Van Genuchten functional coefficients
 User defined coordinate system
1


 Layer information
 -----------------
 LAYER NO.    LAYER THICKNESS     MATERIAL PROPERTY
 ---------    ---------------     -----------------
     1                   1.00             1


                                                      DATA FOR MATERIAL  1
                                                      ---- --- --------
                                                  VADOSE ZONE MATERIAL VARIABLES


           --------------------------------------------------------------------
---------------------------------------------------
                       VARIABLE NAME                UNITS      DISTRIBUTION
PARAMETERS              LIMITS

MEAN     STD DEV      MIN         MAX
           --------------------------------------------------------------------
---------------------------------------------------
           Saturated hydraulic conductivity          cm/hr       CONSTANT
0.360E-01 -999.       0.100E-10  0.100E+05
           Unsaturated zone porosity                 --          CONSTANT
0.300     -999.       0.100E-08  0.990
           Air entry pressure head                   m           CONSTANT
0.100     -999.       0.000E+00  -999.
           Depth of the unsaturated zone             m           CONSTANT
1.00     -999.       0.100E-08  -999.


                                                      DATA FOR MATERIAL  1
                                                      ---- --- --------
                                                  VADOSE ZONE FUNCTION VARIABLES


           --------------------------------------------------------------------
---------------------------------------------------
                       VARIABLE NAME                UNITS      DISTRIBUTION
PARAMETERS              LIMITS
```

MEAN   STD DEV   MIN   MAX

VARIABLE NAME	UNITS	DISTRIBUTION	MEAN	STD DEV	MIN	MAX
Residual water content	--	CONSTANT	0.116	-999.	0.100E-08	1.00
Brook and Corey exponent,EN	--	CONSTANT	-999.	-999.	0.000E+00	10.0
ALFA coefficient	1/cm	CONSTANT	0.500E-02	-999.	0.000E+00	1.00
Van Genuchten exponent, ENN	--	CONSTANT	1.09	-999.	1.00	5.00

1

UNSATURATED ZONE TRANSPORT MODEL PARAMETERS

NLAY	- Number of different layers used		1
NTSTPS	- Number of time values concentration calc		40
DUMMY	- Not presently used		1
ISOL	- Type of scheme used in unsaturated zone		1
N	- Stehfest terms or number of increments		18
NTEL	- Points in Lagrangian interpolation		3
NGPTS	- Number of Gauss points		104
NIT	- Convolution integral segments		2
IBOUND	- Type of boundary condition		2
ITSGEN	- Time values generated or input		1
TMAX	- Max simulation time	--	0.0
WTFUN	- Weighting factor	--	1.2

OPTIONS CHOSEN
------- ------
Stehfest numerical inversion algorithm
Nondecaying pulse source
Computer generated times for computing concentrations
1

DATA FOR LAYER   1
---- --- -----
VADOSE TRANSPORT VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Thickness of layer	m	CONSTANT	1.00	-999.	0.100E-08	-999.
Longitudinal dispersivity of layer	m	DERIVED	1.00	-999.	0.100E-02	0.100E+05
Percent organic matter	--	CONSTANT	0.000E+00	-999.	0.000E+00	100.

VARIABLE NAME	UNITS	DISTRIBUTION	MEAN	STD DEV	MIN	MAX
Bulk density of soil for layer	g/cc	CONSTANT	1.70	-999.	0.100E-01	5.00
Biological decay coefficient	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.

1

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION PARAMETERS			LIMITS	
			MEAN	STD DEV	MIN	MAX
Solid phase decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Base catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Reference temperature	C	CONSTANT	20.0	-999.	0.000E+00	100.
Normalized distribution coefficient	ml/g	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Distribution coefficient	--	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00	-999.	0.000E+00	10.0
Reference temperature for air diffusion	C	CONSTANT	20.0	-999.	0.000E+00	100.
Molecular weight	g/M	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Mole fraction of solute	--	CONSTANT	0.000E+00	-999.	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00	-999.	0.000E+00	100.
Henry`s law constant	atm-m^3/M	CONSTANT	0.000E+00	-999.	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00

1

SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.150E-01	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	9.00	-999.	0.100E-01	-999.
Duration of pulse	yr	CONSTANT	0.100E+04	-999.	0.100E-08	-999.
Spread of contaminant source	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.000E+00	-999.	0.000E+00	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Initial concentration at landfill	mg/l	CONSTANT	1.00	-999.	0.000E+00	-999.
Length scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Width scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Particle diameter	cm	CONSTANT	0.500E-01	-999.	0.100E-08	100.
Aquifer porosity	--	CONSTANT	0.300	-999.	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.70	-999.	0.100E-01	5.00
Aquifer thickness	m	CONSTANT	3.00	-999.	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	m	DERIVED	0.100	-999.	0.100E-08	0.100E+06
Conductivity (hydraulic)	m/yr	CONSTANT	3.15	-999.	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.100E-01	-999.	0.100E-07	-999.
Groundwater seepage velocity	m/yr	DERIVED	-999.	-999.	0.100E-09	0.100E+09

```
           Retardation coefficient                  --          DERIVED
1.00     -999.        1.00      0.100E+09
           Longitudinal dispersivity                m           FUNCTION OF X
1.00     -999.       -999.     -999.
           Transverse dispersivity                  m           FUNCTION OF X
-999.     -999.       0.100E-02  0.100E+05
           Vertical dispersivity                    m           FUNCTION OF X
-999.     -999.       -999.      -999.
           Temperature of aquifer                   C           CONSTANT
20.0     -999.       0.000E+00   100.
           pH                                       --          CONSTANT
7.00     -999.       0.300       14.0
           Organic carbon content (fraction)                    CONSTANT
0.000E+00 -999.       0.100E-05   1.00
           Well distance from site                  m           CONSTANT
0.112E+04 -999.        1.00      -999.
           Angle off center                      degree         CONSTANT
0.000E+00 -999.       0.000E+00   360.
           Well vertical distance                   m           CONSTANT
0.000E+00 -999.       0.000E+00   1.00
1

                                                     TIME     CONCENTRATION
                                                     ----     -------------
                                                      0.250E+04 0.12624E-05
                                                      0.255E+04 0.15473E-05
                                                      0.260E+04 0.18805E-05
                                                      0.265E+04 0.22674E-05
                                                      0.270E+04 0.27134E-05
                                                      0.275E+04 0.32238E-05
                                                      0.280E+04 0.38042E-05
                                                      0.285E+04 0.44601E-05
                                                      0.290E+04 0.51968E-05
                                                      0.295E+04 0.60195E-05
                                                      0.300E+04 0.69333E-05
                                                      0.305E+04 0.79430E-05
                                                      0.310E+04 0.90529E-05
                                                      0.315E+04 0.10267E-04
                                                      0.320E+04 0.11589E-04
                                                      0.325E+04 0.13023E-04
                                                      0.330E+04 0.14571E-04
                                                      0.335E+04 0.16234E-04
                                                      0.340E+04 0.18016E-04
                                                      0.345E+04 0.19917E-04
                                                      0.350E+04 0.21938E-04
                                                      0.355E+04 0.24079E-04
                                                      0.360E+04 0.26340E-04
                                                      0.365E+04 0.28719E-04
                                                      0.370E+04 0.31216E-04
 *** WARNING *** Near field mixing factor is greater than 1.
 Mixing factor =   1.14
```

```
CONCENTRATION AT BOTTOM OF VADOSE ZONE
 RUN NO.    1
     AT TIME = 0.3577E+01  CONC = 0.2330E-04
     AT TIME = 0.6941E+01  CONC = 0.5065E-03
     AT TIME = 0.9744E+01  CONC = 0.7539E-02
     AT TIME = 0.1208E+02  CONC = 0.5318E-01
     AT TIME = 0.1403E+02  CONC = 0.1429E+00
     AT TIME = 0.1565E+02  CONC = 0.2482E+00
     AT TIME = 0.1700E+02  CONC = 0.3475E+00
     AT TIME = 0.1813E+02  CONC = 0.4321E+00
     AT TIME = 0.1907E+02  CONC = 0.5008E+00
     AT TIME = 0.1985E+02  CONC = 0.5556E+00
     AT TIME = 0.6985E+02  CONC = 0.9997E+00
     AT TIME = 0.1198E+03  CONC = 0.1000E+01
     AT TIME = 0.1698E+03  CONC = 0.9999E+00
     AT TIME = 0.2198E+03  CONC = 0.1000E+01
     AT TIME = 0.2698E+03  CONC = 0.1000E+01
     AT TIME = 0.3198E+03  CONC = 0.1000E+01
     AT TIME = 0.3698E+03  CONC = 0.1000E+01
     AT TIME = 0.4198E+03  CONC = 0.1000E+01
     AT TIME = 0.4698E+03  CONC = 0.1000E+01
     AT TIME = 0.5198E+03  CONC = 0.1000E+01
     AT TIME = 0.5698E+03  CONC = 0.1000E+01
     AT TIME = 0.6198E+03  CONC = 0.1000E+01
     AT TIME = 0.6698E+03  CONC = 0.1000E+01
     AT TIME = 0.7198E+03  CONC = 0.1000E+01
     AT TIME = 0.7698E+03  CONC = 0.1000E+01
     AT TIME = 0.8198E+03  CONC = 0.1000E+01
     AT TIME = 0.8698E+03  CONC = 0.1000E+01
     AT TIME = 0.9198E+03  CONC = 0.1000E+01
     AT TIME = 0.9698E+03  CONC = 0.1000E+01
     AT TIME = 0.1020E+04  CONC = 0.4444E+00
     AT TIME = 0.1021E+04  CONC = 0.3927E+00
     AT TIME = 0.1022E+04  CONC = 0.3354E+00
     AT TIME = 0.1023E+04  CONC = 0.2741E+00
     AT TIME = 0.1024E+04  CONC = 0.2114E+00
     AT TIME = 0.1026E+04  CONC = 0.1512E+00
     AT TIME = 0.1028E+04  CONC = 0.9790E-01
     AT TIME = 0.1030E+04  CONC = 0.5539E-01
     AT TIME = 0.1033E+04  CONC = 0.2603E-01
     AT TIME = 0.1036E+04  CONC = 0.9440E-02
     AT TIME = 0.3700E+04  CONC = 0.2914E-04

1                                  UNSATURATED ZONE TRANSPORT RESULTS


NORMALIZED
 SERIAL NUMBER           TIME               DEPTH        CONCENTRATION
CONCENTRATION
```

APPENDIX D
CERTIFICATION OF SUSPENSION REQUEST DEMONSTRATION

Certification of suspension request demonstration:

I hereby state that, to the best of my professional judgement, the information provided in this request for suspension of groundwater monitoring requirements for Triassic Park Facility landfill is accurate and complete and the request includes a demonstration that there is limited potential for migration of hazardous constituents from the landfill to the uppermost aquifer during the active life of the landfill and the post-closure care period and the demonstration is based upon:

1. site-specific field measurements, sampling, and analysis of physical, chemical, and biological processes affecting contaminant fate and transport; and,

2. contaminant fate and transport predictions that maximize contaminant migration and consider impacts on public health, welfare and environment.

1/25/2000
Date

Signature of qualified* groundwater scientist

David Ellerbroek
Printed Name

24 JAN 00
Date

Signature of qualified* groundwater scientist

PATRICK CORSER
Printed Name

COVER SHEET

Figure Coversheet

AutoCAD FILE: COVERSHEET

DAVID A. ELLERBROEK, Ph.D
SENIOR HYDROGEOLOGIST / GEOCHEMIST

EDUCATION:

Ph.D., Environmental Engineering, Colorado State University
M.S., Environmental Science, Colorado School of Mines
B.S., Geophysics, University of Colorado

SUMMARY:

Dr. Ellerbroek is responsible for conducting hydrological and geochemical investigations in support of mining, environmental and engineering projects. His background includes 14 years experience in mining and multidisciplinary environmental projects. Particular areas of expertise include groundwater hydrology, geochemistry, analysis of acid rock drainage (ARD) potential in tailings and waste rock, unsaturated flow modeling, reactive transport modeling, geostatistics and investigation of water and solute movement through constructed landforms such as tailings dams, waste rock dumps and mine pit lakes. Dr. Ellerbroek has conducted several large environmental programs for mining clients including evaluation of saturation and sulfide oxidation rates in partially-saturated tailings, predicting long-term water quality in seepage from tailings dams, developing cover systems to limit ARD from tailings and evaluating waste rock geochemistry. He has presented several papers on these subjects at conferences and in referred journals. International project experience includes Australia, Chile, China, Indonesia, Peru, Romania and the United Kingdom.

MINING EXPERIENCE

Senior Geochemist, Thompson Creek Mining, Supplemental Environmental Impact Statement, USA
Performed numeric modeling to predict long-term water quality in seepage from the tailing impoundment and embankment. Reviewed data from static and kinetic geochemical testing to predict the potential for the development of ARD. Modeled potential impacts to surface water quality from ARD for the No-Action and Proposed-Action Alternatives. Reviewed all geochemical information for the EIS and developed sections of the EIS concerned with geochemistry and water quality.

Project Manager / Senior Geochemist and Hydrogeologist, Southern Peru Limited, Torata Flood Control Project, Peru
Managed production of the Environmental Impact Assessment for the Torata Flood Control Project. Developed geochemical and hydrogeologic programs in support of the Torata Flood Control Project. Developed a geochemical testing program for waste rock at the site that was presented to and approved by the Ministry of Energy and Mines. Performed water balance and unsaturated flow modeling to estimate infiltration rates through waste rock. Investigated hydrologic and geochemical issues associated with pit expansion, river diversion and storage of mine waste. Developed a groundwater characterization program in support of the river diversion and pit expansions studies.

Project Manager/ Senior Geochemist and Hydrogeologist, Southern Peru Copper, Toquepala Baseline and Environmental Impact Studies, Peru

Managed production of two environmental impact assessments for expansion of the SX/EW facility and waste dump leaching at the Toquepala Mine. Developed a geochemical testing program for characterizing ARD potential from waste rock. Data generated from of these studies were used to evaluate potential impacts from ARD and waste rock seepage to downgradient water quality. Evaluated mitigation strategies for ARD at the site.

Senior Geochemist, Third Party EIS, McDonald Gold Project, Montana, USA

Reviewed data predicting waste rock seepage rates and acid rock drainage potential from waste rock and tailings. Evaluated geochemical issues associated with disposal of pit water, land application areas and pit lake water quality. Assisted in production of reports detailing background geochemistry, water quality and ARD potential at the site.

Senior Hydrogeologist/Geochemist, Renison Bell Tin Mine, Evaluation of Close-out Options for Sulfidic Tailings, Tasmania, Australia.

Investigated close-out options for three sulfidic tailings dams. Responsibilities included design and performance of hydrochemical studies to evaluate sulfide oxidation rates, water balance and factors determining water quality in the tailings dam system. Conducted unsaturated flow modeling to evaluate the effectiveness of a wet cover to minimize oxygen diffusion and sulfide oxidation in the tailings. Modeled oxygen diffusion and sulfide oxidation in the tailings for a range of climatic conditions and different cover designs. This site represents the first attempt to design a wet cover for mitigation of sulfidic tailings in Australia.

Senior Geochemist, CDE Chilean Mining Corporation, Furioso Geochemical Studies, Chile (in progress)

Developed a geochemical testing program for the Furioso Environmental Impact Statement. Developed a testing program based on static and kinetic geochemical testing to meet Chilean requirements. Reviewed geochemical and geologic data to predict the potential for development of ARD from tailings and waste rock at the site.

Senior Hydrogeologist/Geochemist, BHP Coal, Hydrology of Final Voids, Queensland, Australia.

Investigated water and solute movement in coal spoil to develop strategies for long term management of water (both quantity and quality) in final voids created by coal mining. Developed a groundwater flow model for the coal spoil and final void system. Performed unsaturated flow modeling for coal spoil to evaluate recharge rates to the final void. Evaluated solute mobilization and transport in the spoil using results from column and batch leach tests. Assessed the potential mobility of selenium, arsenic and molybdenum in the subsurface based on groundwater modeling and column leach test results.

Senior Hydrologist/Geochemist, Western Mining Company, Tailings Dam Close-out Options, Western Australia.

Provided technical review and support to evaluate close-out options for sulfidic tailings. Provided third party review of the site characterization program and results. Evaluated alternative mitigation strategies with respect to hydrochemical impacts and water quality. Assisted in design of a revised characterization study.

Project Manager/Senior Hydrologist, Hamersley Iron Pty, Ltd., Pit Lake Hydrology and Water Quality, Western Australia.
Developed a program to review pit lake modeling practices in the United States and performed numeric modeling to estimate water quality in the Yandi Pit in the Pilbara region of Western Australia. Reviewed several studies of pit lake modeling including Gold Quarry, Goldstrike and Twin Creek Mines. These studies were used to assist Hamersley in design of their pit lake modeling program. Meet with regulators to discuss regulations pertaining to pit lake quality and re-injection of water from pit dewatering.

Project Manager/Senior Hydrogeologist, Jabiluka Uranium Mine, Boyweg Groundwater Investigation, Northern Territory, Australia.
Performed a hydrogeologic characterization and groundwater modeling study to investigate potential impacts from dewatering of the Jabiluka Mine on the Boyweg Site which is an aboriginal sacred site. Developed a conceptual hydrogeologic model for the region based on hydraulic and geochemical data and used this model to estimate potential impacts from dewatering at the mine.

Project Manager/Senior Hydrologist, Ranger Uranium Mine, Hydrogeologic Characterization, Northern Territory, Australia.
Developed a program to investigate the hydrologic and geochemical consequences of tailings storage in mine pits. Reviewed all previous hydrologic investigations and designed a program for hydrologic characterization of the overall site. Investigated surface water and groundwater interaction in support of the hydrologic characterization and tailings storage programs. Assisted in writing sections of the Environmental Impact Statement for the Jabiluka project concerning tailings disposal and hydrogeologic issues.

Research Scientist, Australian Centre for Minesite Rehabilitation Research. Brisbane, Australia.
Presented a lecture discussing management options and factors controlling water quality in mine pit lakes to mining industry representatives. Issues which were discussed included predicting long term water quality and the water balance of mine pit lakes. The lecture also covered relevant examples from Australia and factors for consideration during design of field monitoring studies.

Senior Hydrologist, Worsley Aluminum Company. Western Australia.
Designed a study to evaluate sources of water in underground mine workings using groundwater dating techniques.

Senior Hydrologist, P.T. Freeport Indonesia, Irian Jaya, Indonesia.
Designed and performed hydrologic and geochemical studies of tailings transport in a river system. Assisted in preparation of the ANDAL. Designed, operated, and maintained automated data collection stations for collection of hydrologic and meteorological data. Evaluated environmental impacts from riverine disposal of tailings including the fate and transport of metals in the river system and performed geochemical modeling.

Research Scientist, Chinese Academy of Science, Peoples Republic of China.
Participated in a scientific exchange between the Peoples Republic of China and Australia to evaluate the long term hydrologic consequences of coal mining. Developed a research

program to investigate issues associated with subsidence and impacts to groundwater from coal mining.

Project Hydrologist, Bureau of Land Management, Circle Mining District,. Alaska.
Performed field studies evaluating the geomorphology and water quality of placer mined streams. Measured and compared geomorphologic and water quality parameters in watersheds with and without mining. Developed hydrologic criteria for rehabilitation of placer mined streams.

Research Assistant, United States Geological Survey, Tennessee Park, Colorado.
Assisted in development of a groundwater and water quality monitoring program to characterize hydrochemical processes in a natural wetland receiving acid mine drainage. Installed piezometers and collected water quality samples.

Research Assistant, Colorado School of Mines, Golden, Colorado.
Assisted with various projects evaluating the ability of natural and man-made wetlands to attenuate metals and acidity associated with acid mine drainage. Worked on field surveys, collected and analyzed water quality samples, and performed microbiological testing.

ENVIRONMENTAL EXPERIENCE

Project Manager/Geostatistian, Rocky Flats Soils Program, Golden, Colorado.
Managed the Soils Program at Rocky Flats and performed geostatistical studies to evaluate the spatial distribution of plutonium in soils surrounding the site. Performed probability kriging to determine probability of exceeding background and regulatory levels for plutonium in soils in and near the Rocky Flats Site. The probability kriging provided a risk-based approach for evaluating remediation options and potential exposure levels.

Project Manager, Hydrogeologic Characterization Report, Rocky Flats, Golden, Colorado.
Managed production of the Hydrogeologic Characterization Report for Rocky Flats including technical oversight of all work. Activities included description of the hydrogeologic setting, analyzing surface water and groundwater interaction, defining hydrostratigraphic units, and reviewing hydraulic data. The report incorporated all existing information to construct a conceptual hydrogeologic model that is used for remedial investigations and regulatory activities at the site.

Senior Hydrologist, Well Evaluation Report, Rocky Flats, Golden, Colorado.
Reviewed and assisted in writing chapters of the well evaluation report dealing with hydrology and geochemistry. The well evaluation report evaluated the groundwater monitoring network at Rocky Flats.

Senior Hydrologist/Statistician, RCRA Groundwater Monitoring Report, Rocky Flats, Golden, Colorado.
Developed statistical programs and supervised statistical analysis for the 1993 RCRA Groundwater Monitoring Report at Rocky Flats.

Senior Hydrogeologist, Hazardous Waste Landfill, New Mexico.
Assisted in evaluation of potential solute migration rates through a constructed liner and

natural materials as part of a permit application for a hazardous waste landfill.

Project Manager/Senior Hydrogeologist, DNAPL Assessment, Confidential Client.
Evaluated historic waste management practices and monitored levels of Dense Non-Aqueous Liquids in groundwater in support of a property transfer. Presented results of the investigation to the legal department and Board of Directors.

Project Hydrologist, OU7 Hydrogeology, Rocky Flats, Golden, Colorado.
Characterized hydrogeologic conditions at the landfill at Rocky Flats (OU7) in support of the remedial investigation.

Project Hydrologist, OU11 Hydrogeology, Rocky Flats, Golden, Colorado.
Assisted in evaluation of hydrogeologic conditions at OU11 (Rocky Flats) in support of the remedial investigation.

Senior Hydrologist, Los Alamos NPDES Permit Application, Los Alamos, New Mexico.
Performed hydrologic and water quality assessments in support of the NPDES permit application including field characterization and modeling.

Project Hydrologist, Baseline Environmental Assessment, Romania.
Characterized and documented baseline hydrogeologic conditions and water quality in an exploration area for an international oil firm.

Project Manager, Contaminated Sites Assessment Program, United Kingdom.
Developed a contaminated sites assessment program for a client in the United Kingdom including soil and water sampling protocols.

Project Hydrologist, Glacier National Park Flood Assessment, Montana.
Performed field work, HEC2 modeling, and sediment transport analysis to support flood plain mapping.

Project Hydrologist, Gulkana National Wild and Scenic River, Alaska.
Performed field work and hydrologic modeling to support the application of the first instream flow water right in Alaska.

Project Hydrologist, Delat National Wild and Scenic River, Alaska.
Performed field work and hydrologic modeling to support the application for an instream flow water right.

Research Assistant, Agricultural Chemical in Groundwater, San Luis Valley, Colorado.
Conducted a two year study as part of dissertation research evaluating the occurrence of pesticides and nitrates in groundwater. Performed detailed unsaturated flow modeling describing the movement of pesticides in soil and the role of preferential flow processes. Conducted a stochastic analysis using Monte Carlo techniques to evaluate the relative importance of intrinsic and extrinsic sources of variability on pesticide transport. Evaluated the impact of best management practices on pesticide migration through the soil.

PUBLICATIONS / PRESENTATIONS:

Ellerbroek D.A., and D.R. Jones, 1997, Hydrochemical Characterization to Support Decommissioning of Sulfidic Tailings, Tailings and Mine Waste 97, Fort Collins, Colorado.

Ellerbroek, D.A., D.S. Durnford, and J.C. Loftis, 1998, Modeling Pesticide Transport in an Irrigated Field Soil with Varying Water Application and Hydraulic Conductivity, Journal of Environmental Quality, Vol.27 p. 796-825.

Jones, D.R., Ellerbroek, D.A., and L.R. Townley, 1997, The Hydrology and Water Quality of Final Mining Voids, 22nd Annual Minerals Council of Australia Environmental Workshop. Adelaide, S.A., Australia

Jones, D.R., Ellerbroek, D.A., Hajinakitas J., and D. Blowes, 1997, Coupled Hydrological and Geochemical Modeling to Assess the Performance of a Wet Cover for Tailings Close-Out, 22nd Annual Minerals Council of Australia Environmental Workshop. Adelaide, S.A., Australia

Jones, D.R., Ellerbroek, D.A., and H. Laszczyk, 1997, Evaluating Close-Out Options for Acid Generating, Tailings, Fourth International Conference on Acid Rock Drainage, Vancouver, Canada.

Ellerbroek D.A., D.R. Jones, and L.R. Townley, 1996, Managing the Hydrology and Water Quality of Final Voids After Mining, Workshop on Post-Mining Landform Stability and Design, Australian Centre for Minesite Rehabilitation Research, Brisbane, Australia.

Ellerbroek D.A., D.R. Jones, L.R. Townley, and J.C Eames, 1996, Hydrology and Geochemistry of Coal Spoil and Final Voids, in Subsurface Hydrologic Responses to Land Cover and Land Use Changes, edited by Makoto Taniguchi, Kluwer Academic Press.

Ellerbroek D.A., D.R. Jones, and L.R. Townley, 1996, Water and Solute Movement in Coal Spoil, Western Pacific Geophysics Meeting, Brisbane, Australia.

Ellerbroek, D.A., 1996 Review of Ranger Minesite Hydrology in Relation to Contaminant Transport (Technical Report for Energy Resources of Australia, Ltd.).

Litaor, M.I., D.A. Ellerbroek, and L.E. Allen, 1995, Comprehensive Appraisal of Plutonium-239+240 in Soils of Colorado: A Basis for Risk Analysis, Health Physics (69) 923-935

Ellerbroek, D.A., M.I. Litaor, and L.E. Allen, 1995 Assessment of Plutonium-239+240 Contamination in Soils near the former Rocky Flats Site using Nonparametric Geostatistics, International Conference on Modelling and Simulation, Newcastle, NSW, Australia.

Ellerbroek, D.A. and L.R. Townley, 1995, A review of processes affecting the water and solute balance of final voids, CSIRO Minesite Rehabilitation Research Program, Perth, Australia.

Townley L.R. and D.A. Ellerbroek, 1995, Review of Hydrologic Data at Possum Pit, CSIRO Minesite Rehabilitation Research Program, Perth, Australia.

Townley L.R. and D.A. Ellerbroek, 1995 Water Movement in the Possum Pit Transect, CSIRO Minesite Rehabilitation Research Program, Perth, Australia.

Department of Energy, 1995, Hydrogeologic Characterization Report for the Rocky Flats Site, Golden, Colorado (Project Manager).

Department of Energy, 1994, Well Evaluation Report for the Rocky Flats Site, Golden, Colorado (Chapters 3 and 4, Hydrogeology and Geochemistry).

Ellerbroek, D.A., D.S. Durnford, and C. Pearson, 1992 Monitoring Groundwater Quality in the San Luis Valley. Proceedings: Colorado Water Engineering and Management Conference. Published by the Colorado Water Resources Research Institute, Fort Collins, Colorado.

Ellerbroek, D.A., K.R. Thompson, D.S. Durnford, and S. Davies, 1991, Groundwater Pollution in the San Luis Valley. Proceedings: Colorado Water Engineering and Management Conference. Published by the Colorado Water Resources Research Institute, Fort Collins, Colorado.

PATRICK CORSER, P.E.
VICE PRESIDENT/DIRECTOR OF ENGINEERING

EDUCATION:

M.S., Civil Engineering, Northwestern University
B.S., Civil Engineering, University of Minnesota
Graduate Studies Cold Regions Engineering, University of Alaska, Anchorage, Alaska
Graduate Studies Construction Management, University of Washington, Seattle, Washington

REGISTRATION:

Professional Engineer: Alaska, Arizona, California, Colorado, Nevada, New Mexico, North Dakota, Oregon, Washington, Utah, and Wyoming

SUMMARY:

Mr. Corser is Vice President of Montgomery Watson and is responsible for all engineering studies performed for the Mining Division. Mr. Corser has over 20 years of practical engineering experience servicing the civil, environmental and mining business in the western United States and South America.

EXPERIENCE:

MINING

Project Manager, Cyprus Minerals Cerro Verde Mine, Peru.
Remedial investigation and re-design for leaking PLS Pond for Copper heap leach pad

Project Manager, Newmont Gold South Area Non-Property Heap Leach Pad Deformation Study, Nevada.
Remedial investigation into cause and mechanism for the slope deformation at the Phase II heap leach pad.

Project Director, BHP Old Dominion Mine, Arizona.
Site characterization, design, permitting and construction management for remediation of historic mine facilities. Impacts on surface water quality from tailings piles, waste rock piles, and abandon processing facilities was major issue at the site. Designs were required to preserve the historic character of the site and site address surface water quality issues.

Project Director, Addwest's Gold Road Mine Tailings Facility Expansion, Arizona.
Design, permitting, and construction monitoring for expansion of existing lined tailings facility.

Technical Reviewer, Vista Gold's Amayapampa Mine, Bolivia.
Design and permitting of water supply embankment and tailings facility. Embankment is 65 meters high and includes a concrete lined upstream face.

Technical Specialist, Southeast Idaho Phosphate Mine's Selenium Subcommittee, Idaho.
Site characterization, sampling, analysis and assessment of Se contamination in surface water, groundwater, soil and air from phosphate mining and processing activities. Facilities owned and/or operated by FMC, Monsanto, Agrium, Rhone-Poulenc, and Simplot.

Technical Reviewer, Minera Yanacocha Norte Waste Dump, Peru.
Stability investigation and conceptual designs for stabilization of waste dump over soft peats and clay. Work included field investigation, sampling and testing of foundation materials, stability evaluation and remedial and expansion design recommendations.

Project Manager, Coeur Alaska Inc. - Kensington Dry Tailings Facility, Alaska
Design review and development of cost estimates for alternative construction methods for dry tailings facility for Gold mine in SE Alaska.

Project Director, Various Coal Mines in Rocky Mountains, Colorado.
Reclamation and drainage and sediment control designs and permitting for various coalmines (Kerr, Raton Creek, Southfield, and Colowyo).

Project Manager, Rhone-Poulenc's Rasmussen Ridge Mine, Idaho.
Highwall stability evaluation in limestone hanging wall of Phosphate mine in SE Idaho

Project Manager, Rio Tinto Working Group, Rio Tinto Mine Remediation Project, Nevada.
Comprehensive, five year project to characterize and design remediation for and abandoned mine in northern Nevada. Four previous owners of the property (Cleveland-cliffs, DuPont, ARCO, Cominco) form the Rio Tinto Working Group. Tasks included site characterization, sampling and analysis of surface water and groundwater design, permitting and agency negotiations for remediation of the site and complete construction management services to implement the remediation.

Lead Engineer, Cyprus Mineral Park Application, Arizona.
Lead engineer in the BADCT design of sediment ponds and closure systems for waste rock stockpiles, tailings impoundment for the Cyprus Mineral Park facility located in northwest Arizona. Experience in completing both prescriptive and non-prescriptive BADCT designs.

Technical Reviewer and Resource Specialist, Barrick Gold, Tambo Project, Chile.
Design, Permitting, Construction Management and CQA work performed for multiple lined tailings embankments and impoundments in upper reaches of the Andes Mountains.

Construction Manager, Newmont Gold, Resurrection Project, Colorado.
Construction manager and design reviewer for all remedial construction associated with abandon mining facilities in Leadville, Colorado. Projects included tailings removal actions, tailings regrading and covering, portal discharged collection, piping and infiltration systems and surface water diversion structures and groundwater cutoff structures.

Program Manager, Newmont Gold, Idarado Project, Colorado.
Program Manager for the Idarado Mine Remediation Project in southern Colorado. Provided overall technical project management for this four year project including the removal of hazardous mine tailing, the design of surface water diversion structures,

groundwater interceptor systems, portal plugs, portal discharge collection and infiltration systems, tailings remediation, including regrading and revegetation and the design and construction of closure and barrier layer systems. Provided complete construction designs, permitting, regulatory interaction, construction manpower loading, and cost control and provided overall technical oversight and budget management.

Project Manager, Choquelimpie Mine, Chile.
Project Manager for an assessment of remedial design alternatives for a leaking heap leach pad in central Chile. A risk-based analysis was used to evaluate the effectiveness of each alternative. In addition, probabilistic cost estimates were prepared for each alternative to determine the most cost-effective solution. Selected method consisted of groundwater collection and treatment system below pad in combination with surface water control structures.

Project Manager, Monticello Remedial Action Plan OU-1 Millsite Remediation, Utah.
Construction quality assurance and design assistance related to all geosynthetic components of the liner and cover systems for uranium tailings disposal facility. A staff of five to seven engineers were onsite for the duration of construction to perform engineering and construction monitoring tasks.

Project Manager, Cambior Alaska, Valdez Creek Mine, Alaska.
Field investigation, design and construction monitoring for 40-foot high geosynthetically lined tailings Pond Embankment.

Task Manager, Beartrack Heap Leach Project, Idaho.
Prepared final grading plan and cover design for heap leach facility. Analysis included stability erosion, surface water drainages, cover infiltration and overall water balance.

Project Engineer, Washington Irrigation and Development Company, Washington.
Perform investigations and designs for new reuse retention facilities for coal processing plant. Designs completed for new facilities as well as reclamation of completed facilities.

Project Manager, Usibelli Coal Mine, Alaska.
Project Manager for a risk based analysis that was used to evaluate the stability of in-pit spoil piles that were impacting current mining operations. Analyses were conducted to determine the risk of failure and the associated costs for remediation and impacts to the ongoing operations. The model was also applied to the failing of excess spoil piles that required substantial remediation prior to satisfying regulatory criteria.

Project Engineer, Diamond Chuitna, Alaska.
Surface coalmine permit completeness review.

Project Engineer, State of Alaska, Alaska.
Coal mining reclamation program for seven sites within the Nenana Coal Field.

Project Manager, Usibelli Coal Mine, Alaska.
Poker Flats and Runaway Ridge highwall and spoil stability investigation and dewatering investigation.

Project Engineer, Bering River Coal, Alaska.
Geotechnical investigation and foundation design recommendation.

Project Engineer, Washington Irrigation Development Company, Washington.
Spoil pile stability study.

Project Engineer, Carter Coal, Wyoming.
Highwall and spoil pile stability study at surface coalmines.

Project Engineer, Getty Diatomite Mine, California.
Geotechnical and hydrological investigations and slope stability analysis.

Project Engineer, New Hope Prospect, Arkansas.
Highwall stability study.

Project Engineer, Los Bronces Expansion Project, Chile.
Field investigation for tailings dam design.

WASTE DISPOSAL AND WASTE CONTAINMENT DESIGN PROJECTS

Project Manager, Highway 36 Hazardous Waste Facility, Colorado.
Project manager for design and permitting of five new ten acre landfills, construction quality assurance monitoring for Secure Cell No. 2, closure design Secure Cell No. 1, Class 2 Permit Modification drawings, test fill design and construction monitoring.

Project Manager, Gandy-Marley Hazardous Waste Landfill, New Mexico.
Complete design and permitting services for new hazardous waste landfill and processing facilities in site in New Mexico.

Project Manager, Tower Road Landfill, Colorado.
Project Manager for the landfill expansion design study, site characterization and groundwater monitoring program, Subtitle D compliance demonstration study, and construction quality assurance monitoring.

Project Manager, Kettleman Hills Landfill B-18, California.
Project Manager for CQA program for 36 acres hazardous waste landfill including over 3 million square feet of geosynthetic liner.

Project Manager, Hidronor Industrial Hazardous Waste Landfill, Chile.
Design review, construction management and CQA of the first fully lined hazardous waste facility in Chile.

Project Manager, United Waste System's Jahner Landfill, North Dakota.
Site design and operations plan to expand and updated liner and leachate collection and removal system to meet Subtitle D standards.

Project Manager, Jackson County Landfill, Colorado.
Investigation and characterization of borrow sources to be used for liner and cover construction on MSW landfill.

Project Manager, Chemical Waste Management Inc.
Project Manager for a detailed risk based study to evaluate the most cost effective cover system to meet regulatory criteria, long term performance criteria, minimize capital costs, and minimize maintenance costs. The study included engineering evaluation from TerraMatrix as well as direct input from CWMI regulatory, operations, and financial staff.

Project Manager, Mesa County Orchard Mesa Landfill, Colorado.
Project Manager for a preliminary site compatibility study for a proposed expansion of the Orchard Mesa Landfill located in Grand Junction, Colorado.

Principal-In-Charge, Rio Blanco County, Colorado.
Siting study for a new MSW landfill, expansion of existing facility and closure of historic site.

Project Manager, Rocky Flats OU-7 Landfill, Colorado.
Project Manager for the closure design for existing hazardous and municipal waste landfill (OU-7) including final grading plan, gas collection and venting system design, cover design and slurry wall design. Construction level design drawings, specifications and CQA Plan were prepared.

Project Manager, Rocky Flats Low Level Mixed Waste Facility, Colorado.
Project Manager for the complete construction level design drawings for new five acre double lined landfill.

Project Manager, Kettleman Hills Facility, California.
Project Manager for a 2-year study of a failed landfill. Tasks included; development of immediate remedial measures to stabilize the waste and limit additional movement, design and implementation of a field and laboratory investigation program to determine the cause and mechanism of failures and the design of all final remedial measures for the failed cell.

- Project Manager for cover design for 70 acres of hazardous waste disposal area
- Project Manager for design for 46 acre hazardous waste landfill
- Project Manager. CQA services for 45 acre and 25-acre hazardous waste landfills.

Project Manager, Hanford Nuclear Reservation, Washington.
Project Manager for construction quality assurance observation and testing for lining of 2 two million-gallon purge tanks.

Project Manager, Marsh Canyon Landfill, California.
Project Manager for final design of 90 million cubic yard municipal landfill.

Project Manager, Hanford Nuclear Reservation, W-025 Landfill, Washington.
Project Manager, for design of first RCRA compliant radioactive mixed waste landfill.

Project Engineer, Merrill Field Landfill, Anchorage.
Geotechnical evaluation and closure design.

Project Manager, INEL, Idaho.
Cover design and remedial measures for mixed waste landfills.

Project Engineer, Anchorage Regional Landfill, Alaska.
Geotechnical evaluation of subsurface conditions, development of excavation plan and lining and leachate collection system options. Design and installation of groundwater monitoring wells.

Project Engineer, Arlington RCRA Landfill, Oregon.
Design for covers for RCRA landfills and review of construction quality assurance testing for construction of a new landfill cell and various covers.

Project Manager, Kodiak Island Landfill, Alaska.
Closure design and new cell design.

Project Engineer, Midway Landfill, Washington.
Geotechnical evaluation and conceptual closure design.

Construction Manager, Newmont Gold, Resurrection Project, Colorado.
Construction manager and design reviewer for all remedial construction associated with abandon mining facilities in Leadville, Colorado. Projects included tailings removal actions, tailings regrading and covering, portal discharged collection, piping and infiltration systems and surface water diversion structures and groundwater cutoff structures. Remedial construction valued at over $7 million.

Program Manager, Newmont Gold, CERCLA Idarado Project, Colorado.
Program Manager for the Idarado CERCLA mine remediation Project in southern Colorado. Provided overall technical project management for this four year project including the removal of hazardous mine tailing, the design of surface water diversion structures, groundwater interceptor systems, portal plugs, portal discharge collection and infiltration

systems, tailings remediation, including regrading and revegetation and the design and construction of closure and barrier layer systems. Provided complete construction designs, permitting, regulatory interaction, construction manpower loading, and cost control and provided overall technical oversight and budget management. Total construction valued at over $20 million.

Project Manager and Geosynthetic Design Consultant, DOE Monticello Uranium Tailings Disposal Facility, Utah.
Provide design recommendations for geosynthetic aspects of liner and cover system for uranium tailings disposal facility at DOE site in Utah. In addition, supervised the construction quality assurance observation and testing program for installation of liner and cover system. Project involved mobilization of project team to the DOE facility for nine-month duration during construction of the liner system. Designs included triple lined evaporation pond with multiple GCL layers and double lined repository liner with a GCL in both the primary and secondary liner system.

Project Manager, Mesa County Landfill Alternative Cover Studies, Colorado.
Designed and conducted a program to assess the performance of alternative cover design on water movement in the unsaturated zone. The objective of this study is to provide information that can be used by the regulatory community to approve cover designs based on output from simulations of unsaturated flow. The study will define and provide performance criteria for model calibration that will describe the use of unsaturated flow models (e.g. SoilCover) to validate cover designs in terms of environmental performance. Two sets of criteria will be developed during this study: 1) performance criteria describing the ability of the model to predict net infiltration rates through a cover; and 2) data criteria describing the minimum amount and types of data necessary to achieve the performance criteria. The criteria will be evaluated to determine the ability of the model to meet the performance objective using more generalized information (e.g. regional values for climate or text book values for hydraulic parameters). This information will provide an assessment of the minimum level of characterization necessary to support modeling and design studies. An automated data collection system will be used to collect information (e.g. water contents and soil suctions) describing the performance of the cover systems.

CIVIL/GEOTECHNICAL

Project Manager, Arco Cherry Point Refinery, Washington.
Geotechnical Foundations Study for sulfur recovery unit.

Project Manager, Oakland Quarry, California.
Geotechnical Investigation for Siting Rock Quarry Storage and Processing Facilities.
Project Manager, Lake Washington, Washington.
Geotechnical Investigations, Design Report, Construction Observation for 40 acre multi-facility housing development.

Project Manager, Westside Reservoir, Washington.
Remedial designs for slope failure.

Project Manager, Bradley Lake Hydroelectric Project.
Foundation design for 20 miles of transmission lines.

Project Manager, St. Hermans; Breakwater, Alaska.
Field investigation through design for rubble mount breakwater.

Project Manager, Fish Creek Sewer, Alaska.
Geotechnical investigation and design recommendations for five miles of force main and gravity sewer lines through tide flats.

Project Engineer, Alaska Railroad, Alaska.
Tunnel slope stability analysis blasting design for the removal of Tunnel No. 5.

Project Engineer, Kings Cove Dam, Alaska.
Rock abutment stability analysis and rock anchor design and installation program.

Project Engineer, Seward Shiplift Facility, Alaska.
Field investigation for remedial design of failing sheet pile cofferdam.

Project Engineer, Pacwest Tower, Oregon.
Field investigation and foundation design using 200-ton pile.

ORGANIZATIONS:

American Society of Civil Engineers (ASCE), Solid Waste Association of North America (SWANA)

ADDITIONAL COURSES AND WORKSHOPS:

MSHA and OSHA Health and Safety Training Seminar, 1989 to present

PUBLICATIONS AND PRESENTATIONS

“Uranium Millsite Remediation at Monticello, Utah” Tailings and Mine Waste 98 Conference Proceedings, Fort Collins, Colorado.

“Rio Tinto Mine Remediation: An Alternative Approach to the CERCLA Process,” Tailings and Mine Waste 98 Conference Proceedings, Fort Collins, Colorado.

"Evaluation of Impacts to Productivity and Quality During Construction of a Lined Tailings Impoundment for a Grinding and Cyanide Leaching Mill Process" Tailings and Mine Waste 98 Conference Proceedings, Fort Collins, Colorado.

"Observations on Long-Term Performance of Composite Clay Liners and Covers", Geosynthetics: Design and Performance, 6th Annual Symposium Vancouver Geotechnical Society, 1991.

"Current Design and Construction Methods for Municipal and Hazardous Waste Landfills, Washington Engineers Club, 1991.

"Costs of RCRA Design and Construction Methods", Environmental Compliance - Solutions That Work, Society of Mining Engineers Conference, Denver, Colorado, 1990.

"RCRA Requirements for Mining Wastes", Society of American Foresters Conference, Spokane, Washington, 1989.

"Construction Quality Assurance Methods for Municipal and Hazardous Waste Facilities" Instructor for 2-day seminar for California Department of Health Services, 1988.

"Geotechnical Constraints on Mining in Alaska's Interior - A Case Study", Society of Mining Engineers Annual Conference, Tucson, Arizona, 1988.

"Coal Mining in Alaska's Interior: Problems and Solutions", Cold Regions Engineering - Proceedings of the Fourth International Conference, Anchorage, Alaska 1986.

"Cracking and Construction Blasting" ASCE Journal of Construction Division, March 1991.

Vtrnspt

CONCENTRATION AT BOTTOM OF VADOSE ZONE
RUN NO. 1

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AT TIME = 0.2771E+04   CONC = -.5497E-01
AT TIME = 0.3011E+04   CONC = -.2357E-01
AT TIME = 0.3211E+04   CONC = 0.6788E-01
AT TIME = 0.3378E+04   CONC = 0.1819E+00
AT TIME = 0.3517E+04   CONC = 0.2889E+00
AT TIME = 0.3633E+04   CONC = 0.3765E+00
AT TIME = 0.3730E+04   CONC = 0.4432E+00
AT TIME = 0.3811E+04   CONC = 0.4921E+00
AT TIME = 0.3878E+04   CONC = 0.5272E+00
AT TIME = 0.3934E+04   CONC = 0.5522E+00
AT TIME = 0.3984E+04   CONC = 0.5710E+00
AT TIME = 0.4034E+04   CONC = 0.5864E+00
AT TIME = 0.4084E+04   CONC = 0.5984E+00
AT TIME = 0.4134E+04   CONC = 0.6072E+00
AT TIME = 0.4184E+04   CONC = 0.6126E+00
AT TIME = 0.4234E+04   CONC = 0.6149E+00
AT TIME = 0.4284E+04   CONC = 0.6142E+00
AT TIME = 0.4334E+04   CONC = 0.6107E+00
AT TIME = 0.4384E+04   CONC = 0.6046E+00
AT TIME = 0.4434E+04   CONC = 0.5960E+00
AT TIME = 0.4484E+04   CONC = 0.5853E+00
AT TIME = 0.4534E+04   CONC = 0.5725E+00
AT TIME = 0.4584E+04   CONC = 0.5580E+00
AT TIME = 0.4634E+04   CONC = 0.5420E+00
AT TIME = 0.4684E+04   CONC = 0.5246E+00
AT TIME = 0.4734E+04   CONC = 0.5062E+00
AT TIME = 0.4784E+04   CONC = 0.4868E+00
AT TIME = 0.4834E+04   CONC = 0.4667E+00
AT TIME = 0.4884E+04   CONC = 0.4461E+00
AT TIME = 0.4934E+04   CONC = 0.4252E+00
AT TIME = 0.4990E+04   CONC = 0.4015E+00
AT TIME = 0.5057E+04   CONC = 0.3730E+00
AT TIME = 0.5137E+04   CONC = 0.3391E+00
AT TIME = 0.5234E+04   CONC = 0.2995E+00
AT TIME = 0.5350E+04   CONC = 0.2542E+00
AT TIME = 0.5489E+04   CONC = 0.2041E+00
AT TIME = 0.5656E+04   CONC = 0.1512E+00
AT TIME = 0.5856E+04   CONC = 0.9867E-01
AT TIME = 0.6097E+04   CONC = 0.5080E-01
AT TIME = 0.1036E+05   CONC = 0.3151E-02
```

1 UNSATURATED ZONE TRANSPORT RESULTS

TRAIL2-VTRN

Figure TRAIL-2

AutoCAD FILE: TRAIL2-VTRN

Vtrnspt

```
CONCENTRATION AT BOTTOM OF VADOSE ZONE
 RUN NO.     1
      AT TIME = 0.1385E+04   CONC = -.4778E-01
      AT TIME = 0.1505E+04   CONC = -.5522E-02
      AT TIME = 0.1606E+04   CONC = 0.7461E-01
      AT TIME = 0.1689E+04   CONC = 0.1696E+00
      AT TIME = 0.1759E+04   CONC = 0.2580E+00
      AT TIME = 0.1817E+04   CONC = 0.3311E+00
      AT TIME = 0.1865E+04   CONC = 0.3897E+00
      AT TIME = 0.1905E+04   CONC = 0.4373E+00
      AT TIME = 0.1939E+04   CONC = 0.4767E+00
      AT TIME = 0.1967E+04   CONC = 0.5097E+00
      AT TIME = 0.2017E+04   CONC = 0.5701E+00
      AT TIME = 0.2067E+04   CONC = 0.6326E+00
      AT TIME = 0.2117E+04   CONC = 0.6964E+00
      AT TIME = 0.2167E+04   CONC = 0.7598E+00
      AT TIME = 0.2217E+04   CONC = 0.8200E+00
      AT TIME = 0.2267E+04   CONC = 0.8739E+00
      AT TIME = 0.2317E+04   CONC = 0.9186E+00
      AT TIME = 0.2367E+04   CONC = 0.9517E+00
      AT TIME = 0.2417E+04   CONC = 0.9715E+00
      AT TIME = 0.2467E+04   CONC = 0.9773E+00
      AT TIME = 0.2517E+04   CONC = 0.9692E+00
      AT TIME = 0.2567E+04   CONC = 0.9477E+00
      AT TIME = 0.2617E+04   CONC = 0.9145E+00
      AT TIME = 0.2667E+04   CONC = 0.8710E+00
      AT TIME = 0.2717E+04   CONC = 0.8194E+00
      AT TIME = 0.2767E+04   CONC = 0.7617E+00
      AT TIME = 0.2817E+04   CONC = 0.6998E+00
      AT TIME = 0.2867E+04   CONC = 0.6356E+00
      AT TIME = 0.2917E+04   CONC = 0.5708E+00
      AT TIME = 0.2967E+04   CONC = 0.5067E+00
      AT TIME = 0.2995E+04   CONC = 0.4717E+00
      AT TIME = 0.3028E+04   CONC = 0.4307E+00
      AT TIME = 0.3069E+04   CONC = 0.3834E+00
      AT TIME = 0.3117E+04   CONC = 0.3297E+00
      AT TIME = 0.3175E+04   CONC = 0.2703E+00
      AT TIME = 0.3244E+04   CONC = 0.2069E+00
      AT TIME = 0.3328E+04   CONC = 0.1424E+00
      AT TIME = 0.3428E+04   CONC = 0.8091E-01
      AT TIME = 0.3548E+04   CONC = 0.2785E-01
      AT TIME = 0.5804E+04   CONC = 0.6340E-02

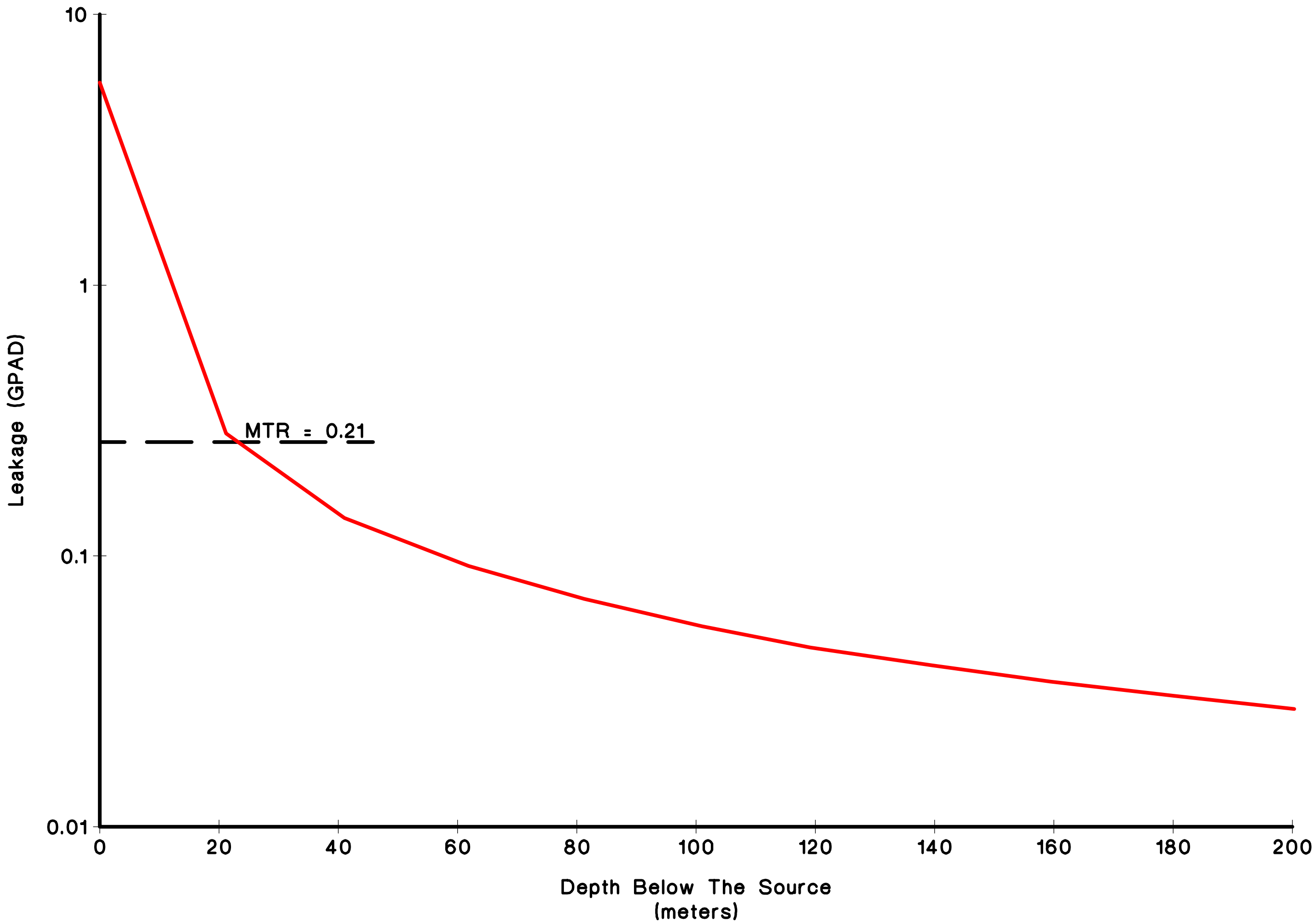
1                   UNSATURATED ZONE TRANSPORT RESULTS

                                                                     NORMALIZED
SERIAL NUMBER          TIME              DEPTH        CONCENTRATION  CONCENTRATION
```

TRAIL1-VTRN

Figure TRAIL-1

AutoCAD FILE: TRAIL1-VTRN

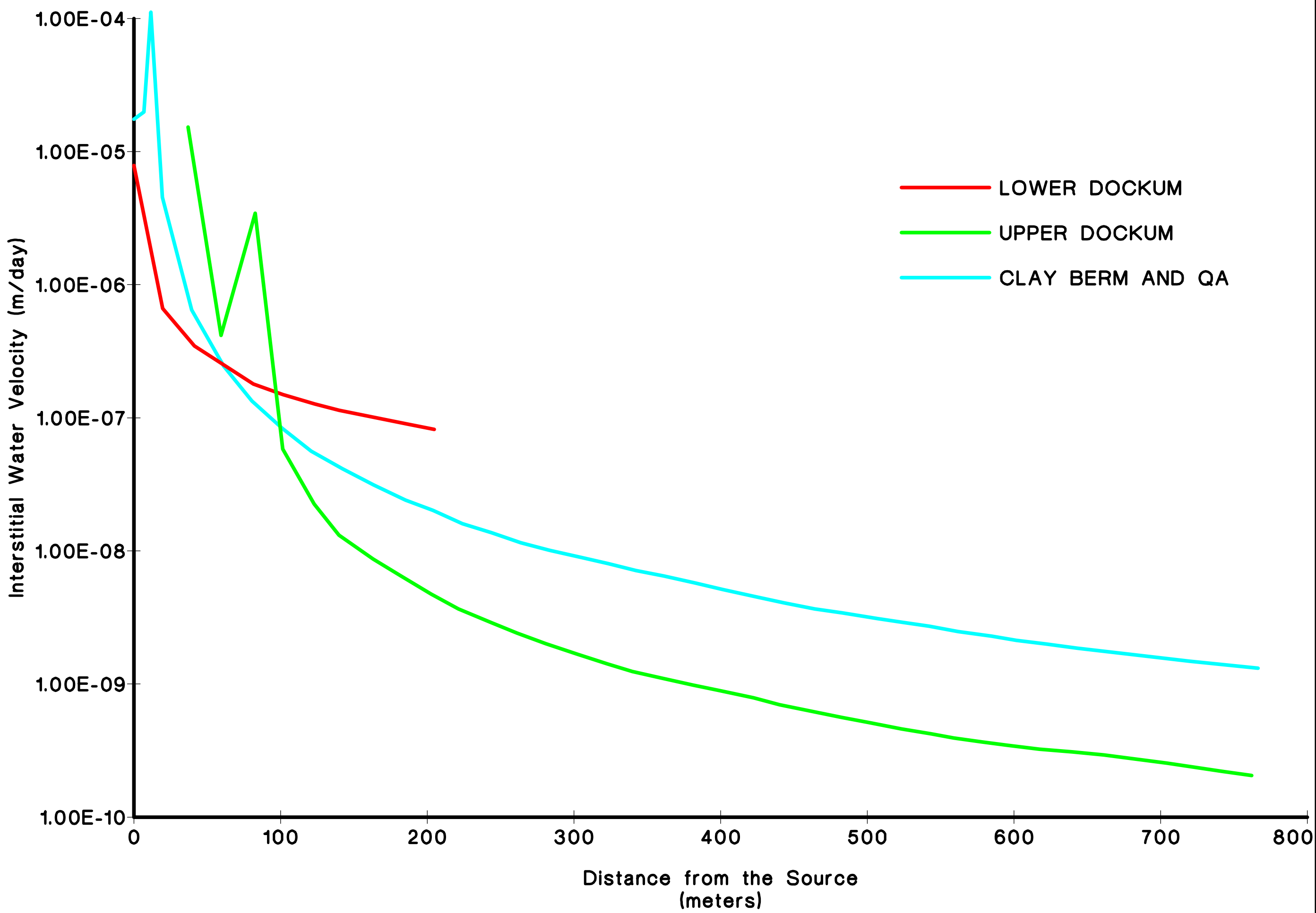


STEADY STATE LEAKAGE INTO LOWER DOCKUM vs.DISTANCE FROM SOURCE

Figure B-5

TRIASSIC PARK WASTE DISPOSAL FACILITY

AutoCAD FILE: GANDY-FIGB-5

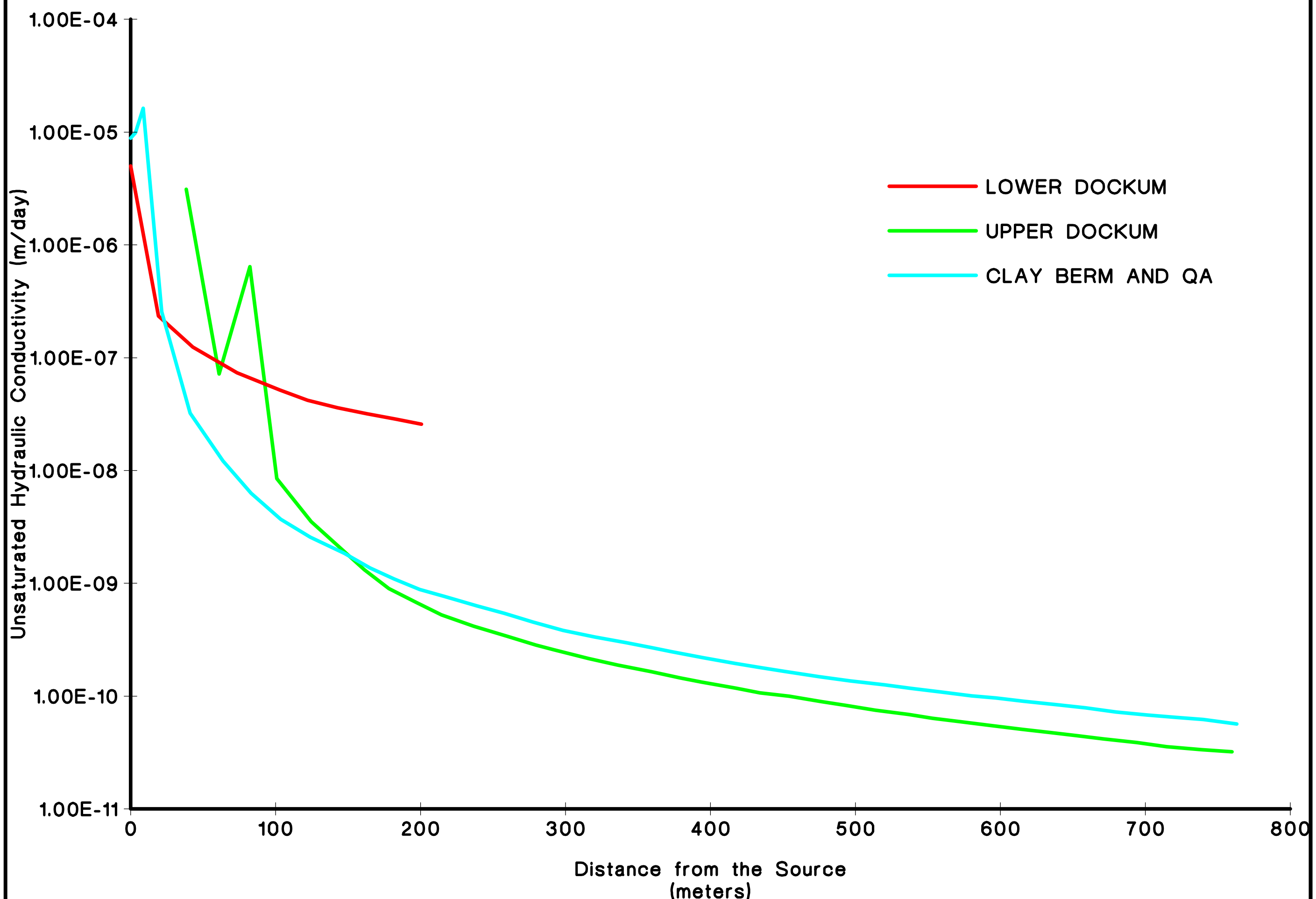


INTERSTITIAL WATER VELOCITY vs. DISTANCE FROM SOURCE

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure B-4

AutoCAD FILE: GANDY-FIGB-4

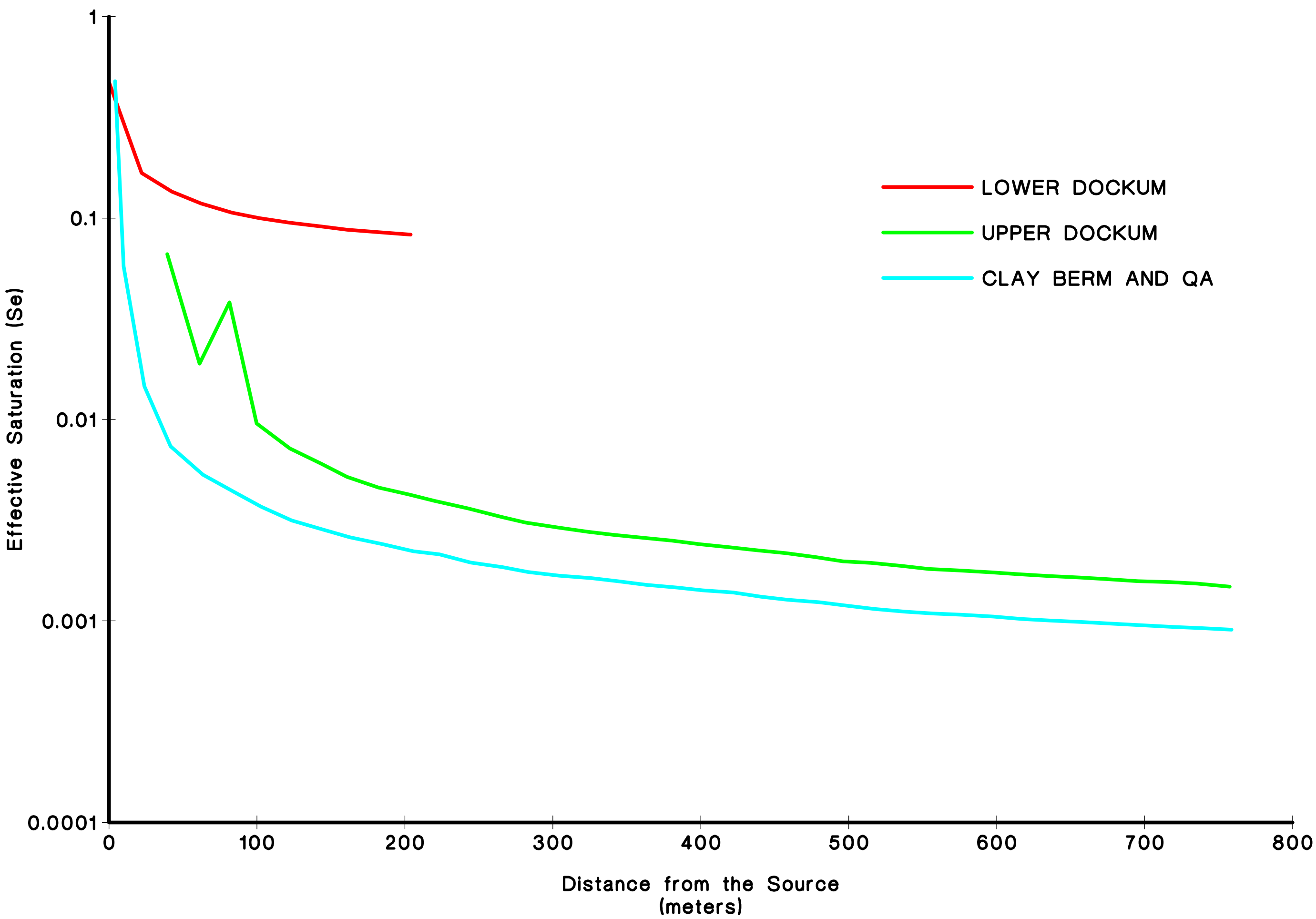


STEADY STATE UNSATURATED HYDRAULIC CONDUCTIVITY vs. DISTANCE FROM SOURCE

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure B-3

AutoCAD FILE: GANDY-FIGB-3

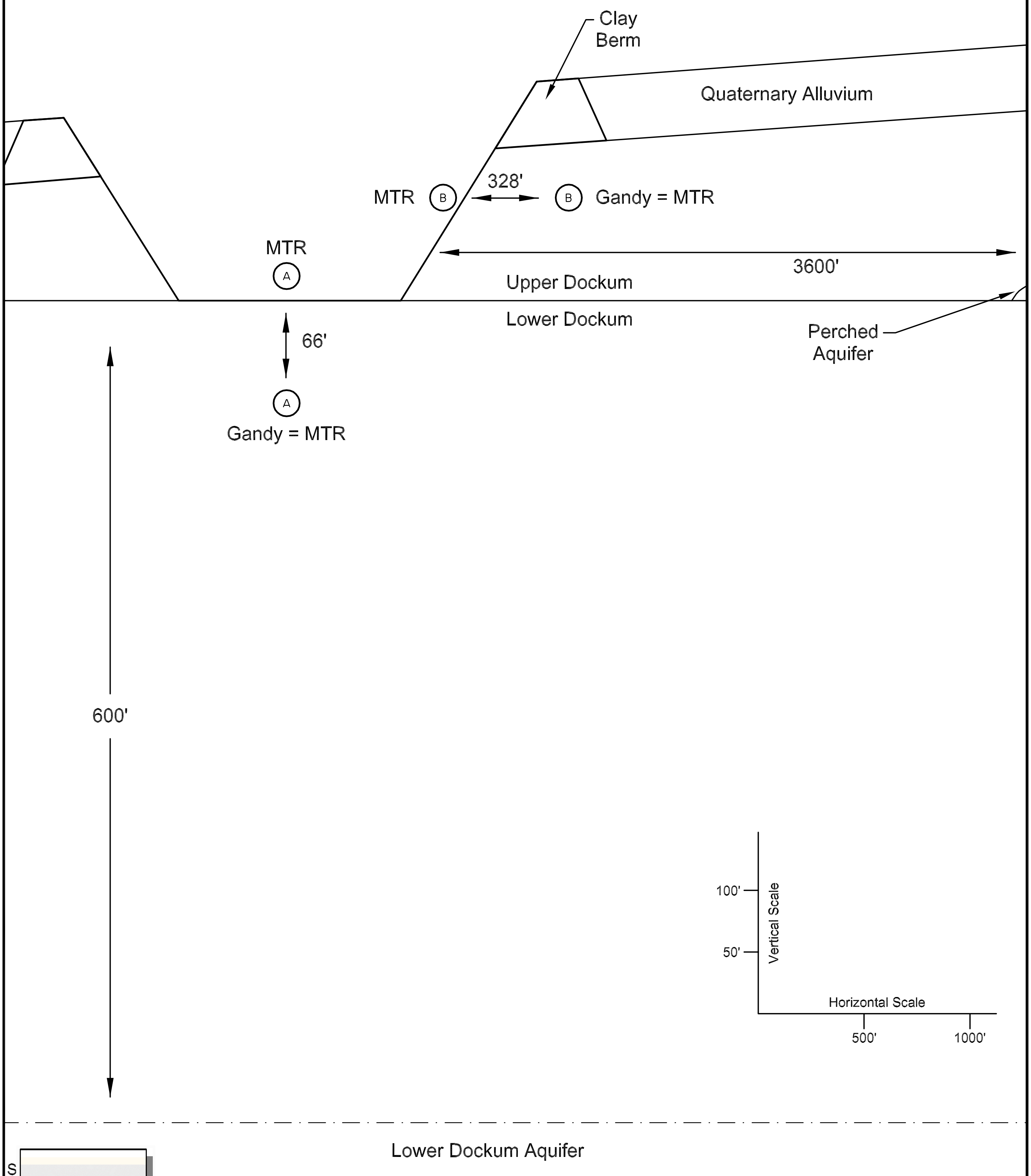


STEADY STATE EFFECTIVE SATURATION vs. DISTANCE FROM SOURCE

Figure B-2

TRIASSIC PARK WASTE DISPOSAL FACILITY

AutoCAD FILE: GANDY-FIGB-2

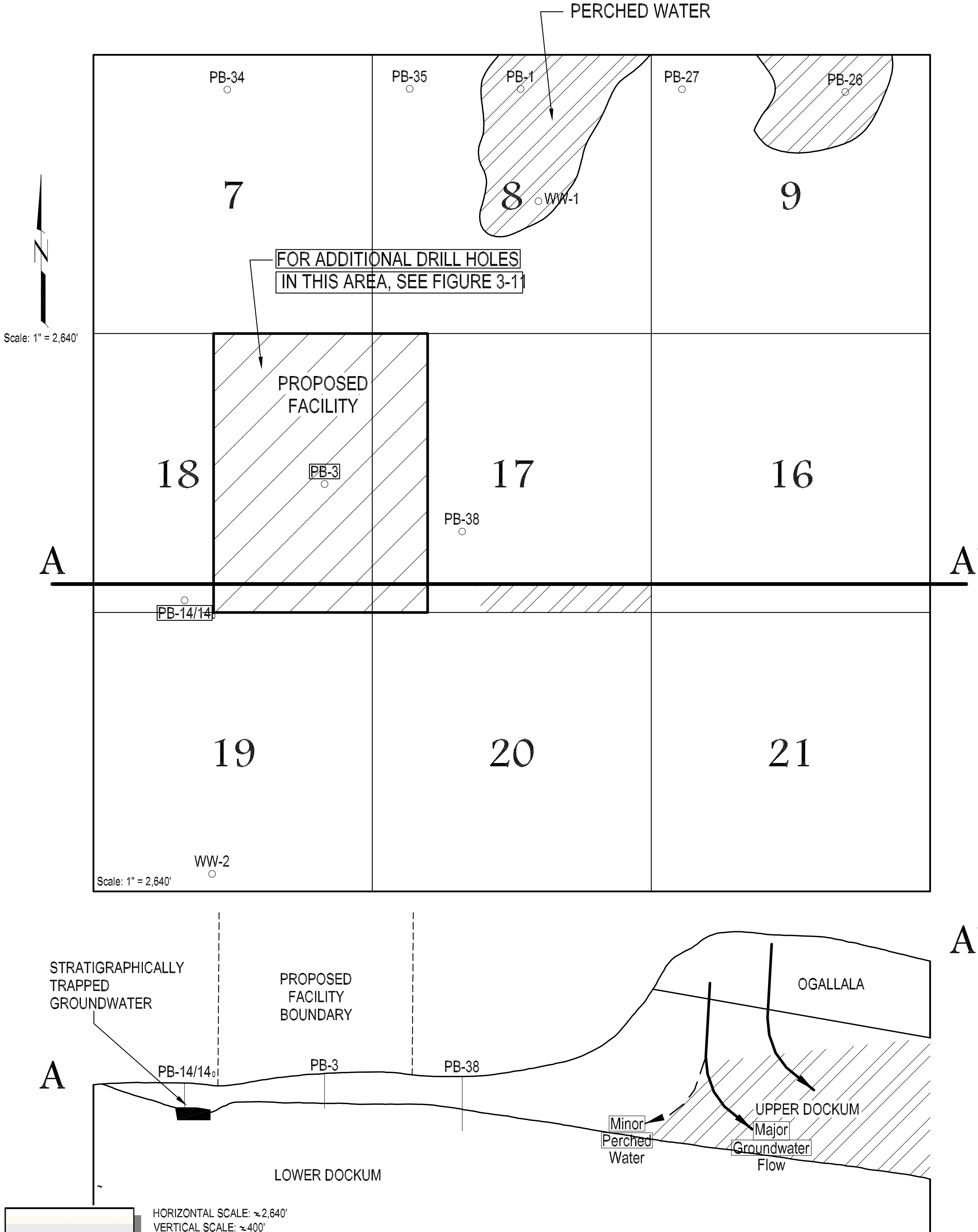


LANDFILL PROFILE

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure B-1

AutoCAD FILE: GANDY-FIGB-1

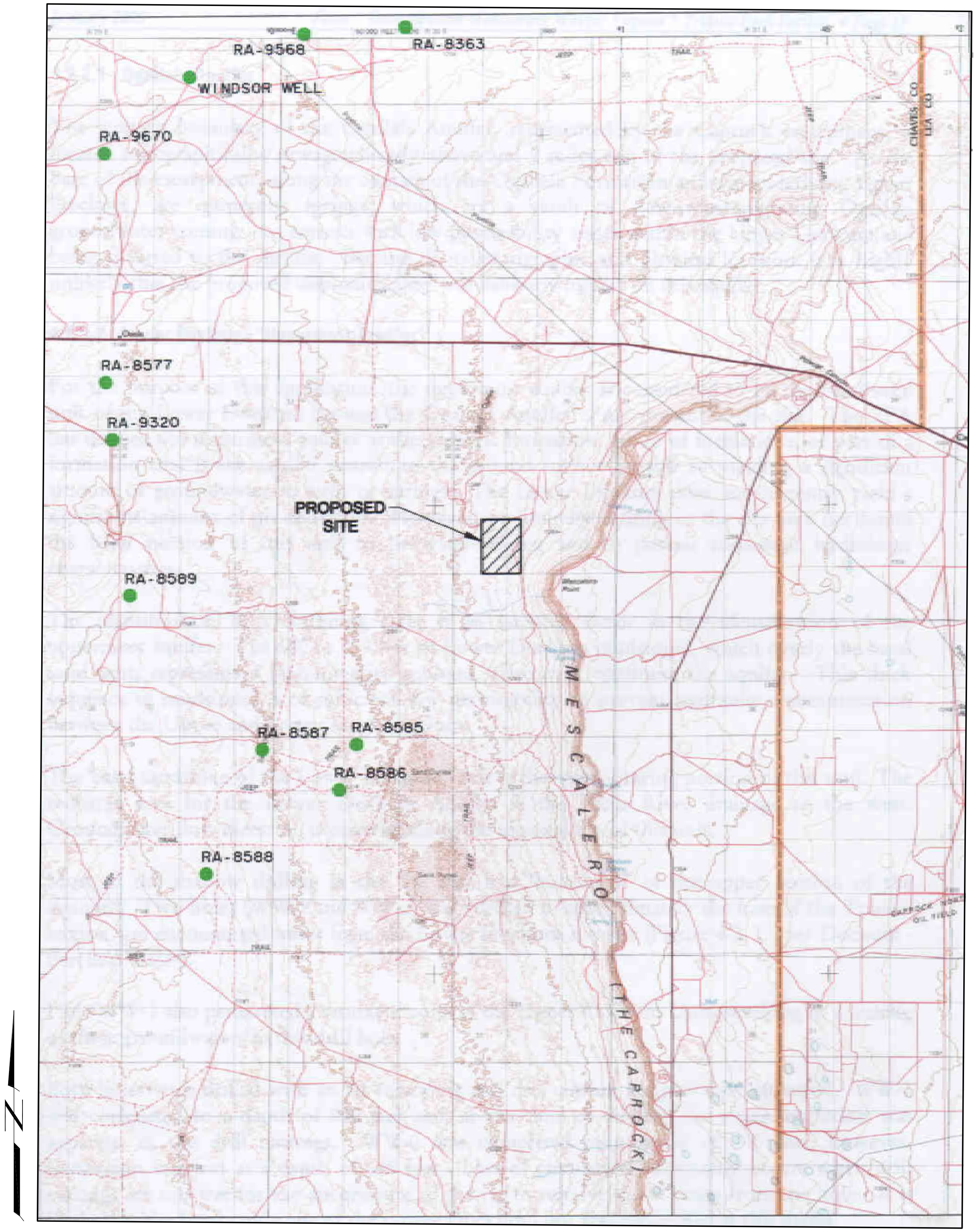


UPPER DOCKUM - PERCHED WATER

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 4-2

AutoCAD FILE: GANDY-FIG4-2



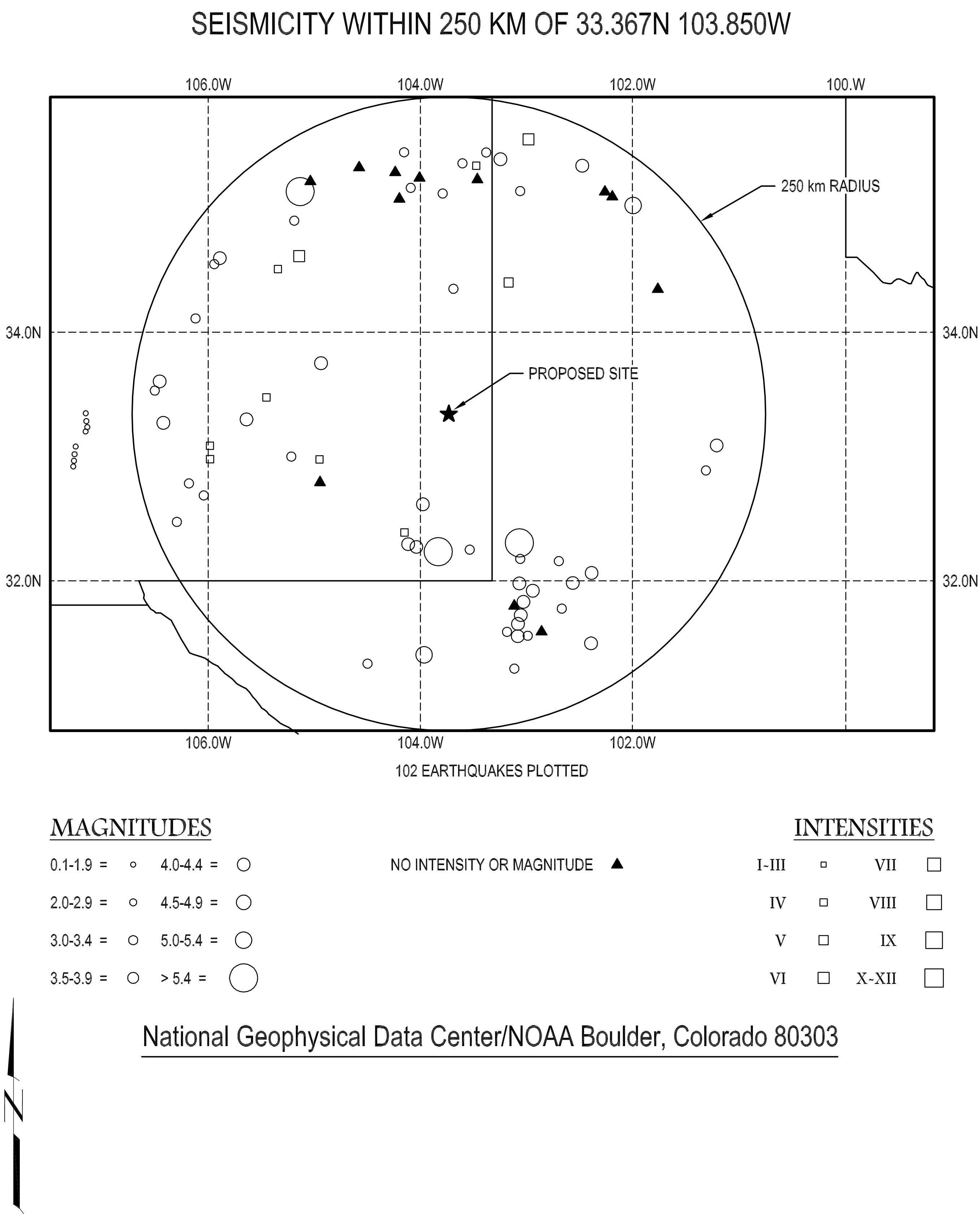
Scale: 1:100,000

WATER WELLS - 10 MILE RADIUS

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 4-1

AutoCAD FILE: GANDY-FIG4-1

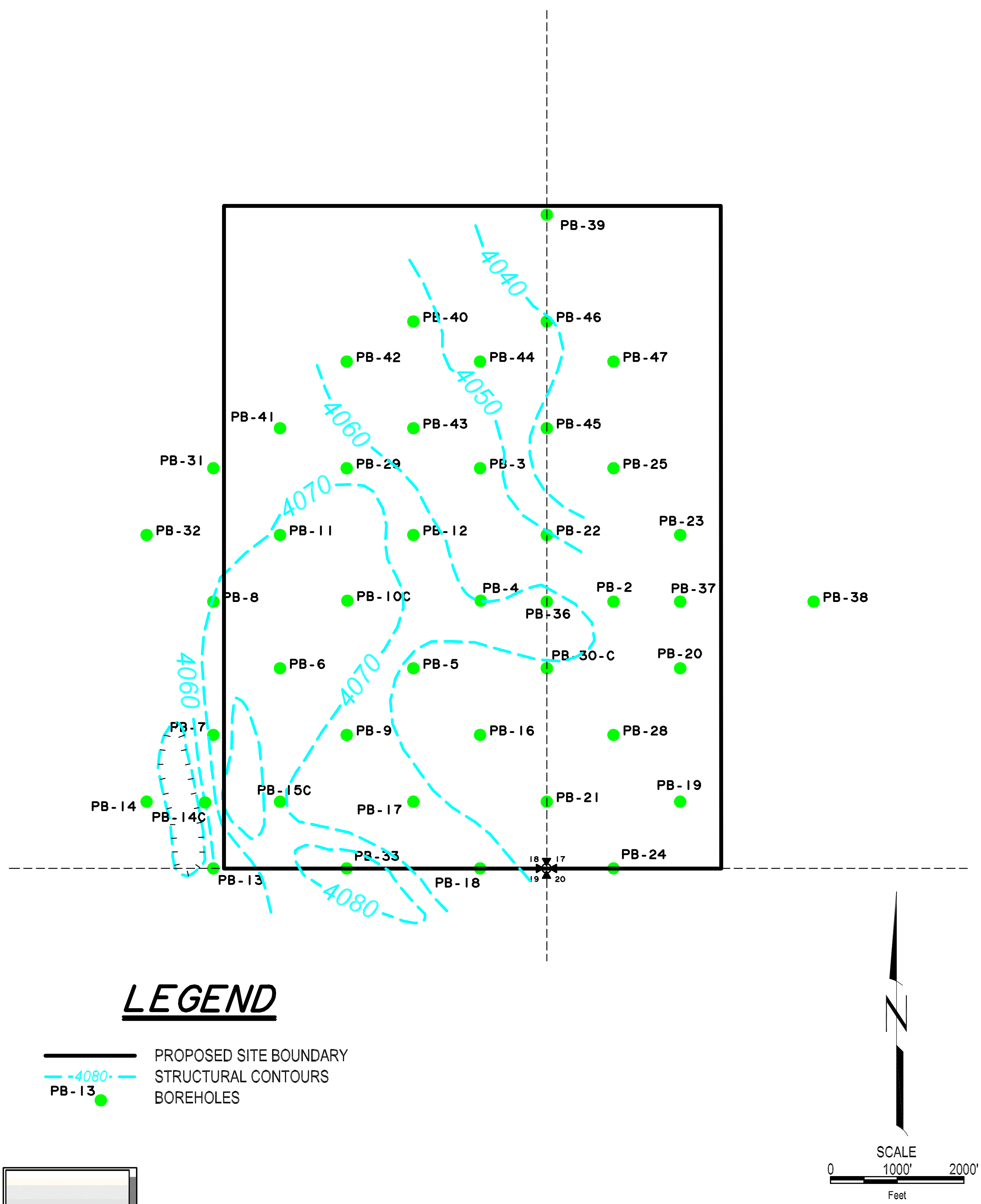


SEISMIC ACTIVITY MAP

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-7

AutoCAD FILE: GANDY-FIG3-7

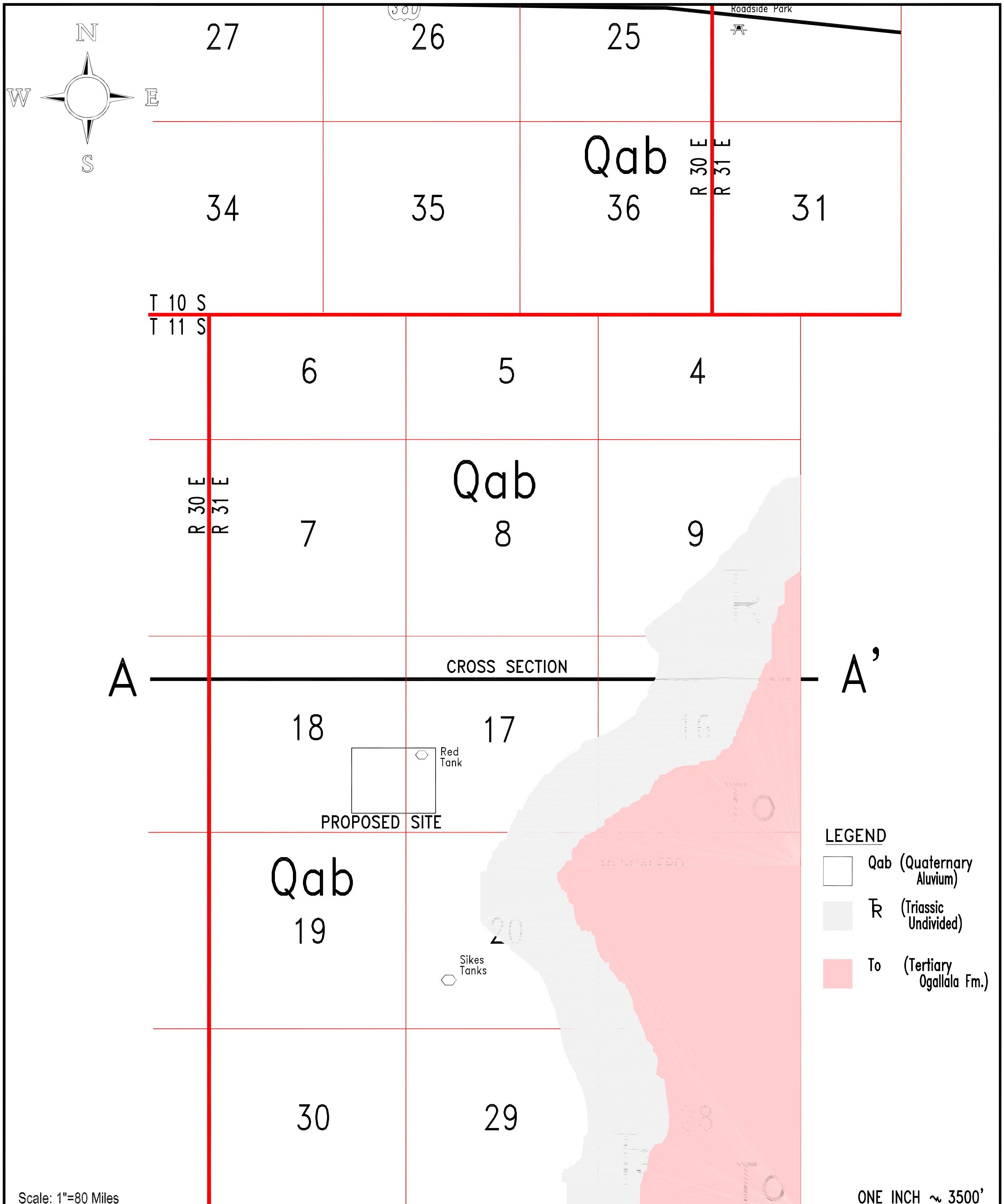


STRUCTURE CONTOUR TOP OF LOWER DOCKUM

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-6

AutoCAD FILE: GANDY-FIG-3-6

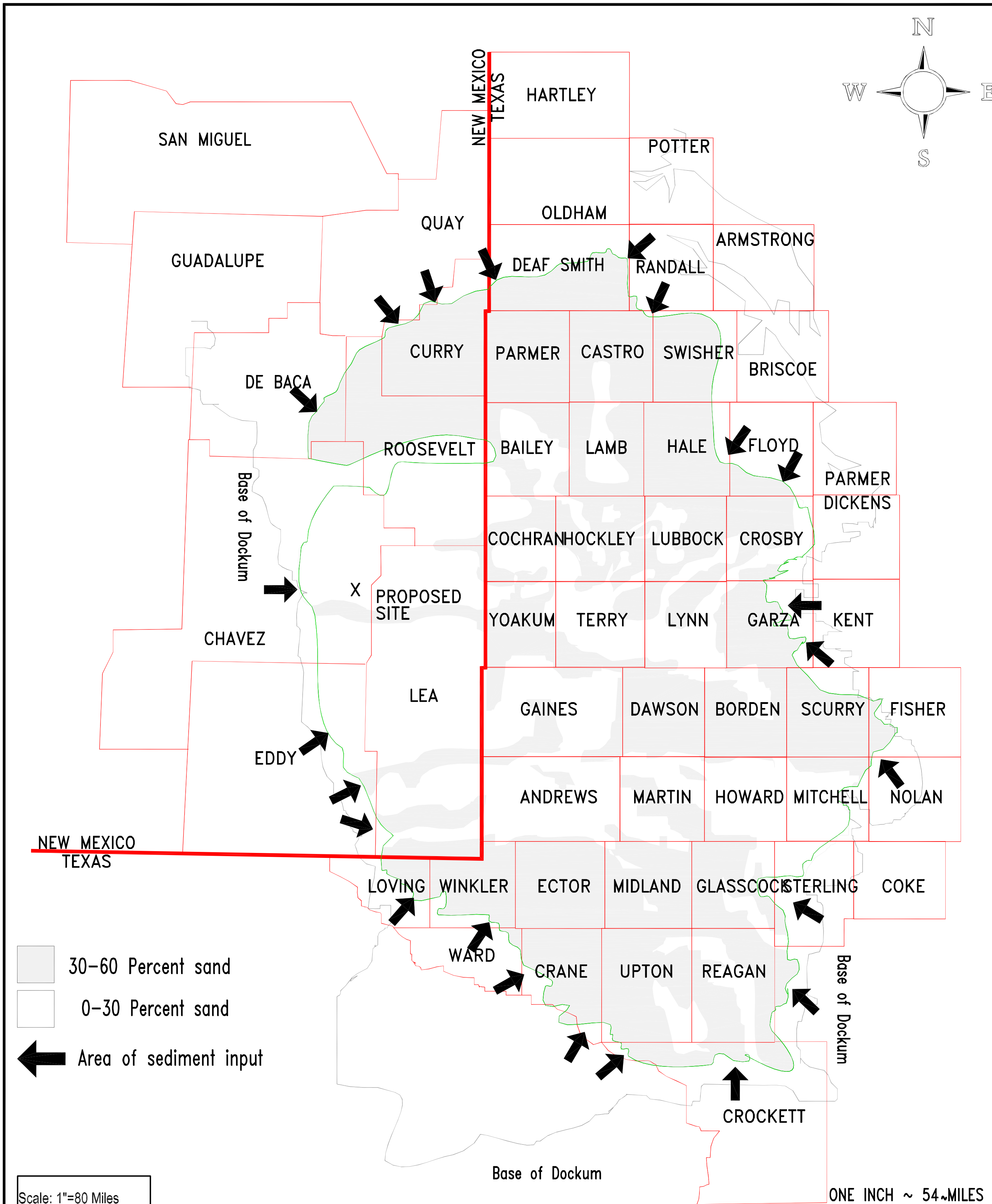


SURFACE GEOLOGY - PROJECT AREA

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-4

AutoCAD FILE: *GANDY-FIG3-4*

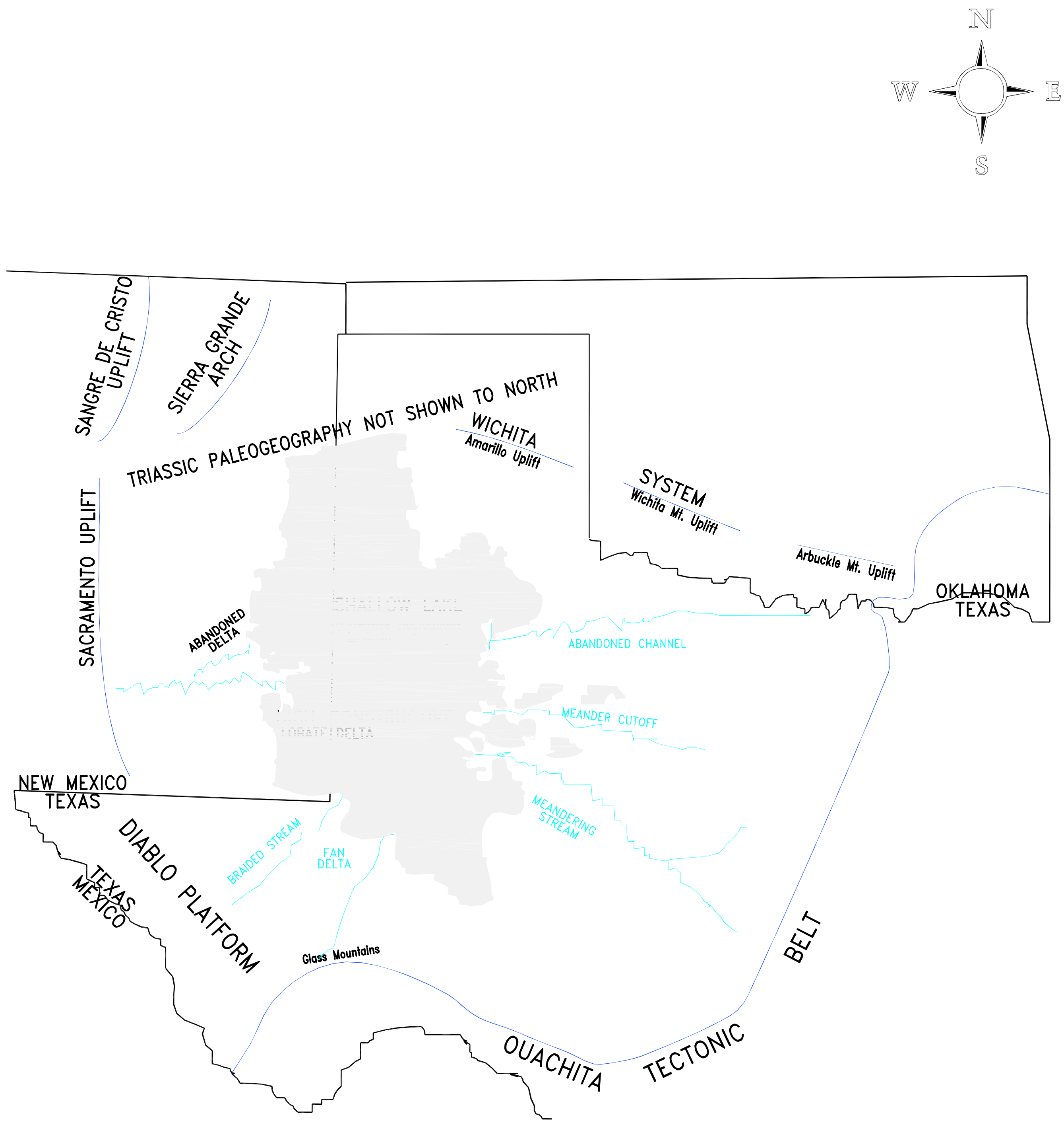


TRIASSIC PERIOD SAND ACCUMULATION IN PALEOBASIN

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-3

AutoCAD FILE: GANDY-FIG3-3



Scale: 1"=80 Miles

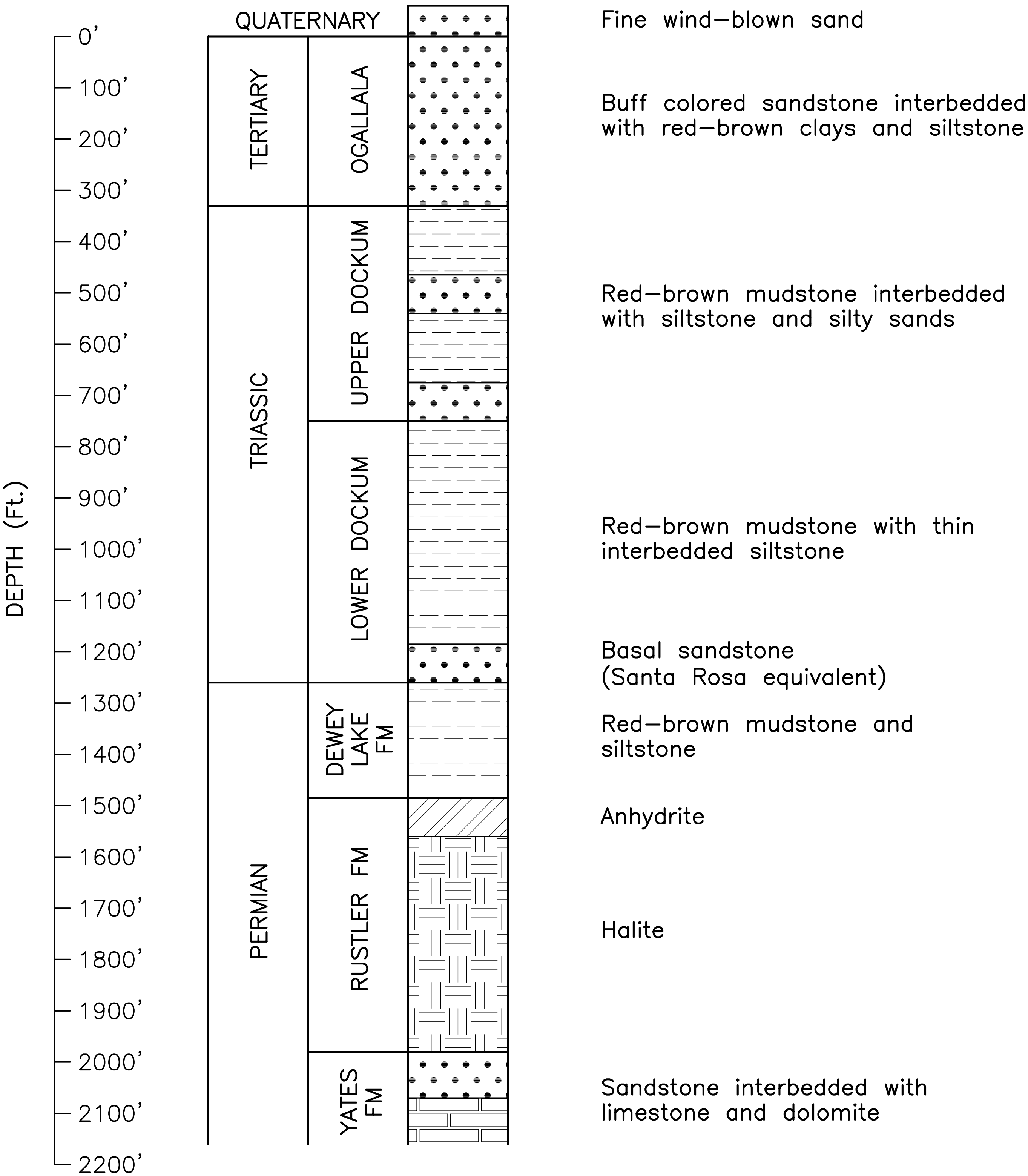
ONE INCH ~ 100 MILES

BASIN PALEOMAP FOR TRIASSIC PERIOD

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-2

AutoCAD FILE: *GANDY-FIG3-2*

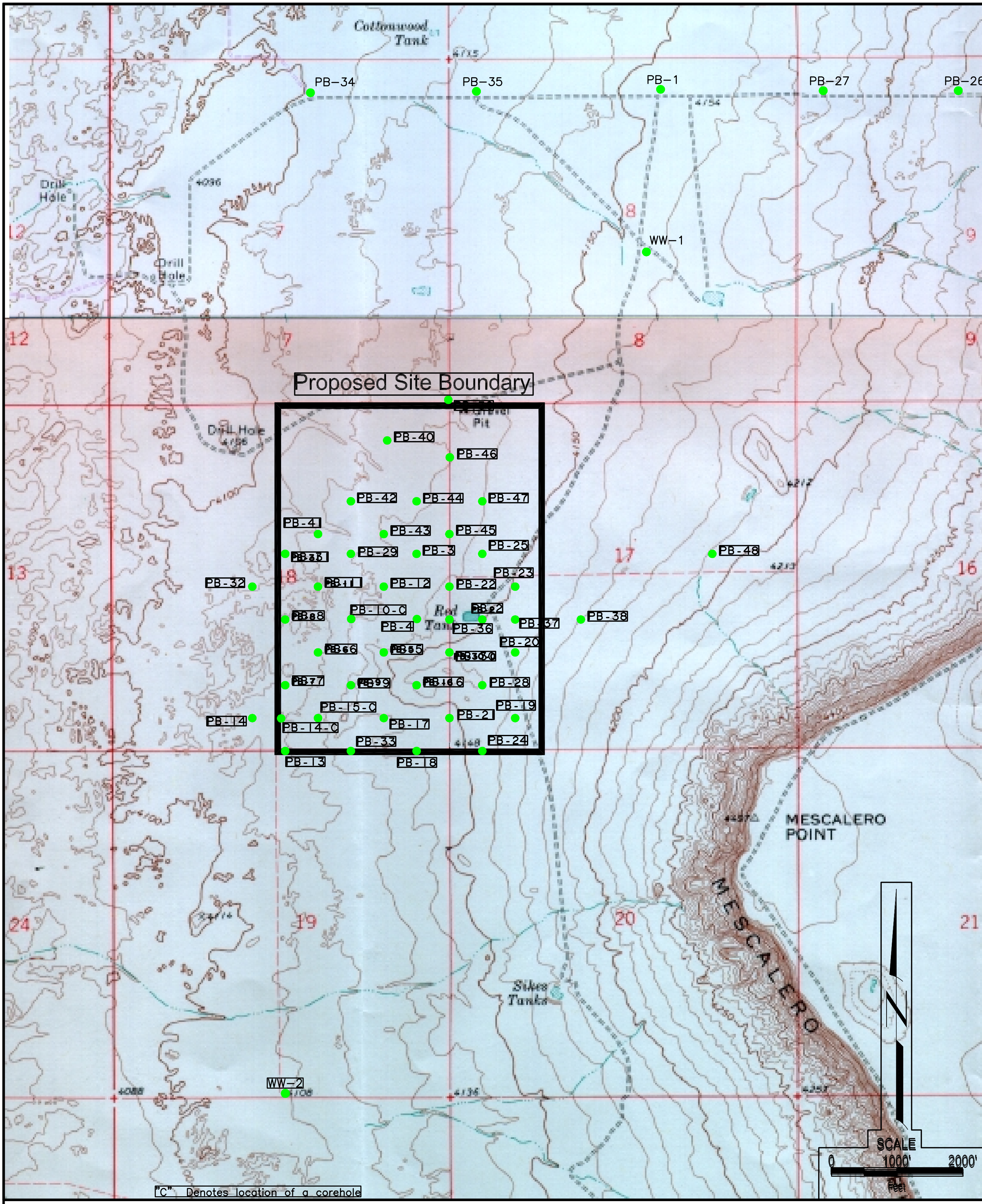


STRATIGRAPHIC COLUMN

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 3-1

AutoCAD FILE: GANDY-FIG3-1



D:\602\FINAL DWGS\TEXT-FIGURES\Nm.tif

DRILL HOLE LOCATIONS

TRIASSIC PARK WASTE DISPOSAL FACILITY

Figure 1-1

AutoCAD FILE: *GAN-DHLOC.DWG*

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES			
Local Identifier	Station Number	Date	Time
09S.29E.22. Bozart Well	333132103574701	07/15/40	--09S.29E.22.
09S.29E.22. Jess Beadle	333133103574801	06/19/40	--09S.29E.22.
09S.29E.35. Winsor Well	332857103564501	07/15/40	--09S.29E.35.
09S.29E.36. J Beadle WL	332857103554301	03/11/40	--09S.29E.36.
09S.30E.36. J Beadle	332858103554401	07/13/38	--09S.30E.36 J
09S.31E.26. Camino Well	333014103442201	08/13/82	1415 09S.31E.26.
09S.31E.26.440	333000103442401	05/25/70	1400 09S.31E.26.4
12S.30E.07. Culp Ranch	331705103574801	08/13/82	1015 12S.30E.07.
12S.30E.31. Culp Ranch Well	331803103542101	08/46/82	1210 12S.30E.31.C

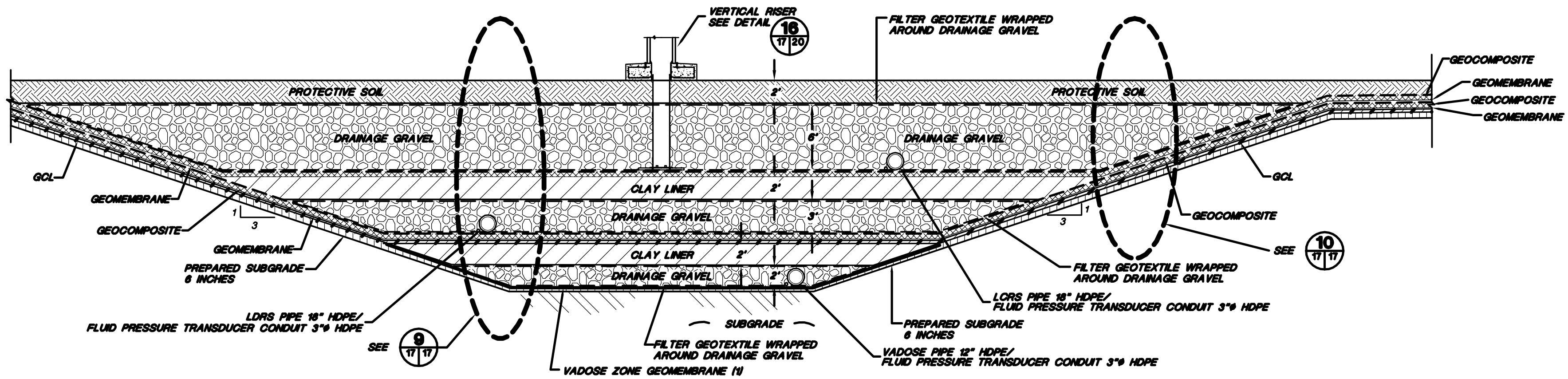
UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES						
Local Identifier	Date	Site	Geological Unit	Tempera ture Water (Deg C) (00010)	Agency Collecting Sample (Code Number) (00027)	Agency Analyzing Sample (Code Number) (00028)
09S.29E.22. Bozart	07/15/40	GW	--	--	1028	1028
09S.29E.22. Jess B	06/19/40	GW	231DCKM	--	1028	1028
09S.29E.35 Winsor	07/15/40	GW	231DCKM	--	1028	1028
09S.29E.36. J Beadle	03/11/40	GW	--	--	1028	1028
09S.30E.36. J Beadle	07/13/38	GW	--	--	1028	1028
09S.31E.26. Camino	08/13/82	GW	--	19.0	80020	80020
09S.31E.26.440	05/25/70	GW	231SNRS	--	--	--
12S.30E.07. Culp Ranch	08/13/82	GW	--	20.0	80020	80020
12S.30E.31. Culp Ranch Well	08/13/82	GW	--	18.5	80020	80020

UNITED STATES DEPARTMENT OF INTERIOR – GEOLOG MULTIPLE STATION ANALYSES						
Local Identifier	Date	PH Water Whole Lab (Standard Units) (00403)	Carbon Dioxide Dissolved (MG/L as CO2) (00405)	ANC Water Unfltrd Fet Field MG/L as CACO3 (00410)	ANC Water Unfltrd Fet Field MG/L as HCO3 (00440)	ANC Unfltrd Carb, Fet Field MG/L as CO3 (00445)
09S.29E.22. Bozart	07/15/40	--	--	--	880	28
09S.29E.22. Jess Beadle	06/19/40	--	--	--	160	0
09S.29E.35 Winsor	07/15/40	--	--	--	220	0
09S.29E.36. J Beadle	03/11/40	--	--	--	300	27
09S.30E.36 J Beadle	07/13/38	--	--	--	370	104
09S.31E.26. Camino	08/13/82	8.5	5.7	--	--	--
09S.31E.26.440	05/25/70	--	2.3	189	230	0
12S.30E.07. Culp Ranch	08/13/82	8.1	12	--	--	--
12S.30E.31. Culp Ranch Well	08/13/82	8.3	8.6	--	--	--

APPENDIX A

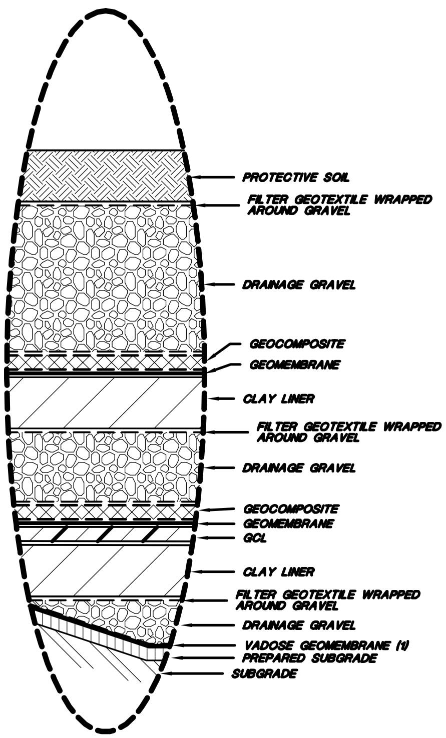
Figure APP-A

AutoCAD FILE: APPA-FIG



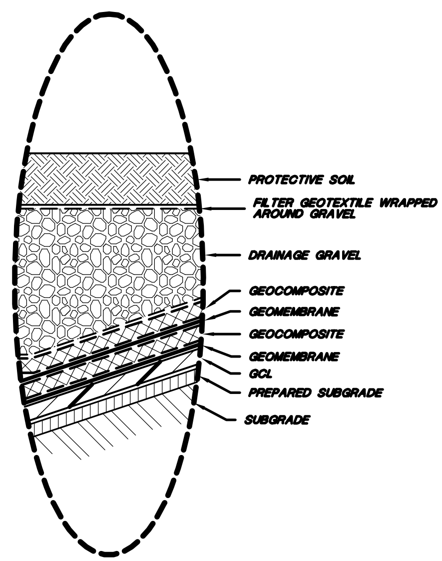
8 (16|17) TYPICAL SUMP DETAIL

SCALE
0 5.0' 10.0'
Feet



9 (17|17) EXAGGERATED GEOSYNTHETIC COMPONENT DETAIL

Not To Scale



10 (17|17) EXAGGERATED GEOSYNTHETIC COMPONENT DETAIL

Not To Scale

NOTES:
1. THE VADOSE GEOMEMBRANE EXTENDS TO LIMITS OF THE SECONDARY CLAY LINER.
2. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No 2, "INDEX, LEGEND AND GENERAL NOTES".

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	E.Simonsen	P.Corser

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date ______ Patrick G. Corser, NM P.E. 12236

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
TYPICAL SUMP DETAIL CROSS-SECTION

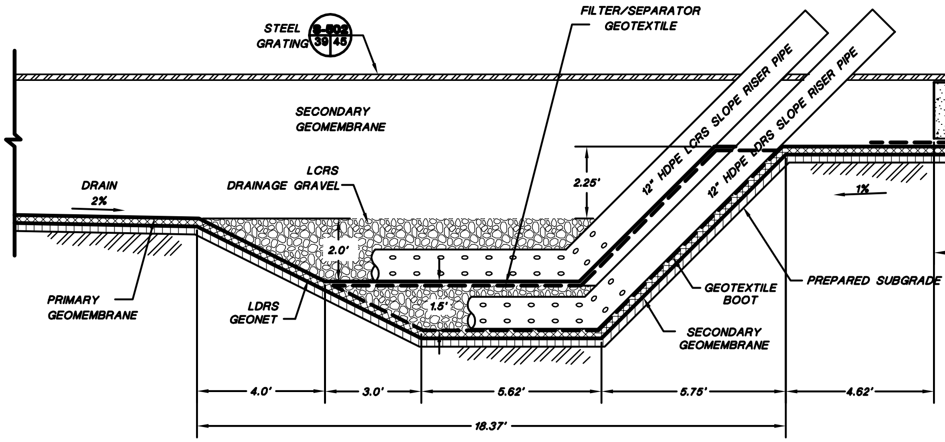
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets

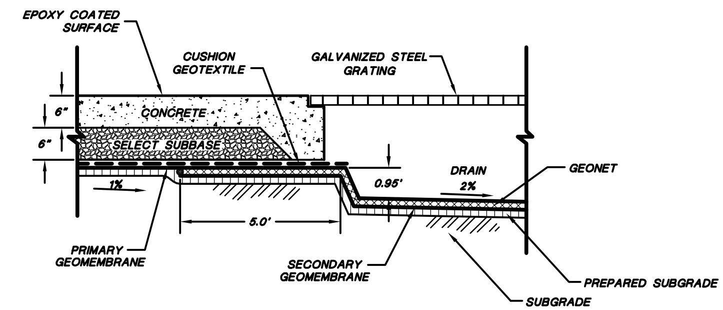
SCALE: Not To Scale

DRAWING No. 17

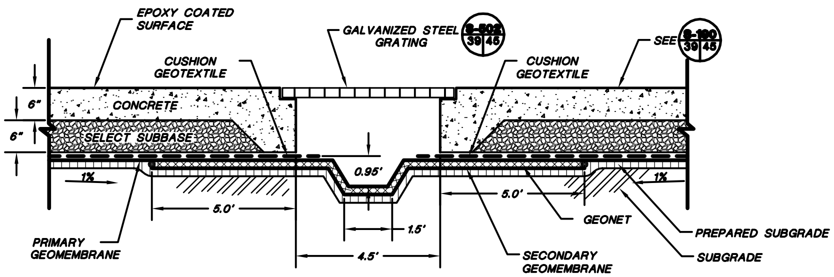
AutoCAD FILE: TYP-SUMP-DETAIL.DWG PROJECT NUMBER: 602-0200



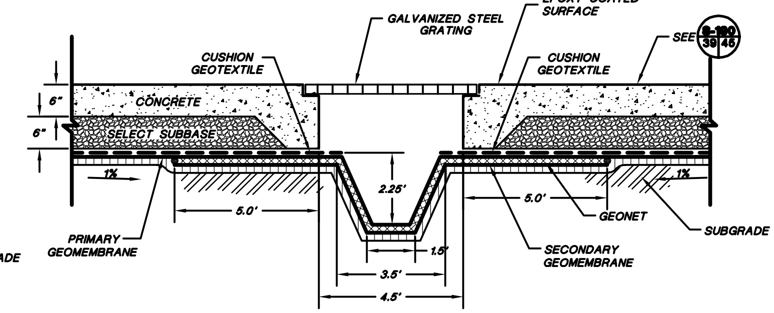
B 39 39 **CROSS-SECTION B-B'**
Not To Scale



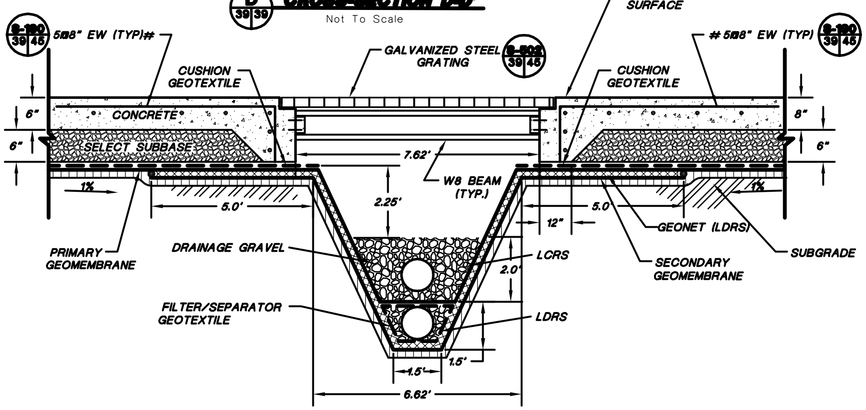
C 39 39 **CROSS-SECTION C-C'**
Not To Scale



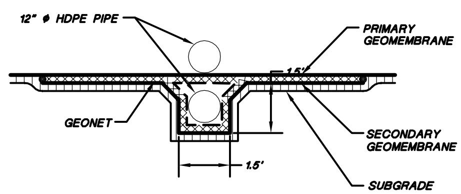
D 39 39 **CROSS-SECTION D-D'**
Not To Scale



E 39 39 **CROSS-SECTION E-E'**
Not To Scale



F 39 39 **CROSS-SECTION F-F'**
Not To Scale



G 39 39 **CROSS-SECTION G-G'**
Not To Scale

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date — *Patrick G. Corser, NM P.E. 12236*

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
3	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
2	SEPTEMBER 1999 REVISION	9/99	P.Corser	T.Clark	P.Corser
1	NOVEMBER 1998 REVISION	10/30/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

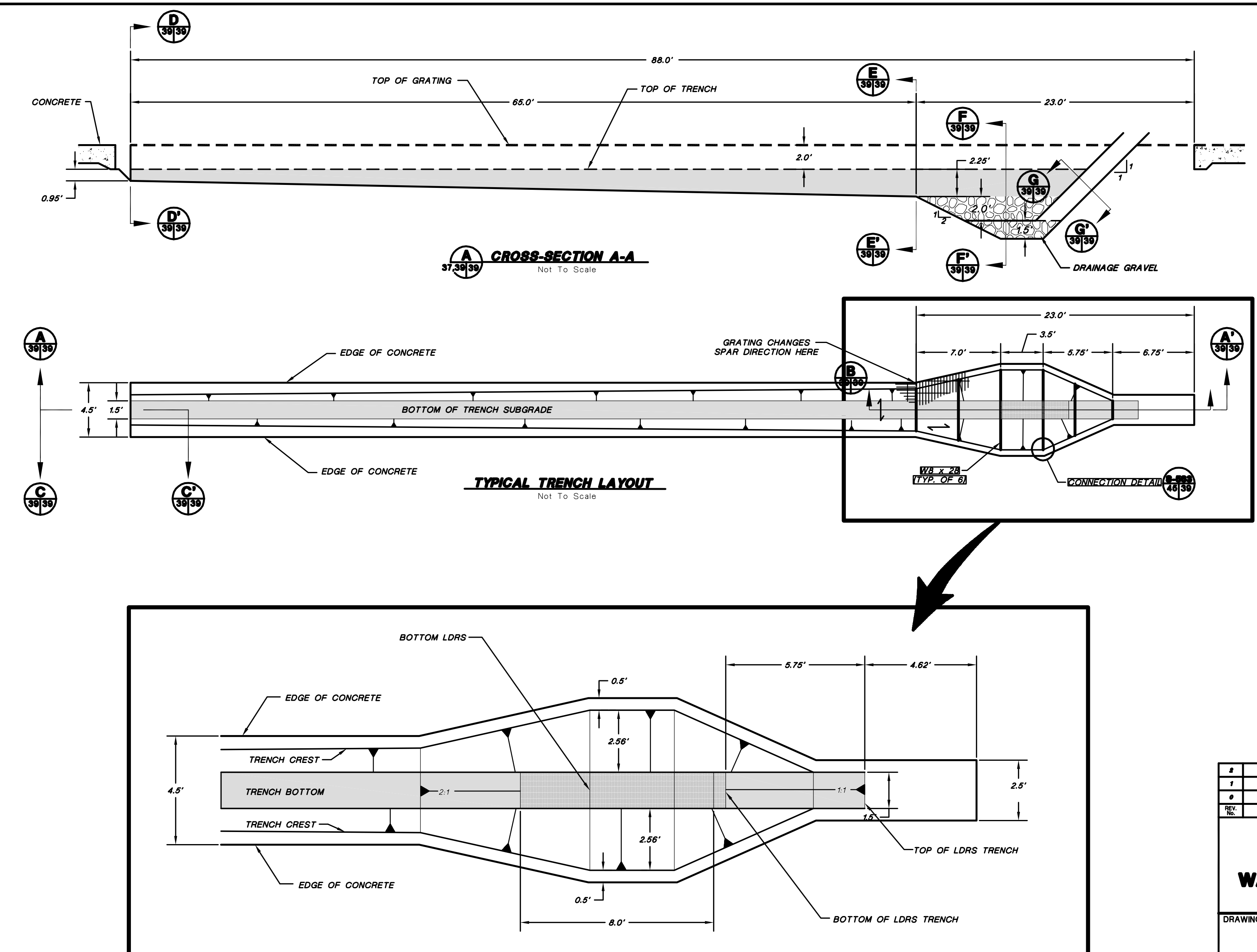
DRAWING TITLE:
DRUM HANDLING UNIT SUMP DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 2 Of 2 Sheets
SCALE: As Shown
DRAWING No. 39

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: TRN-DTL2B.DWG
PROJECT NUMBER: 602-0200



PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pelliser	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/30/98	J.Pelliser	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

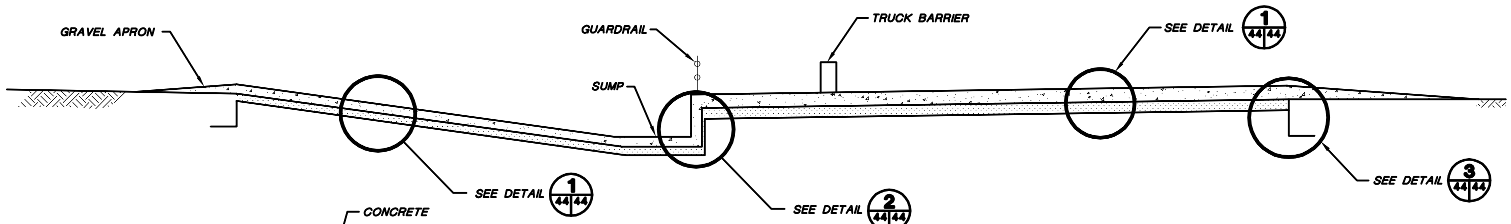
DRAWING TITLE:
DRUM HANDLING UNIT SUMP DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 2 Sheets
SCALE: As Shown
DRAWING No. 39

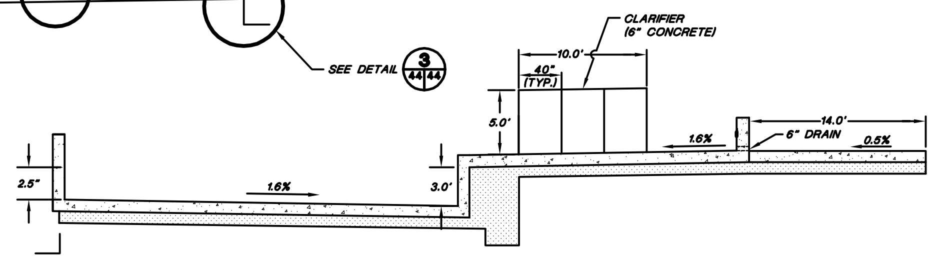
AutoCAD FILE: TRN-DTL48.DWG PROJECT NUMBER: 602-0200

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".



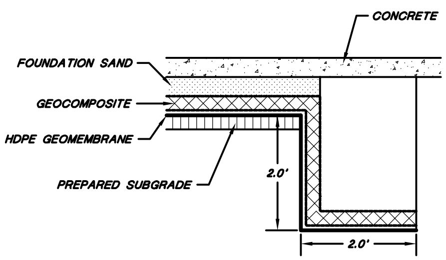
A 44/44 **TRUCK WASH CROSS-SECTION**

SCALE 0 5 10 FEET



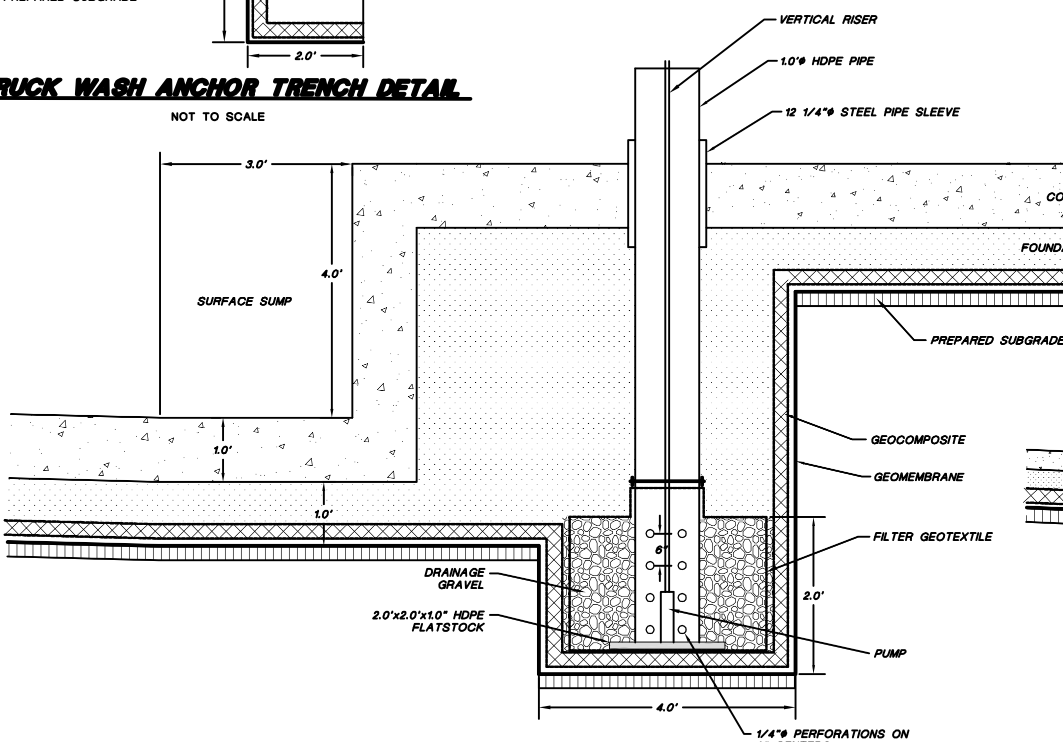
B 44/44 **TRUCK WASH SUMP CROSS-SECTION**

SCALE 0 5 10 FEET



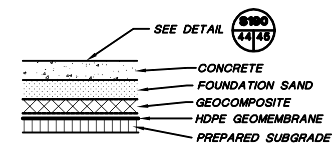
3 44/44 **TRUCK WASH ANCHOR TRENCH DETAIL**

NOT TO SCALE



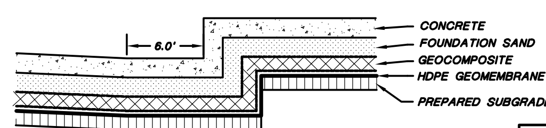
TRUCK WASH LEAK DETECTION SUMP

SCALE 0 1 2 FEET



1 44/44 **TRUCK WASH LINER DETAIL**

NOT TO SCALE



2 44/44 **TRUCK WASH SUMP DETAIL**

NOT TO SCALE

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date   Patrick G. Corser, NM P.E. 12236

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
4	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
3	NOVEMBER 1999 UPDATES	11/02/99	J.Troncoso	M.Mathisen	P.Corser
2	SEPTEMBER 1999 REVISION	9/99	P.Corser	T.Clark	P.Corser
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0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

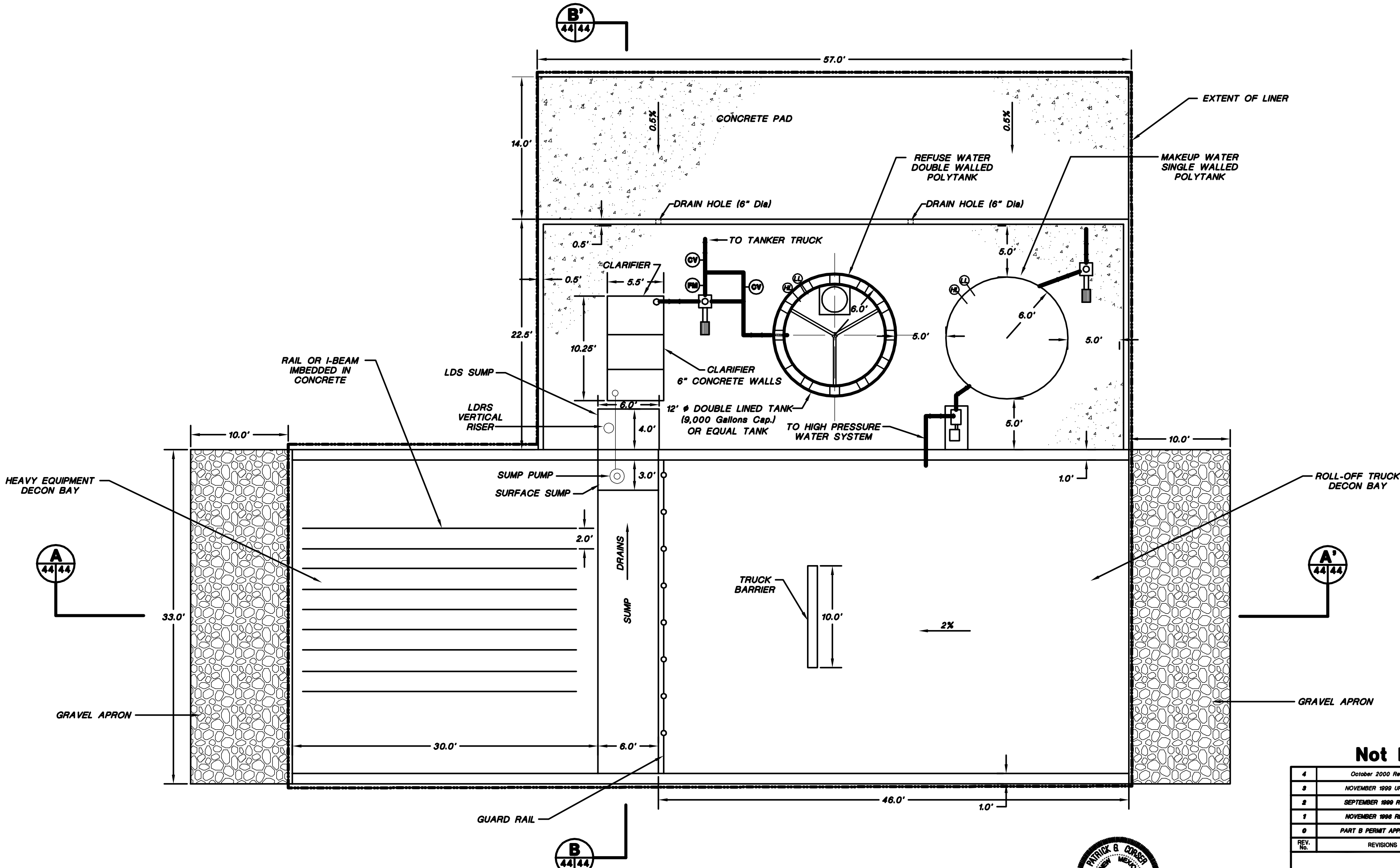
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE: **TRUCK WASH LAYOUT AND DETAILS**

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 2 Of 2 Sheets
SCALE: Not to Scale
DRAWING No. 44

AutoCAD FILE: TRKWSHDTLS.DWG   PROJECT NUMBER: 602-0200



PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

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NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. FOR CONCRETE DETAILS SEE DRAWING 45.
3. PIPING SYSTEM WILL COMPLY WITH API PUBLICATIONS 1615 (NOVEMBER 1979) OR ANSI STANDARD B31.2 AND ANSI STANDARD B31.4.

AutoCAD FILE: TRKWASH.DWG PROJECT NUMBER: 602-0200

Not For Construction

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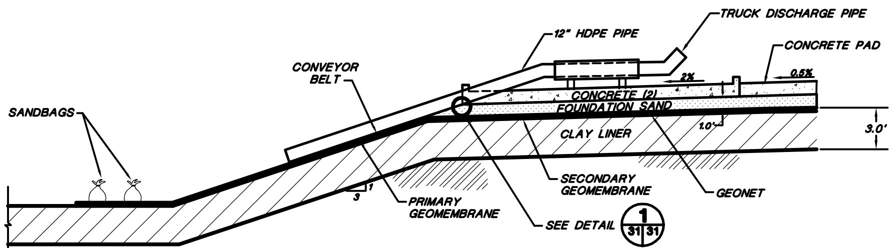
TRIASSIC PARK WASTE DISPOSAL FACILITY

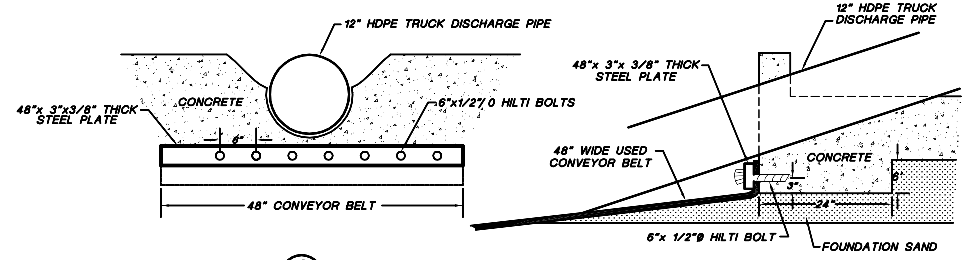
DRAWING TITLE: **TRUCK WASH LAYOUT AND DETAILS**

TerraMatrix
MONTGOMERY WATSON
Mining Group

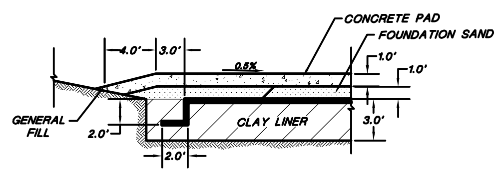
Sheet 1 Of 2 Sheets
SCALE: Not to Scale
DRAWING No. 44



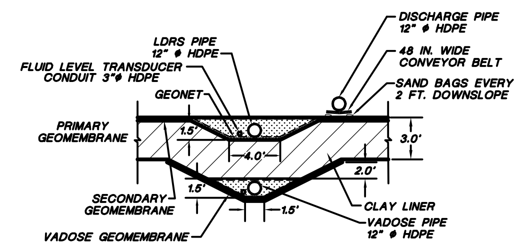
C 31 31 **CROSS-SECTION C-C'**
Not To Scale



1 31 31 **DETAIL CONVEYOR BELT CONNECTION**
Not To Scale

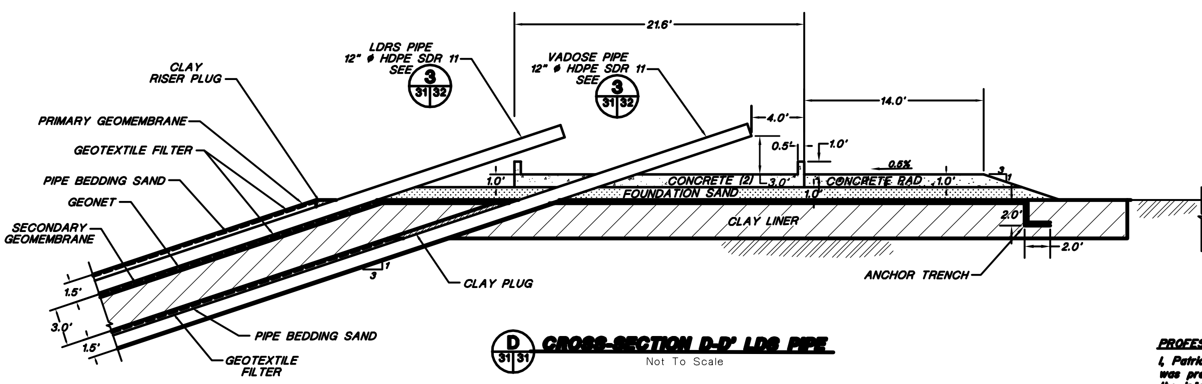


E 31 31 **CROSS-SECTION E-E' ACCESS RAMP**
Not To Scale



F 31 31 **CROSS-SECTION F-F' CONVEYOR BELT**
Not To Scale

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2 "INDEX, LEGEND AND GENERAL NOTES".
2. FOR CONCRETE DETAILS SEE DRAWING No. 45.



D 31 31 **CROSS-SECTION D-D' LDS PIPE**
Not To Scale

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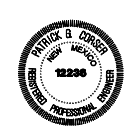

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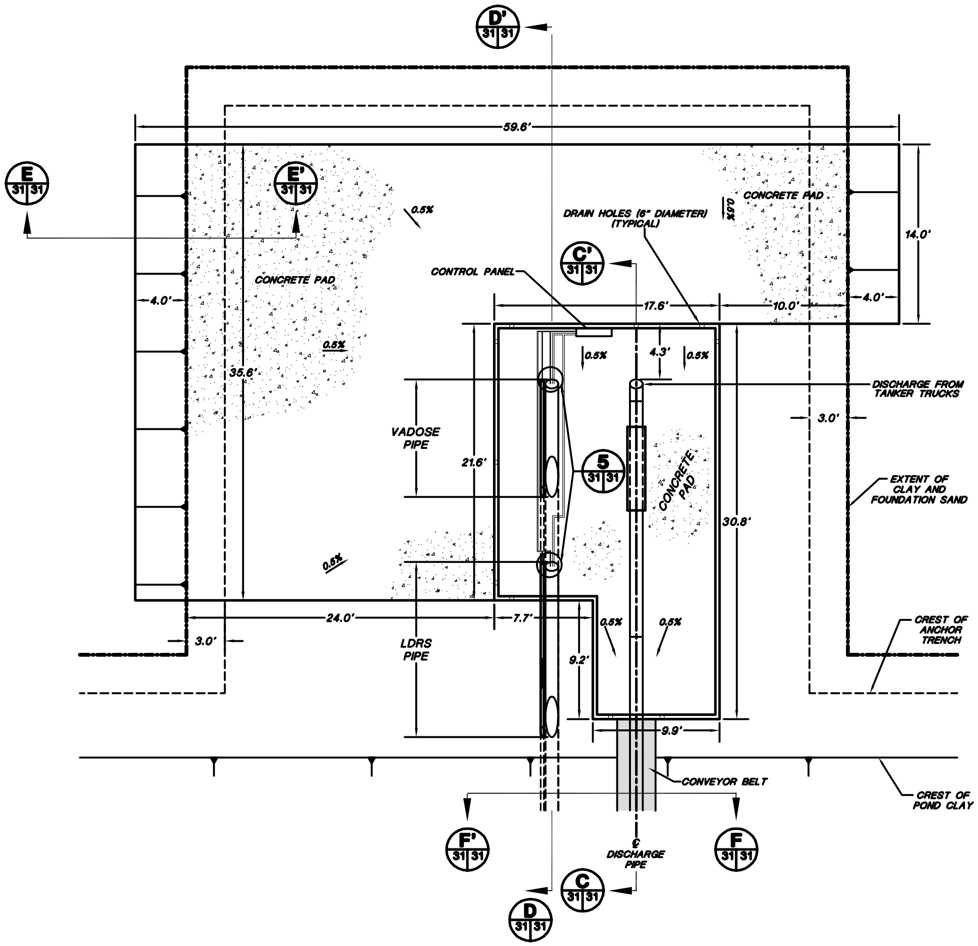
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
EVAPORATION POND TRUCK DISCHARGE STATION

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 2 Of 2 Sheets
SCALE: As Shown
DRAWING No. 31

AutoCAD FILE: TANKPAD3.DWG
PROJECT NUMBER: 602-0200

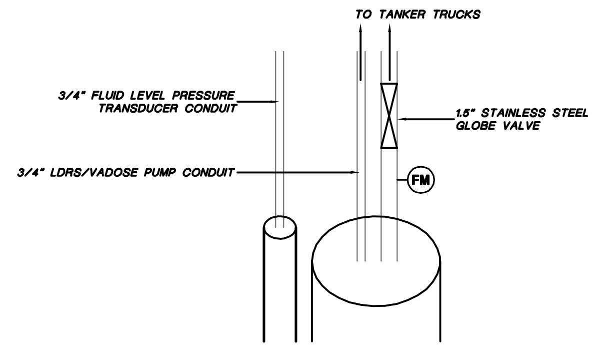


4 (30 | 31) **TRUCK DISCHARGE STATION LAYOUT**

SCALE

5' 0 5' 10'

CONTOUR INTERVAL N.A.



5 (31 | 31) **PIPE CONDUIT DETAIL**

NOT TO SCALE

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
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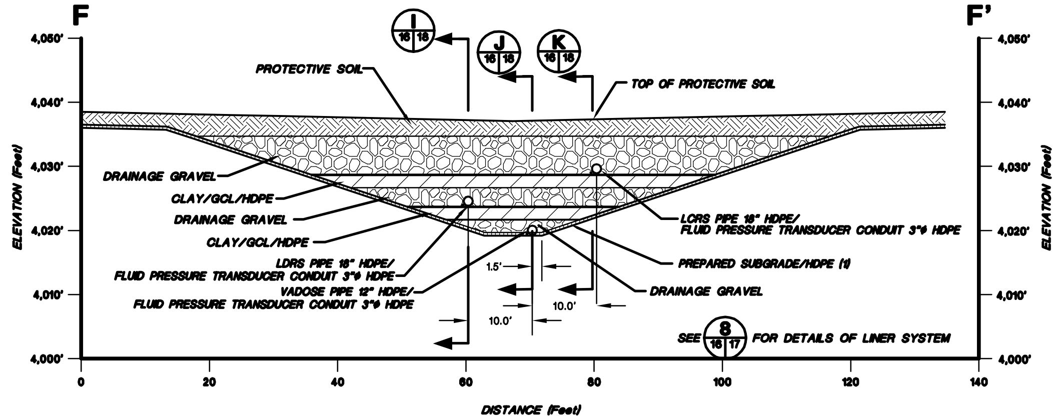
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
EVAPORATION POND TRUCK DISCHARGE STATION

TerraMatrix
MONTGOMERY WATSON
Natural Resources Group

Sheet 1 Of 2 Sheets
SCALE: As Shown
DRAWING No. 31

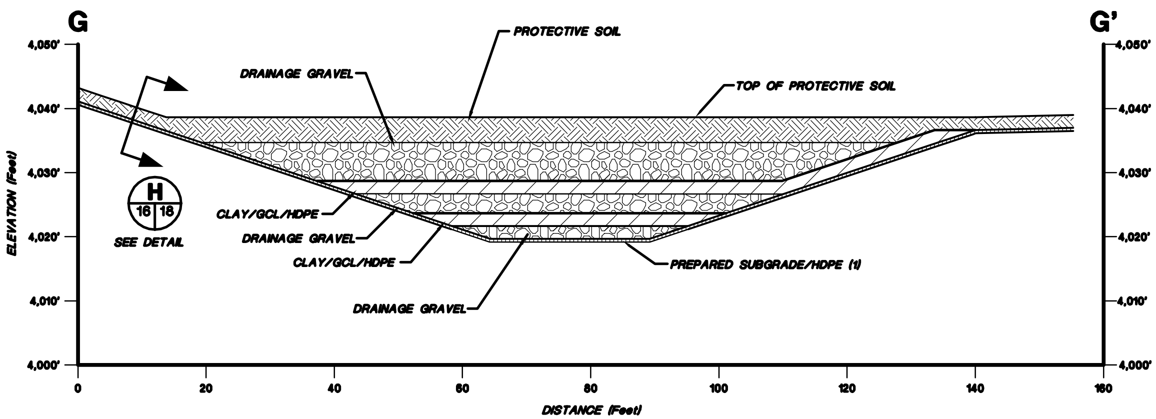
AutoCAD FILE: TANKPAD2.DWG   PROJECT NUMBER: 602-0200



F 15|16 **SUMP - CROSS-SECTION F-F'**

HORIZONTAL SCALE
0 10.0' 20.0'

VERTICAL SCALE
0 10.0' 20.0'



G 15|16 **SUMP - CROSS-SECTION G-G'**

HORIZONTAL SCALE
0 10.0' 20.0'

VERTICAL SCALE
0 10.0' 20.0'

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: SUMPPLAN-XSEC.DWG PROJECT NUMBER: 602-0200

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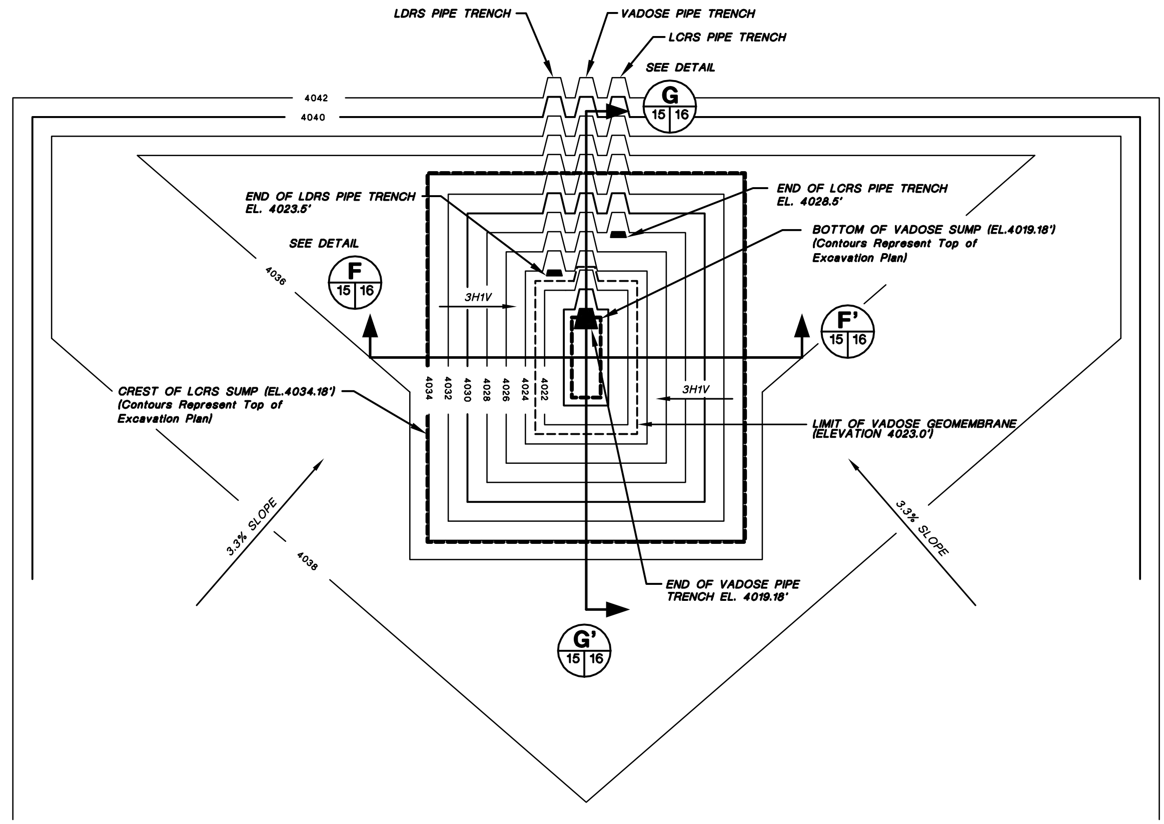
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	E.Simonsen	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
SUMP CROSS-SECTIONS - PHASE 1A

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 1 Of 1 Sheets
SCALE: See Scale Bar
DRAWING No. 16



SUMP PHASE 1A - PLAN VIEW

SCALE

20' 0 20' 40'

CONTOUR INTERVAL 2Ft.

Not For Construction

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TRIASSIC PARK

WASTE DISPOSAL FACILITY

DRAWING TITLE:

SUMP PLAN VIEW - PHASE 1A

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets

SCALE: See Scale Bar

DRAWING No. 15

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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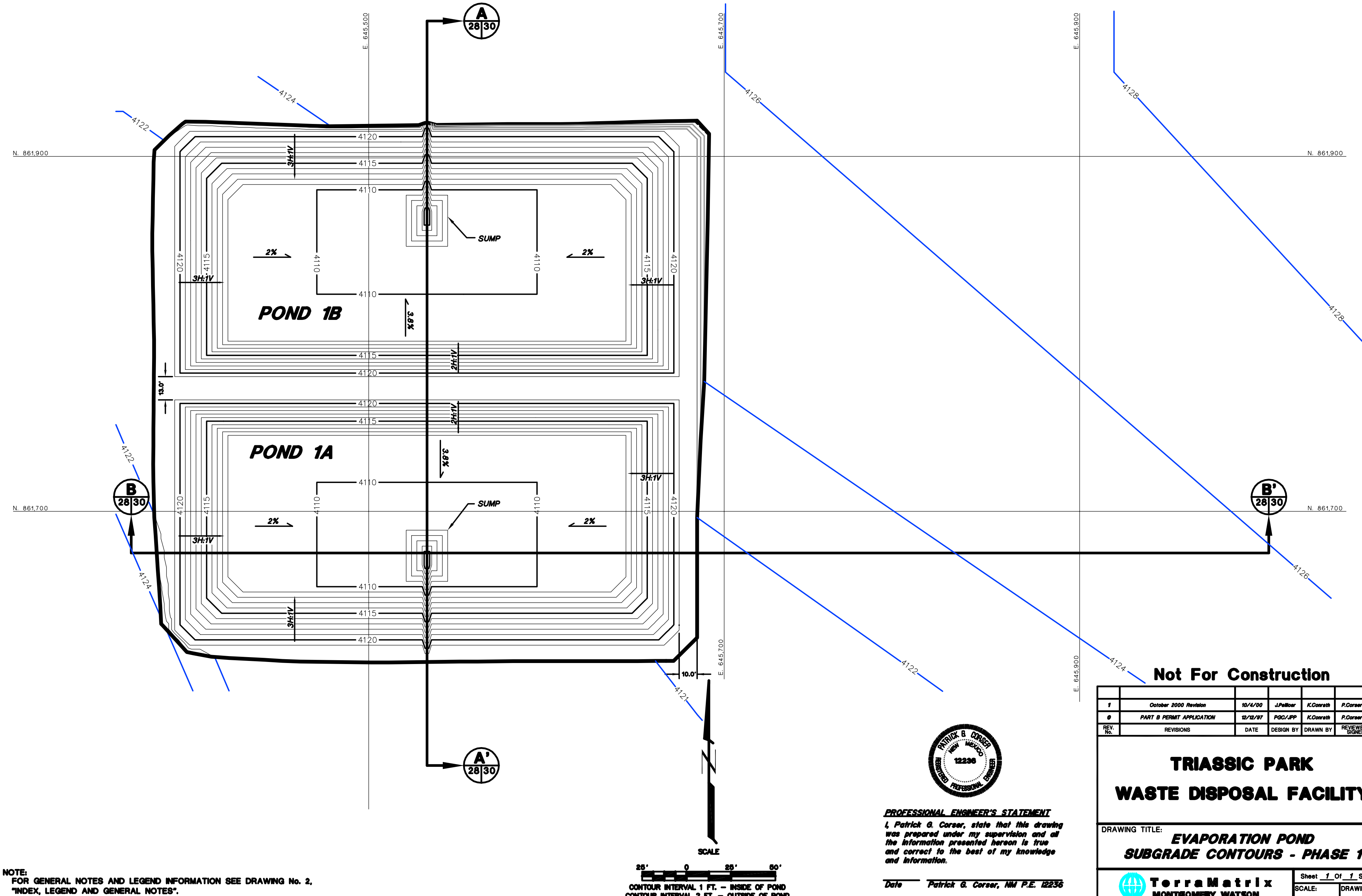
NOTES:

1. THE V-TRENCH ON THE FLOOR OF LANDFILL (SEE DETAIL 5 9|12) WILL EXTEND INTO SUMP TO ELEVATION OF THE LDRS PIPE 4023.5. THE PIPE FROM THE FLOOR WILL EXTEND ACROSS THE BASE OF THE SUMP.
2. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: SUMPPLAN.DWG   PROJECT NUMBER: 602-0200



NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: SUBGRD-CONT28.DWG PROJECT NUMBER: 602-0200

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TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

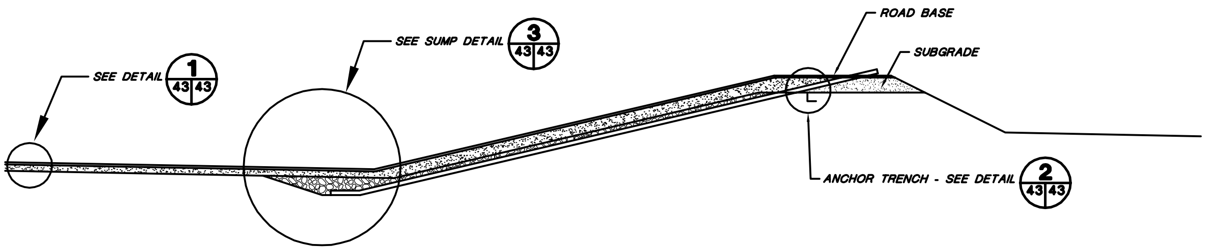
EVAPORATION POND SUBGRADE CONTOURS - PHASE 1

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets

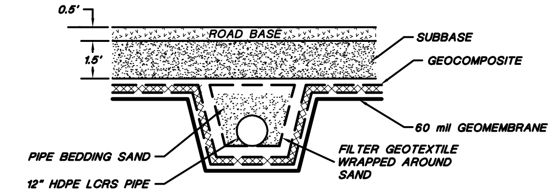
SCALE: As Shown

DRAWING No. 28



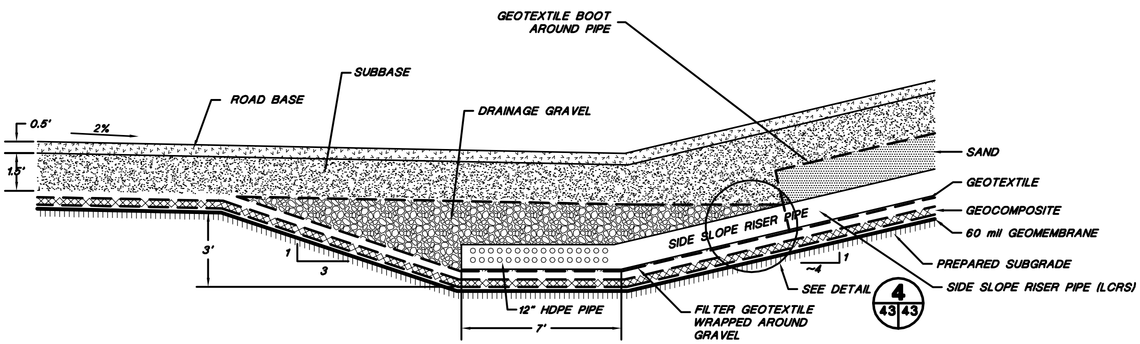
D 41|43 D 42|43 **CROSS-SECTION D**

SCALE 0 7.5' 15' Feet



4 43|43 **PIPE TRENCH DETAIL**

NOT TO SCALE



3 43|43 **SUMP DETAIL**

SCALE 0 2.5' 5' Feet

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

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TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
TRUCK ROLL-OFF AREA LINER DETAILS

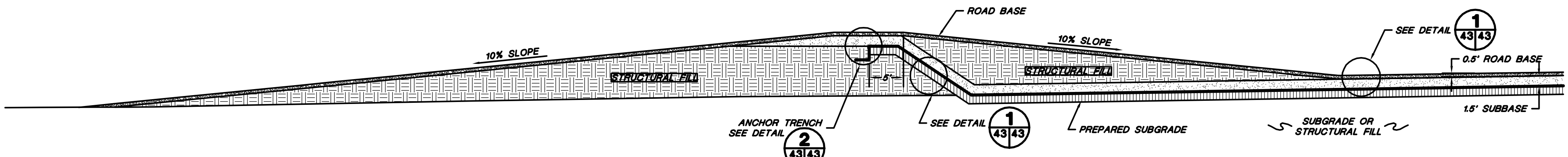
TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 2 Of 2 Sheets

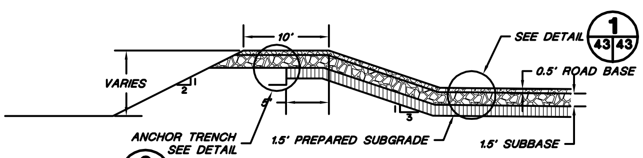
SCALE: As Shown

DRAWING No. 43

AutoCAD FILE: ROLLOFFDTL2.DWG PROJECT NUMBER: 602-0200

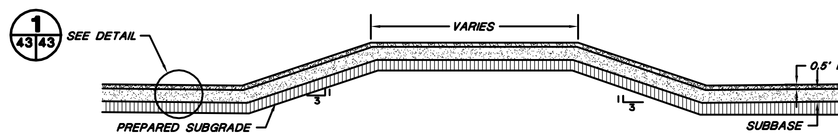


A 41|43 A 42|43 ACCESS ROAD DETAIL



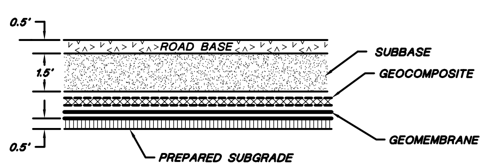
B 41|43 B 42|43 BERM DETAIL

SCALE
0 7.5' 15'
Feet



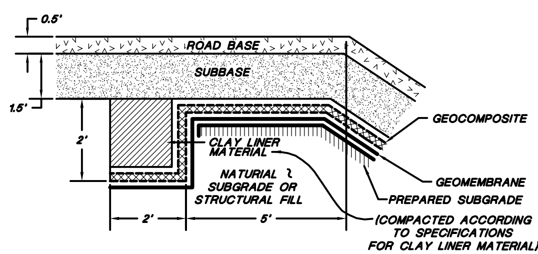
C 41|43 C 42|43 INNER FACILITY BERM DETAIL

SCALE
0 7.5' 15'
Feet



FLOOR AND SLOPE NON-STABILIZED WASTE CELL
1 43|43 LINER & DRAIN CROSS-SECTION

NOT TO SCALE



2 43|43 ANCHOR TRENCH DETAIL

NOT TO SCALE

NOTE:
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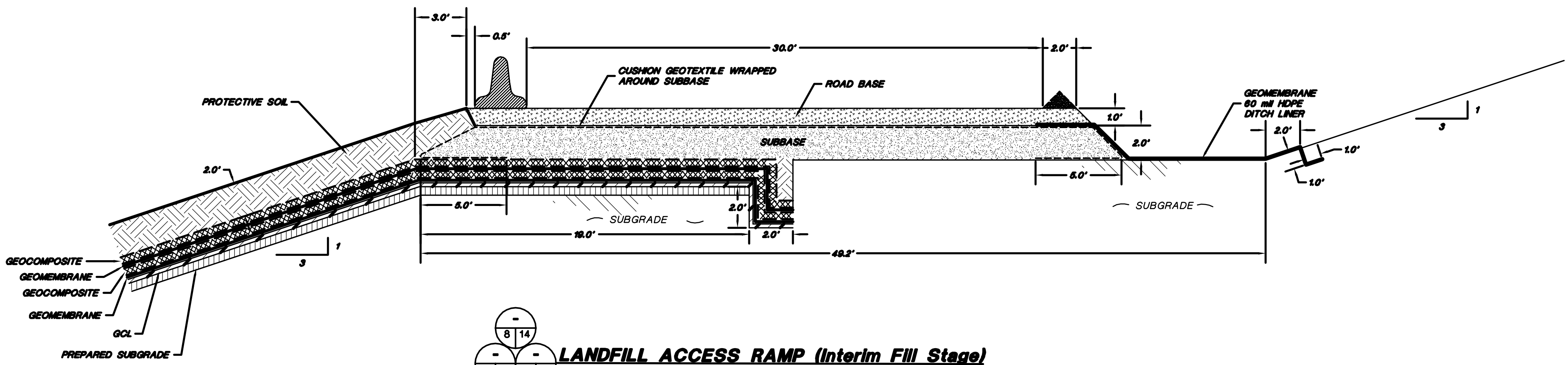
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
TRUCK ROLL-OFF AREA LINER DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 2 Sheets
SCALE: As Shown
DRAWING No. 43

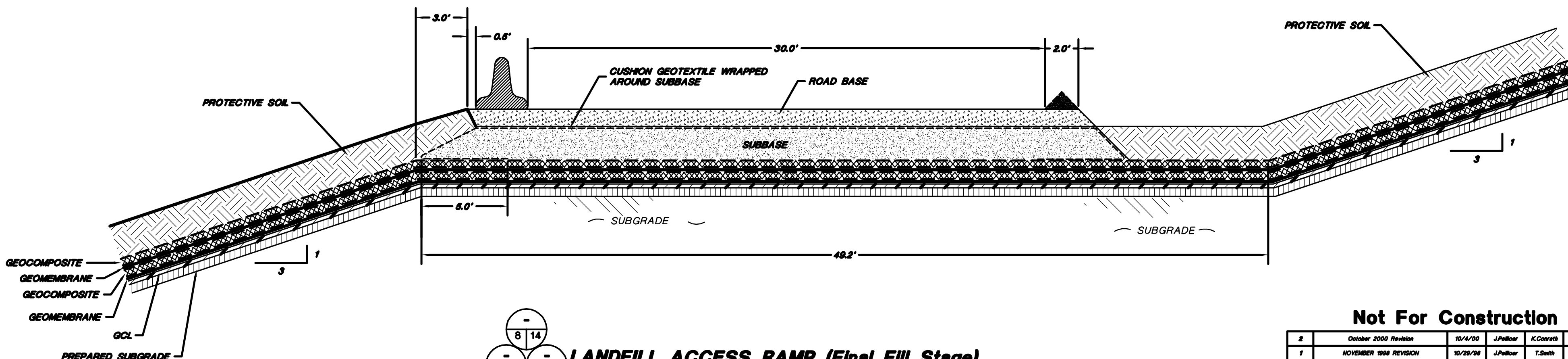
AutoCAD FILE: ROLLOFFDTL.DWG
PROJECT NUMBER: 602-0200



- 8 | 14, - 9 | 14, - 10 | 14, - 13 | 14

LANDFILL ACCESS RAMP (Interim Fill Stage)

SCALE 0 3 6 Feet



- 8 | 14, - 9 | 14, - 10 | 14, - 13 | 14

LANDFILL ACCESS RAMP (Final Fill Stage)

SCALE 0 3 6 Feet

NOTE:
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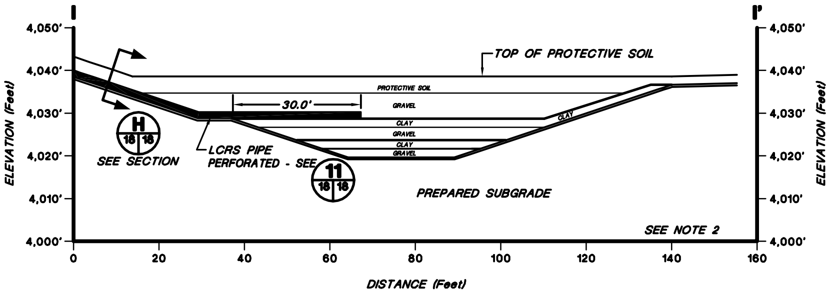
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
TYPICAL LANDFILL ACCESS RAMP DETAILS

TerraMatrix MONTGOMERY WATSON Mining Group

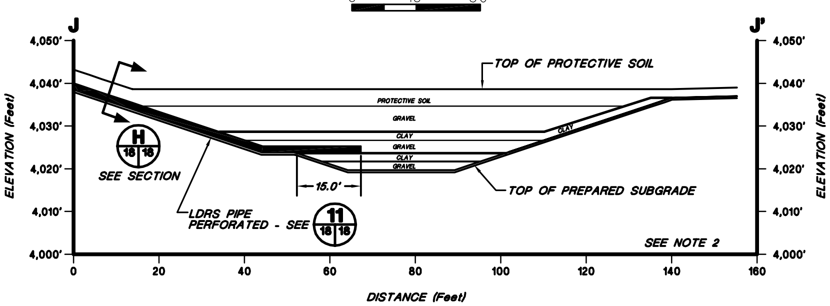
Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 14

AutoCAD FILE: RAMP-DETAIL.DWG PROJECT NUMBER: 602-0200



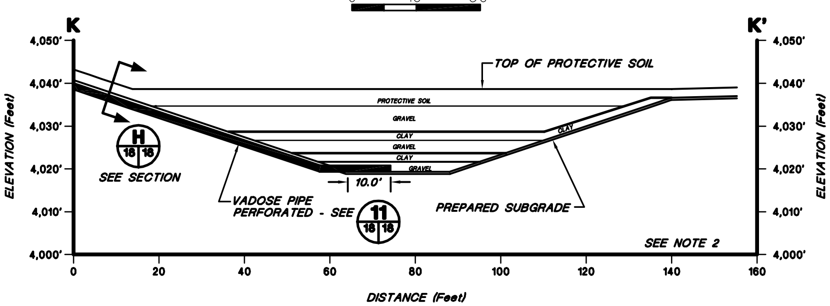
LCRS PIPE PLACEMENT IN SUMP

HORIZONTAL SCALE 0 15' 30'
VERTICAL SCALE 0 15' 30'



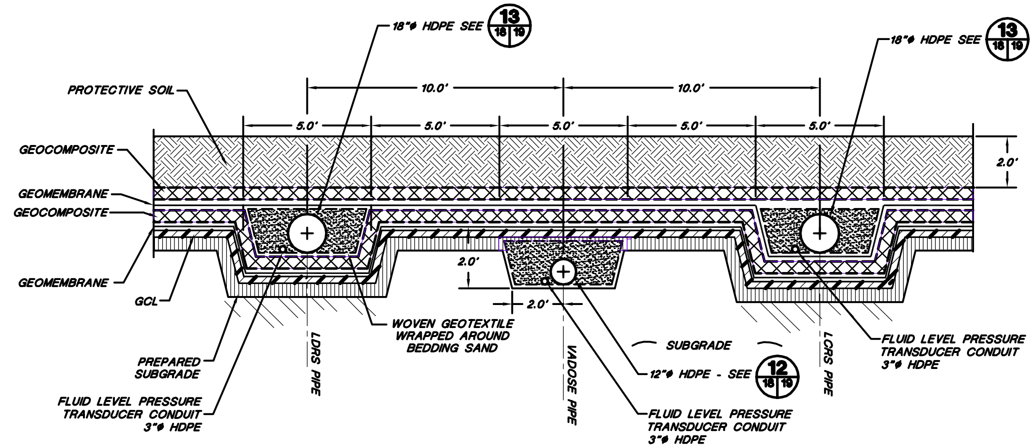
LDRS PIPE PLACEMENT IN SUMP

HORIZONTAL SCALE 0 15' 30'
VERTICAL SCALE 0 15' 30'



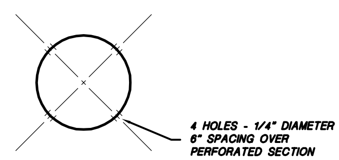
VADOSE PIPE PLACEMENT IN SUMP

HORIZONTAL SCALE 0 15' 30'
VERTICAL SCALE 0 15' 30'



LDRS, VADOSE AND LCRS PIPES SLOPE SECTION

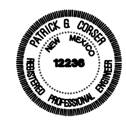
Not To Scale



PIPE PERFORATION DETAIL

Not To Scale

NOTE:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. SEE 8/18-17 FOR LINER DETAILS IN SUMP.



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0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

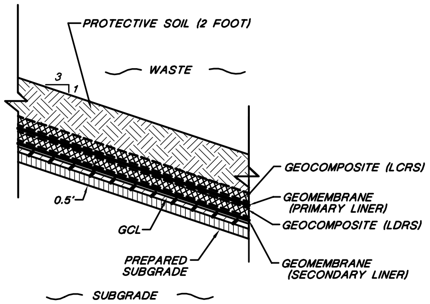
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
VADOSE, LDRS, LCRS CROSS-SECTIONS AND DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: See Scale Bar
DRAWING No. 18

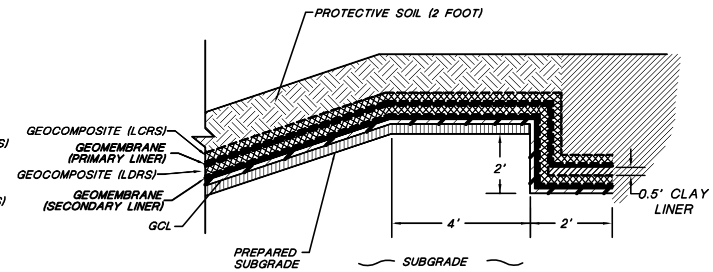
PROJECT NUMBER: 602-0200
AutoCAD FILE: PS-DETAIL.DWG



SLOPE LINER SYSTEM DETAIL

1 | 7 | 12

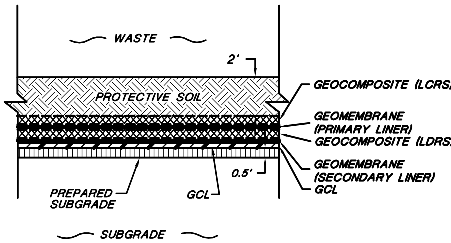
Not To Scale



LINER ANCHOR TRENCH DETAIL

2 | 8 | 12; 2 | 9 | 12; 2 | 10 | 12; 2 | 23 | 12; 2 | 24 | 12

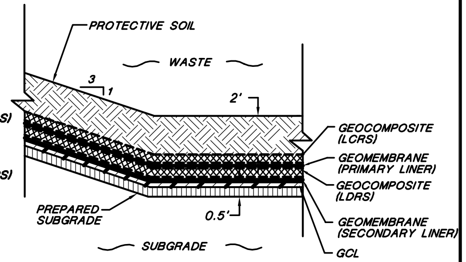
Not To Scale



FLOOR LINER SYSTEM DETAIL

3 | 7 | 12; 3 | 24 | 12

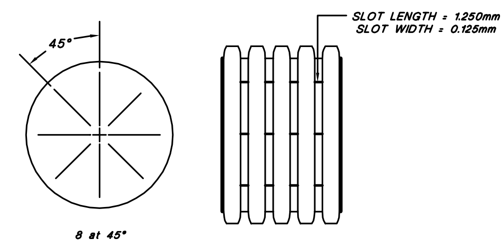
Not To Scale



TOE OF SLOPE LINER SYSTEM DETAIL

4 | 7 | 12

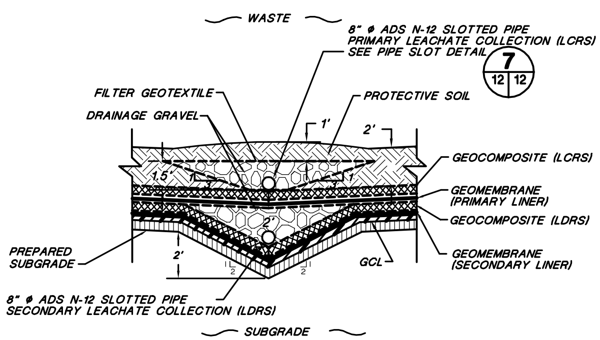
Not To Scale



ADS N-12 PIPE SLOT DETAIL

7 | 12 | 12

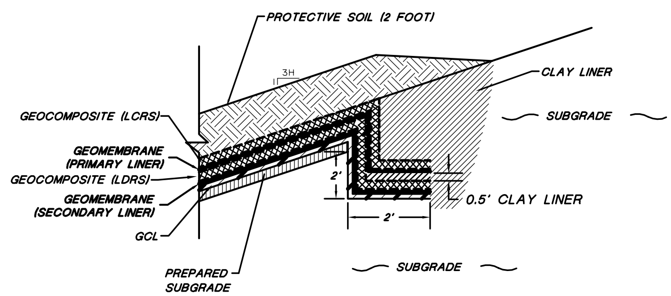
Not To Scale



FLOOR PIPE DETAIL

5 | 9 | 12

Not To Scale



SLOPE ANCHOR TRENCH

6 | 8 | 12; 6 | 13 | 12

Not To Scale

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date ______ Patrick G. Corser, NM P.E. 12236

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

LINER DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets

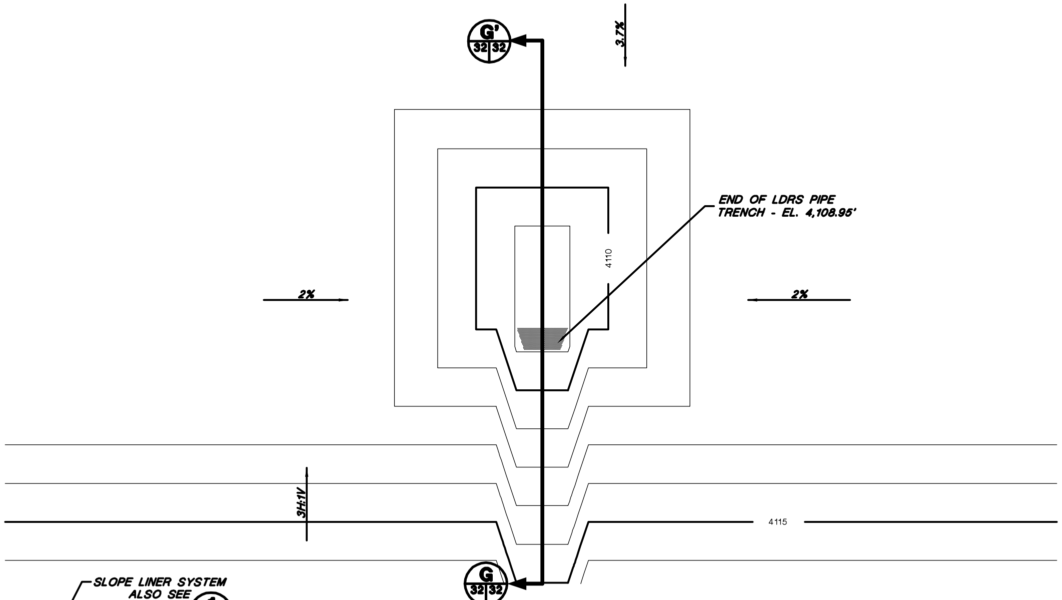
SCALE: As Shown

DRAWING No. 12

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

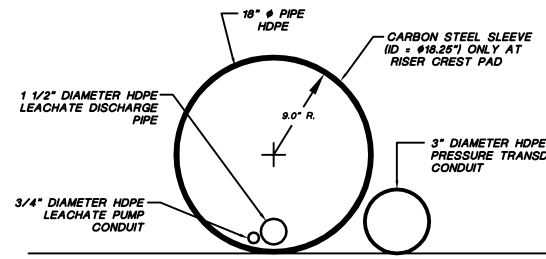
AutoCAD FILE: LNRDTLS.DWG

PROJECT NUMBER: 602-0200



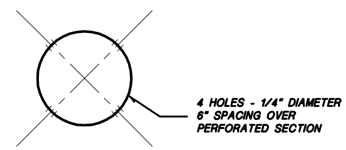
2 EVAPORATION POND SUMP LAYOUT
29 | 32

SCALE
0 5' 10'
Feet



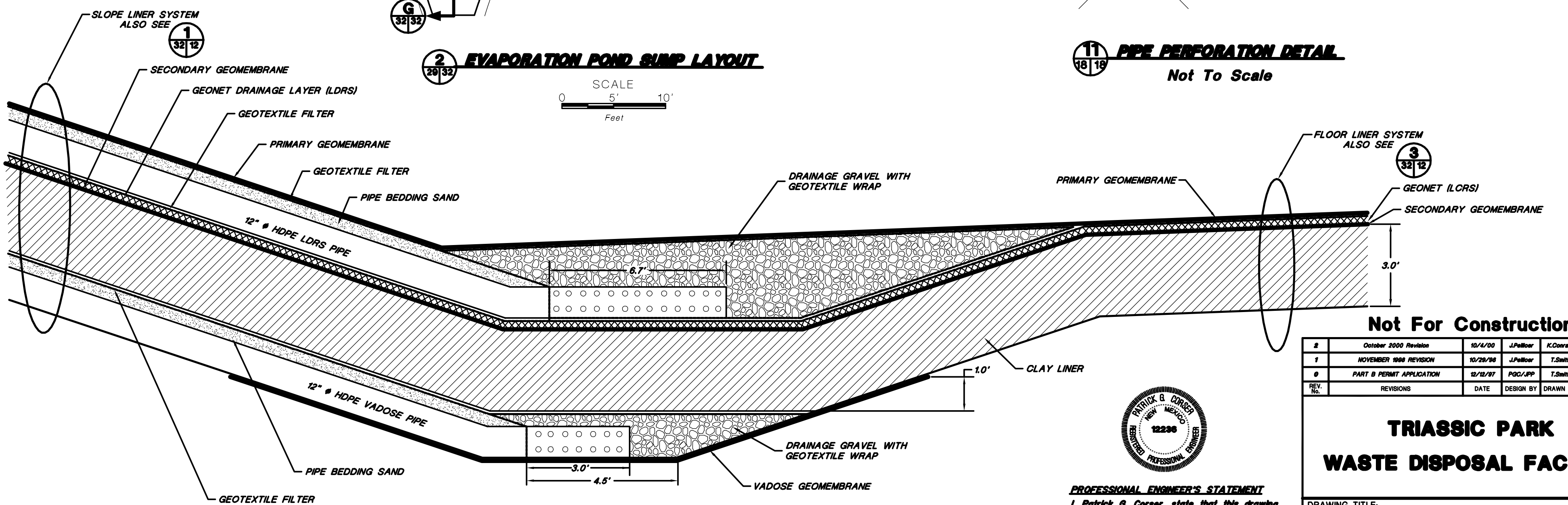
3 LCRS AND LDRS RISER PIPE DETAIL
31 | 32

SCALE
0 0.5' 1.0'
Feet



11 PIPE PERFORATION DETAIL
18 | 18

Not To Scale



G EVAPORATION POND SUMP CROSS-SECTION
32 | 32

Not To Scale

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: LDSPLAN.DWG
PROJECT NUMBER: 602-0200

PATRICK G. CORSER — NEW MEXICO — 12236 — REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date — Patrick G. Corser, NM P.E. 12236

Not For Construction

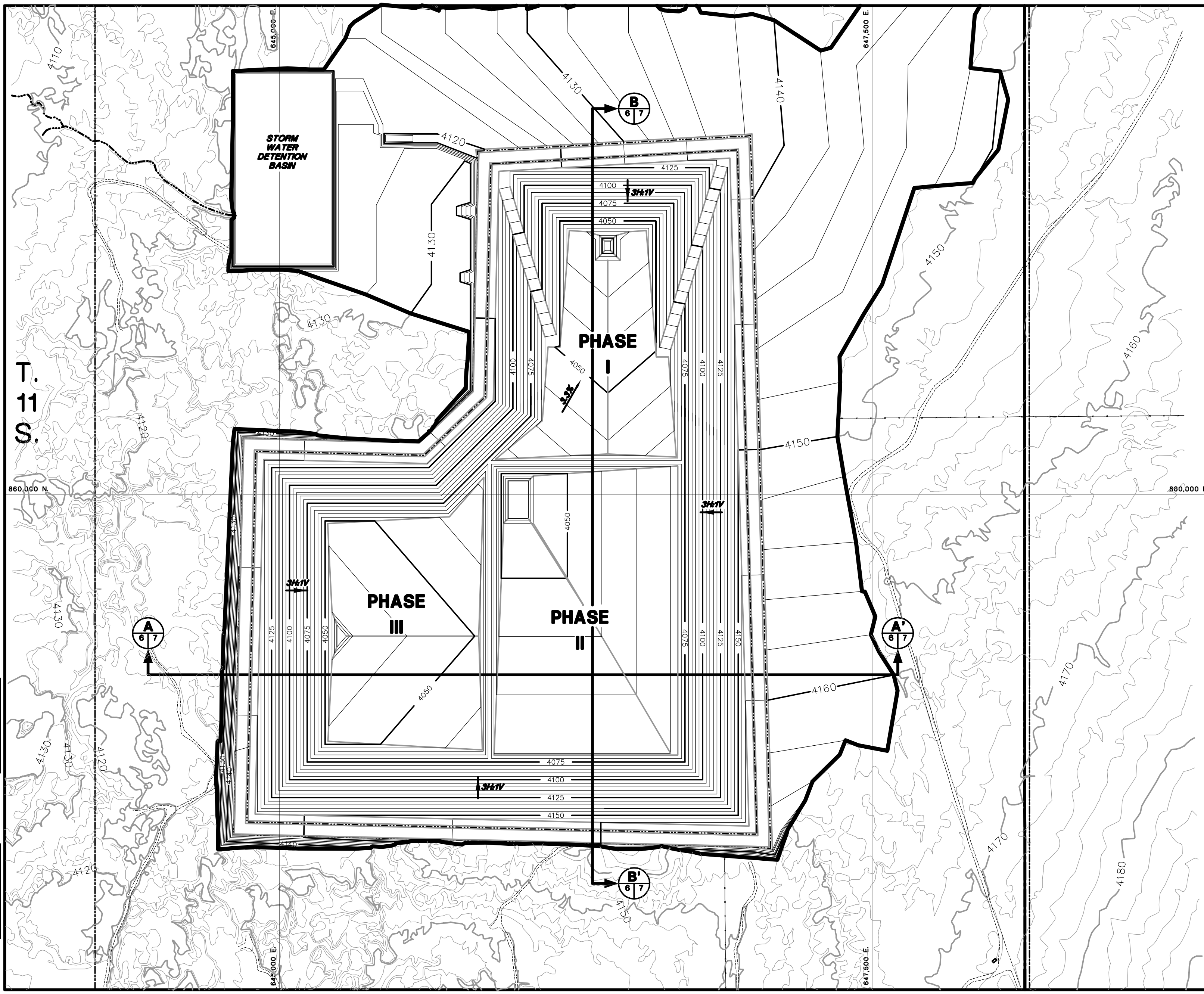
REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pelliccr	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pelliccr	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
EVAPORATION POND LDRS AND VADOSE PLAN AND DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 32



AutoCAD FILE: GMI-ULFP.DWG

PROJECT NUMBER: 602-0200

NOTES:

1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.
3. BASE GRADES FOR PHASES II AND III TO BE MODIFIED PRIOR TO CONSTRUCTION TO ACHIEVE A MINIMUM OF 2%.

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

SCALE

200' 0 200' 400'

CONTOUR INTERVAL 5 FT.
SURFACE TOPOGRAPHY CONTOUR INTERVAL 2 FT.

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revisions	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	November 1998 Revision	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	EWS	P.Corser

TRIASSIC PARK

WASTE DISPOSAL FACILITY

DRAWING TITLE:

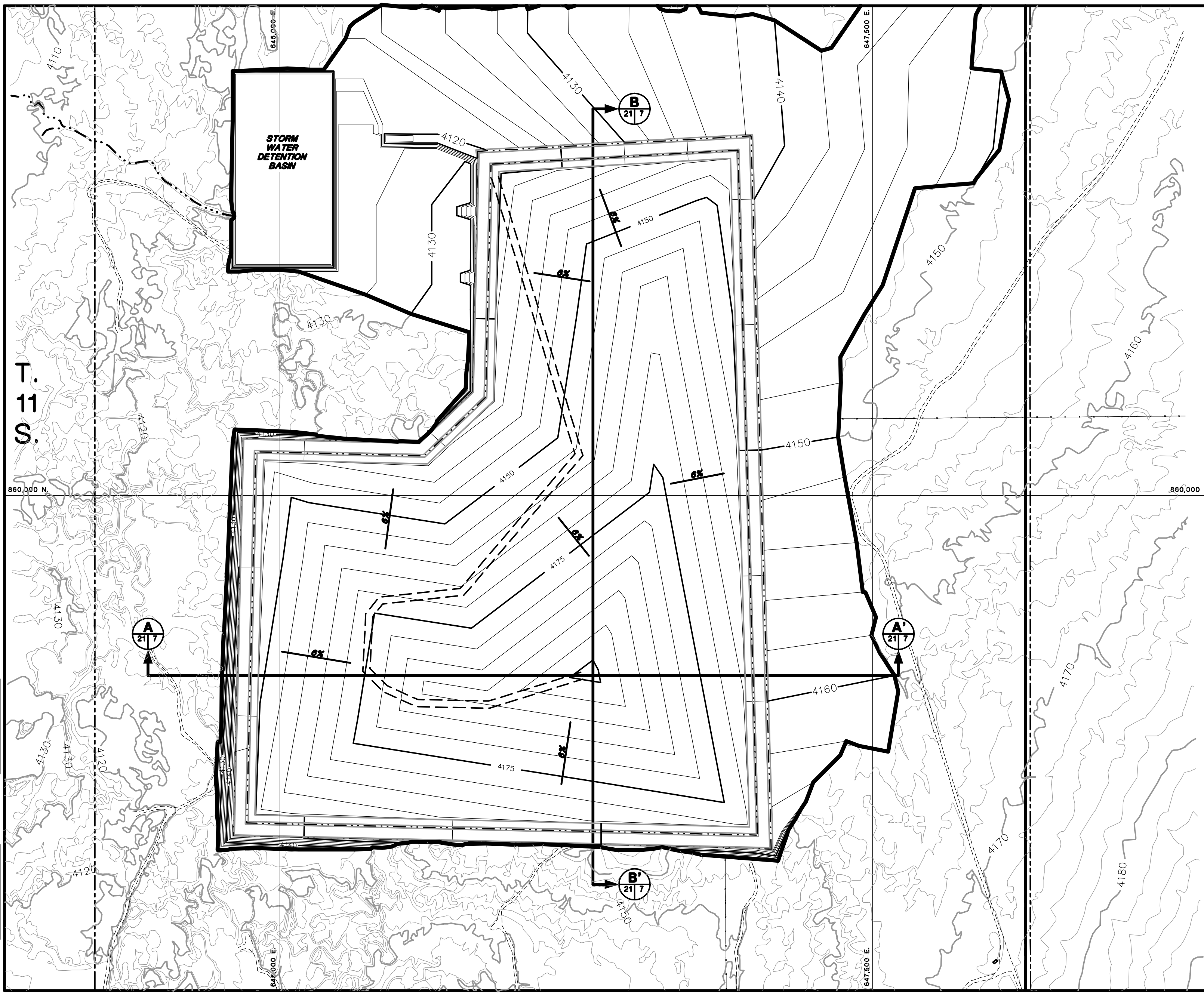
ULTIMATE LANDFILL EXCAVATION PLAN

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets

SCALE: AS NOTED

DRAWING No. 6



NOTES:

1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date — *Patrick G. Corser, NM P.E. 12236*

SCALE

200' 0 200' 400'

CONTOUR INTERVAL 5 FT.
SURFACE TOPOGRAPHY CONTOUR INTERVAL 2 FT.

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

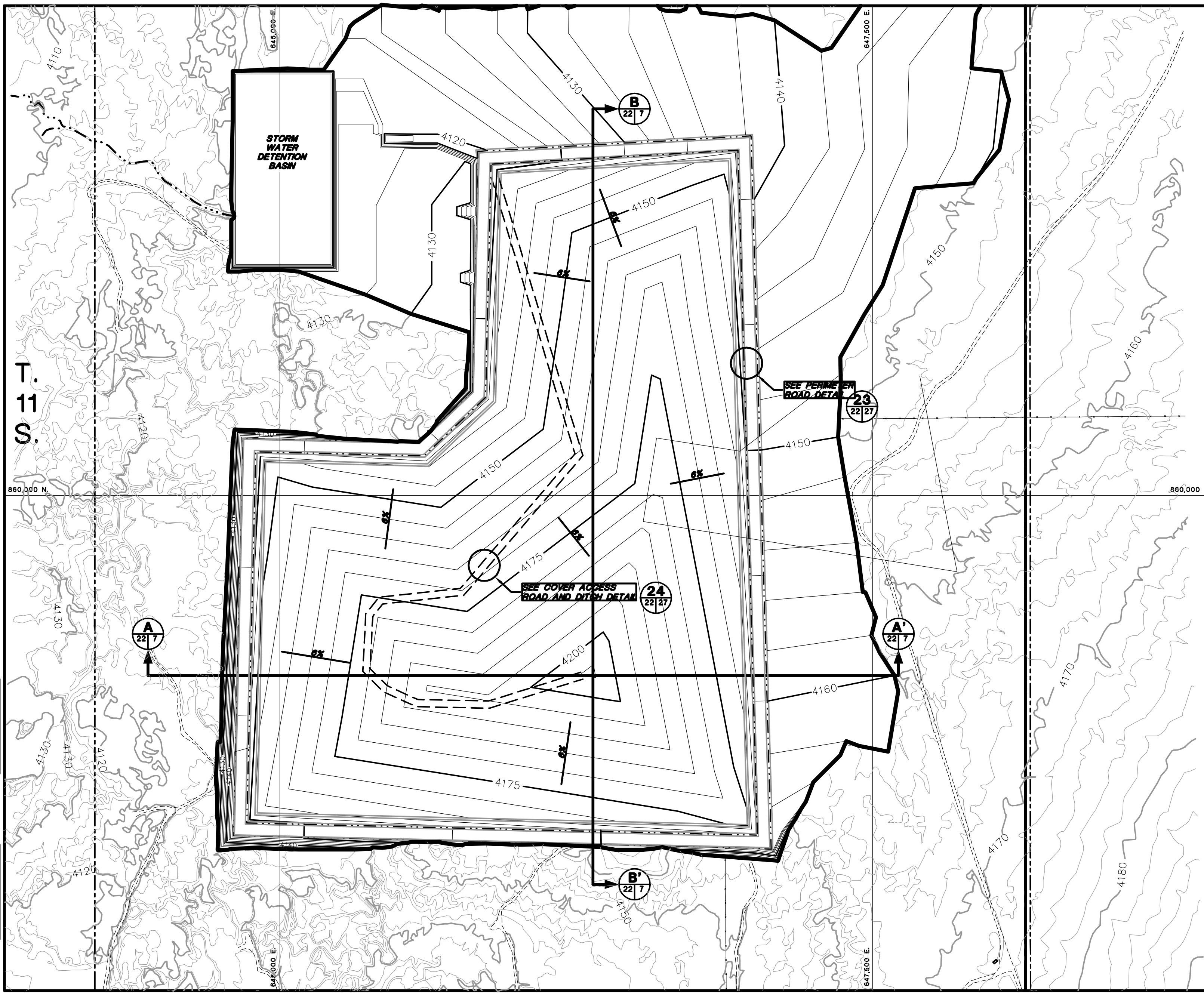
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
FINAL GRADING PLAN - TOP OF WASTE CONTOURS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 21

AutoCAD FILE: GM-FGPTWC.DWG — PROJECT NUMBER: 602-0200



NOTES:

1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

N

SCALE

200' 0 200' 400'

CONTOUR INTERVAL 5 FT.
SURFACE TOPOGRAPHY CONTOUR INTERVAL 2 FT.

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

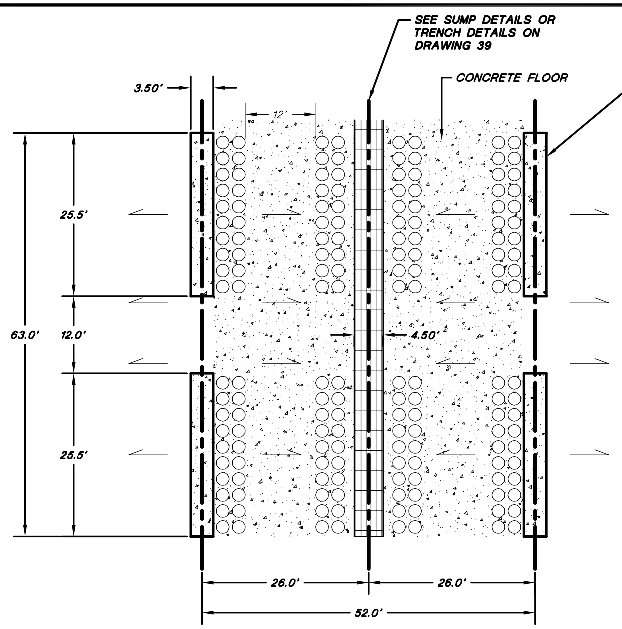
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

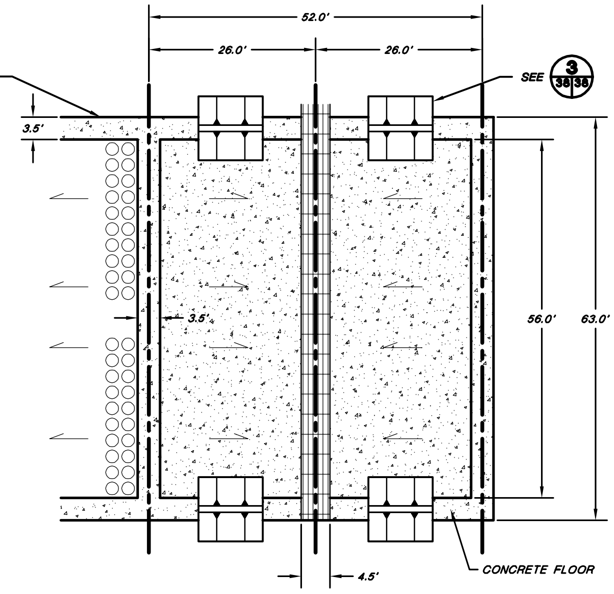
FINAL GRADING PLAN - TOP OF VEGETATIVE COVER CONTOURS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 22



1 37|38 TYPICAL RCRA CELL DETAIL
Not To Scale



2 37|38 TYPICAL TSCA CELL DETAIL
Not To Scale

LEGEND

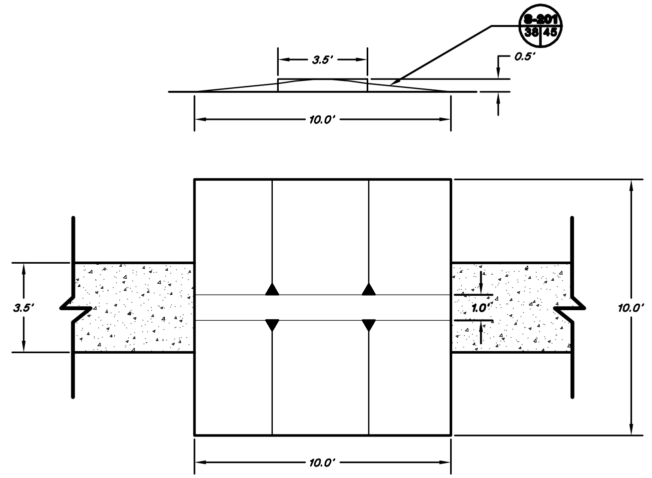
DRAINAGE FLOW DIRECTION ON TOP OF CONCRETE

CENTERLINE

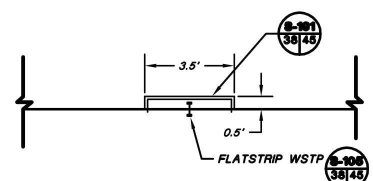
DRUMS

SCALE

10' 0 10' 20'



3 37|38 TYPICAL TSCA CELL ACCESS RAMP DETAIL
Not To Scale



4 37|38 TYPICAL BERM WALKWAY DETAIL
Not To Scale

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date ____ Patrick G. Corser, NM P.E. 12236

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
3	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
2	SEPTEMBER 1999 REVISION	9/99	P.Corser	T.Clark	P.Corser
1	NOVEMBER 1998 REVISION	10/30/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

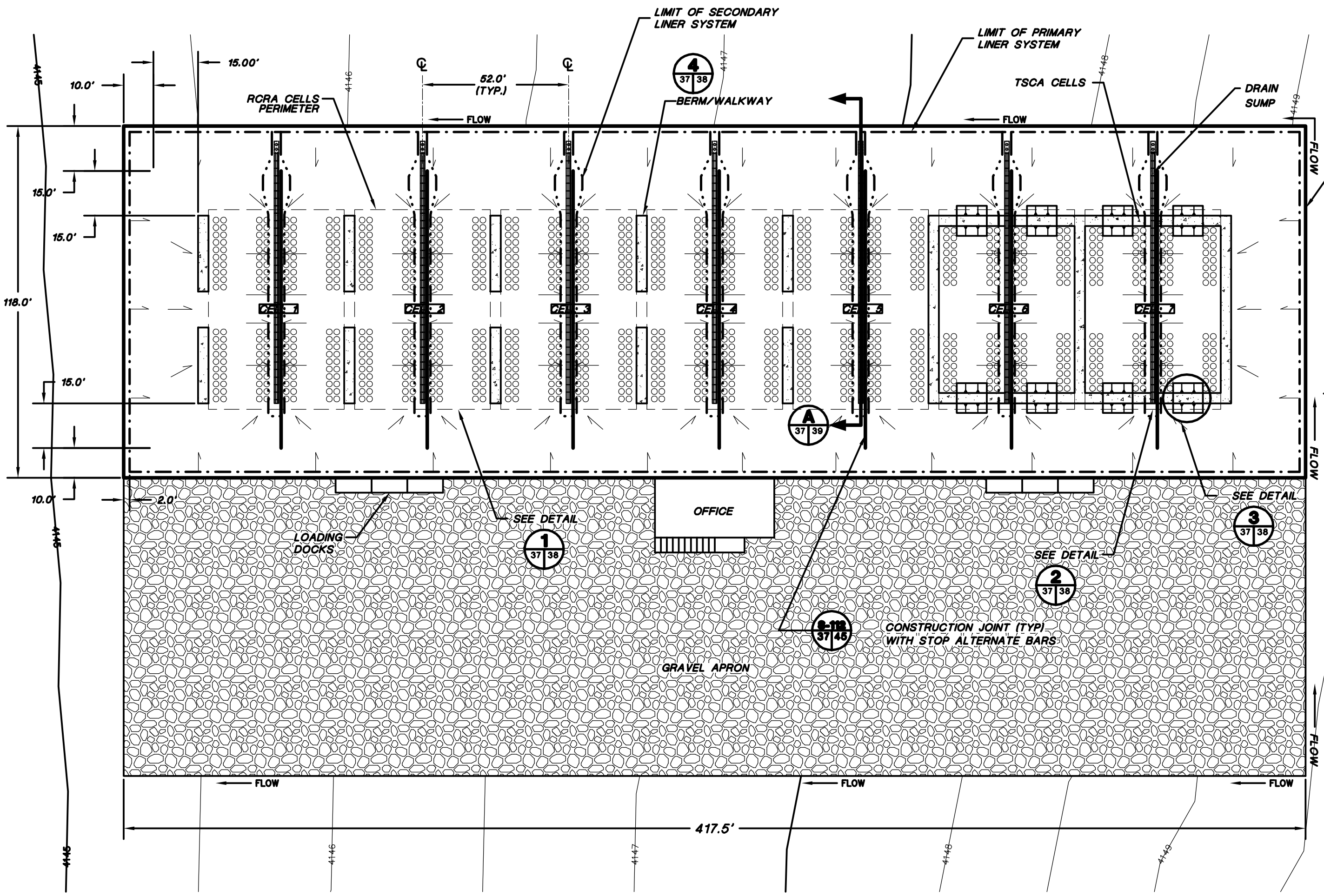
DRAWING TITLE:
DRUM HANDLING UNIT DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 38

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: GMI-DHF2.DWG PROJECT NUMBER: 602-0200



TYPICAL DRUM FLOOR LAYOUT

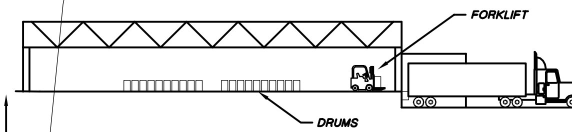
LEGEND

DRAINAGE FLOW DIRECTION ON TOP OF CONCRETE

EXTENT OF PRIMARY GEOMEMBRANE

EXTENT OF SECONDARY GEOMEMBRANE

DRUMS



TYPICAL SIDE ELEVATION

SCALE

20' 0 20' 40'

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date   Patrick G. Corser, NM P.E. 12236

Not For Construction

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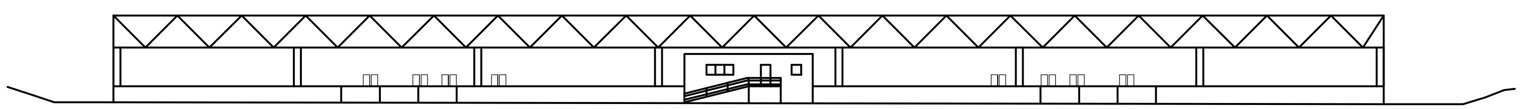
3	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
2	SEPTEMBER 1999 REVISION	09/01/99	P.Corser	T.Smith	P.Corser
1	NOVEMBER 1998 REVISION	10/30/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE: **DRUM HANDLING UNIT GENERAL ARRANGEMENT**

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 37



TYPICAL FRONT ELEVATION

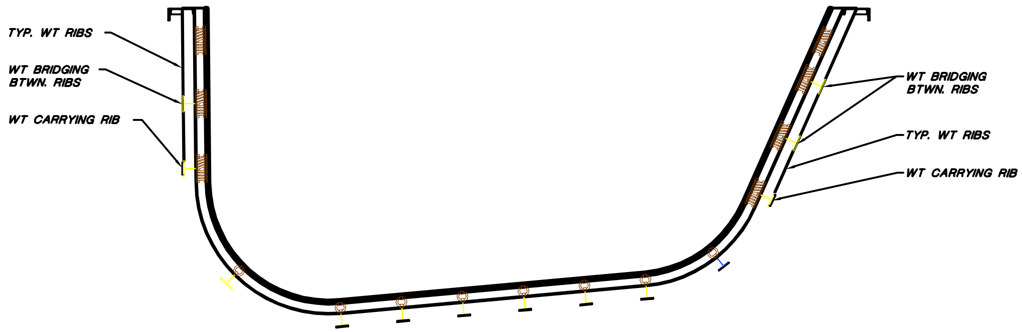
NOTES:

1) FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

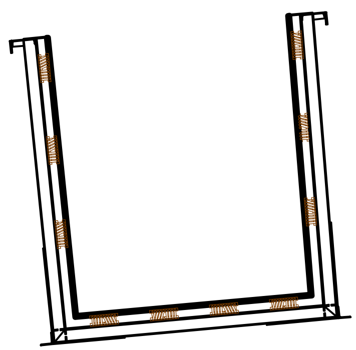
2) EACH CELL SHALL BE LABELED ACCORDING TO THE TYPE OF WASTE BEING STORED.

3) INCOMPATIBLE WASTES WILL BE STORED IN SEPARATE CELLS.

AutoCAD FILE: GMI-DHF.DWG
PROJECT NUMBER: 602-0200



LONGITUDINAL SECTION - INNER/OUTER LINERS & FRAMING



LATTERAL SECTION - INNER/OUTER LINERS & FRAMING

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

Not For Construction

SCALE

4' 0 2' 4' 6'

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
STABILIZATION UNIT BIN DESIGN DETAILS

FRED H. SCHOTT & ASSOCIATES
CIVIL and STRUCTURAL ENGINEERING • LAND PLANNING & BUILDING DESIGN
200 Suburban Road, Suite A San Luis Obispo, CA 93401
(805) 544-1216 FAX (805) 544-2804

TerraMatrix
MONTGOMERY WATSON
Mining Group

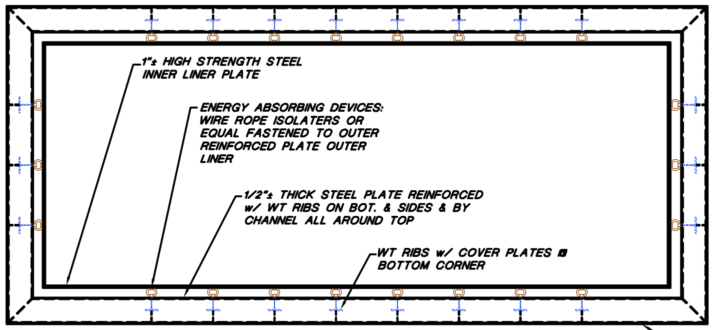
Sheet 2 Of 2 Sheets

SCALE: As Shown

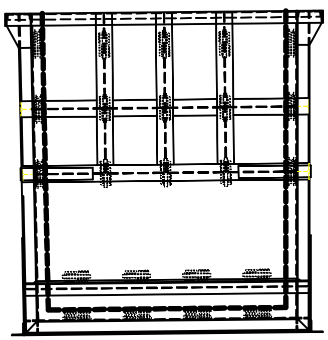
DRAWING No. 36

AutoCAD FILE: GM-BIN3.DWG

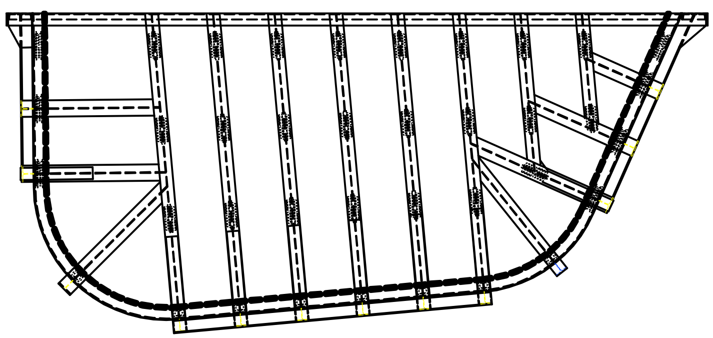
PROJECT NUMBER: 602-0200



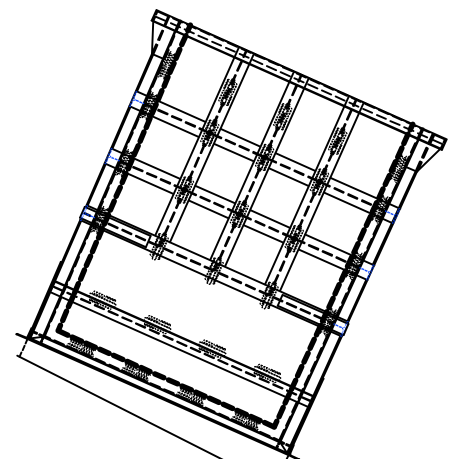
TOP VIEW



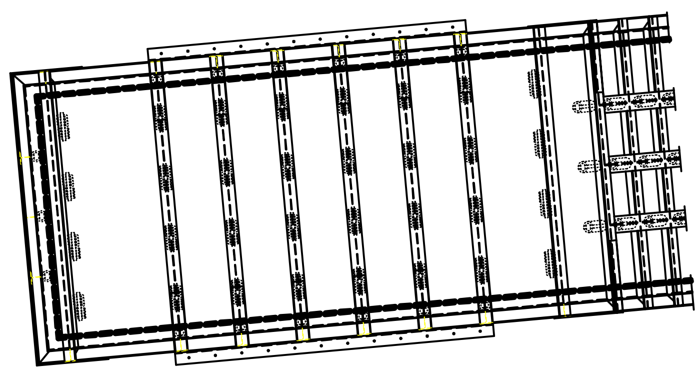
LEFT SIDE ELEVATION



TYPICAL SIDE ELEVATION



RIGHT SIDE ELEVATION



VIEW OF BOTTOM

SCALE 4' 0 2' 4' 6'

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date Patrick G. Corser, NM P.E. 12236

Not For Construction

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2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

STABILIZATION UNIT BIN DESIGN DETAILS

FRED H. SCHOTT & ASSOCIATES
CIVIL and STRUCTURAL ENGINEERING • LAND PLANNING & BUILDING DESIGN
280 Suburban Road, Suite A San Luis Obispo, CA 93401
(805) 544-1216 FAX (805) 544-2004

TerraMatrix MONTGOMERY WATSON Mining Group

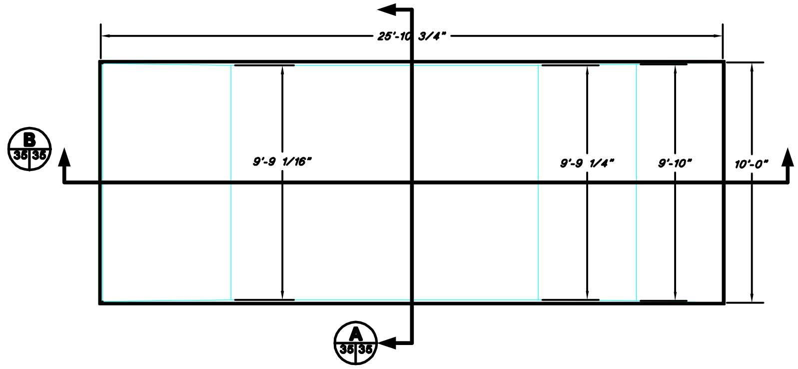
Sheet 1 Of 2 Sheets

SCALE: As Shown

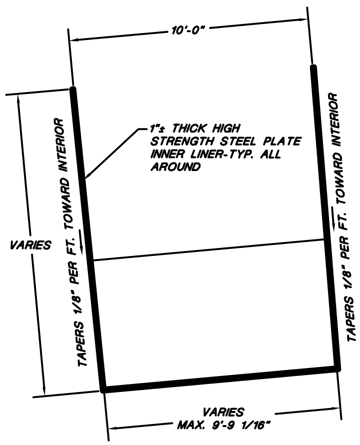
DRAWING No. 36

PROJECT NUMBER: 602-0200

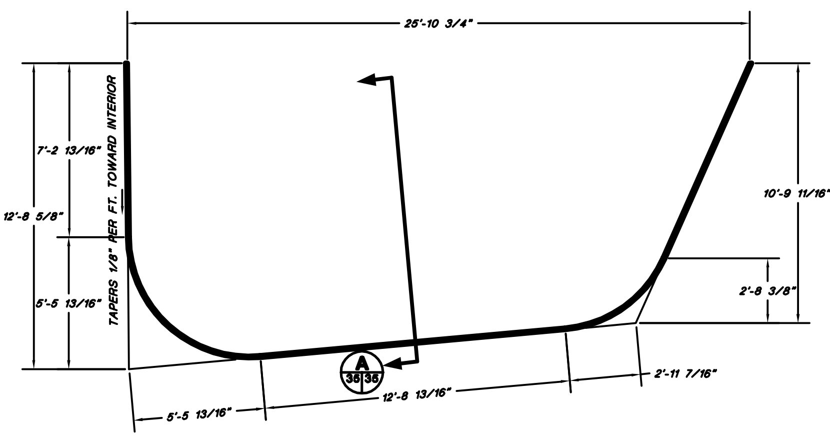
AutoCAD FILE: GM-BIN2.DWG



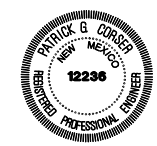
PLAN VIEW - INNER LINER



A 35 35 CROSS SECTION - INNER LINER



B 35 35 LONGITUDINAL SECTION - INNER LINER



PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date ______ Patrick G. Corser, NM P.E. 12236

Not For Construction

SCALE
4' 0 2' 4' 6'

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
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TRIASSIC PARK
WASTE DISPOSAL FACILITY

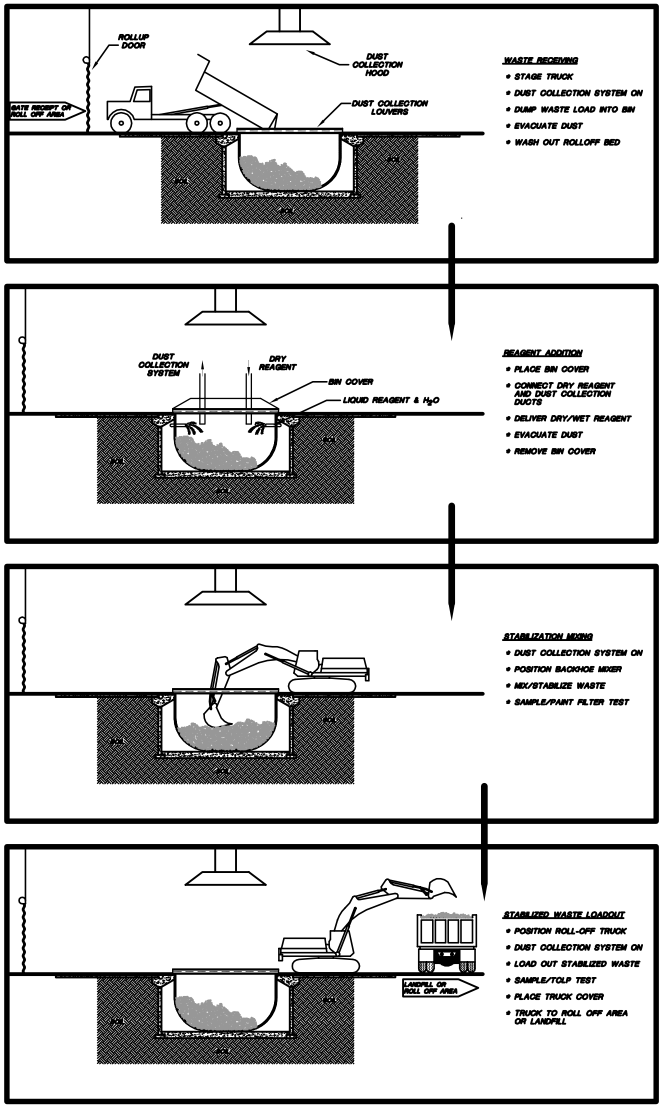
DRAWING TITLE:
STABILIZATION UNIT BIN DESIGN

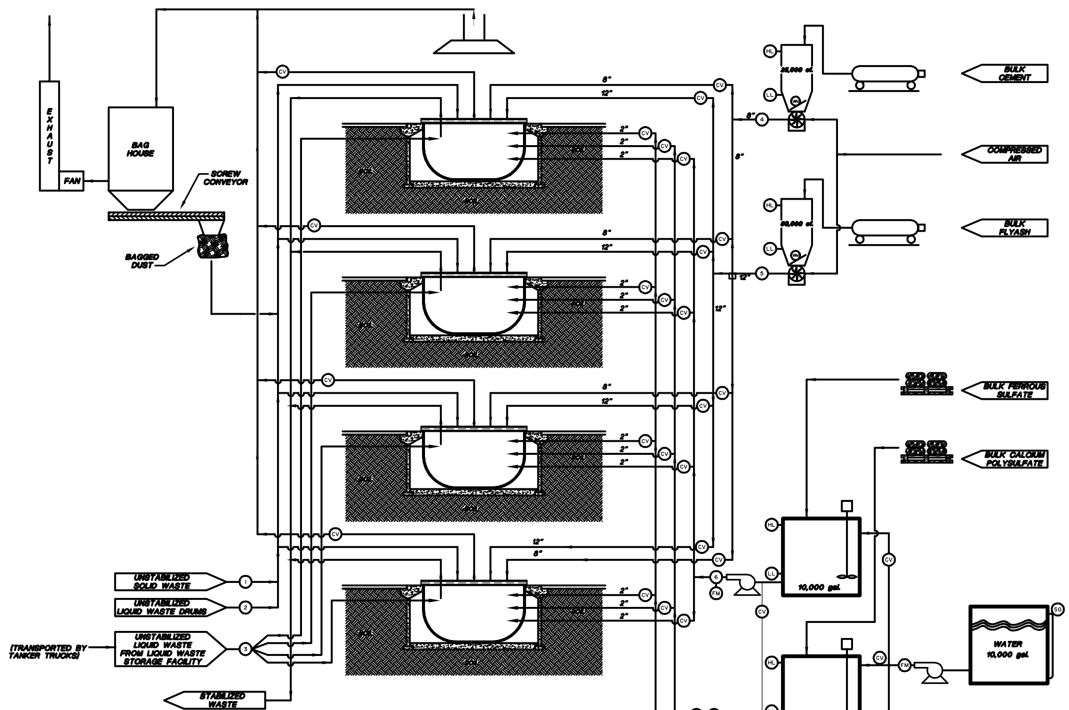
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 35

FRED H. SCHOTT & ASSOCIATES
CIVIL and STRUCTURAL ENGINEERING • LAND PLANNING & BUILDING DESIGN
200 Suburban Road, Suite A San Luis Obispo, CA 93401
(805) 544-1216 FAX (805) 544-2004

AutoCAD FILE: GM-BIN1.DWG PROJECT NUMBER: 602-0200





LEGEND

- (HL) HIGH LEVEL CUT-OFF
- (LL) LOW LEVEL CUT OFF
- (WM) WEIGHT METER
- (FM) FLOW METER
- (CV) CONTROL VALVE
- (SG) SIGHT GAUGE

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. ACTUAL REAGENT: WASTE RATIOS ARE DEPENDENT ON SPECIFIC CHARACTERISTIC OF WASTE.
3. PIPING WILL BE INSTALLED ACCORDING TO API PUBLICATION 1615 (NOVEMBER 1979) OR ANSI STANDARD B31.2 AND ANSI STANDARD B31.4.
4. PIPING LOCATION WILL BE DETERMINED IN THE FIELD.
5. REAGENTS MAY BE MANUALLY FED DIRECTLY TO THE BINS.

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
3	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
2	SEPTEMBER 1999 REVISION	9/99	P.Corser	T.Clark	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

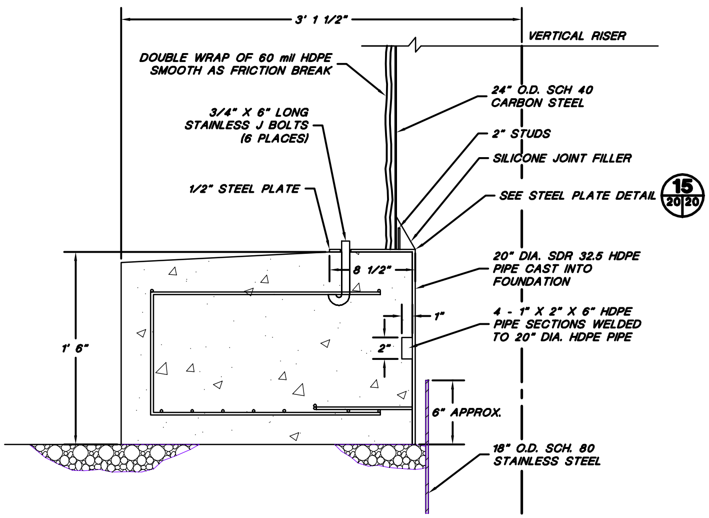
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
STABILIZATION UNIT WASTE FLOW DIAGRAM

TerraMatrix
MONTGOMERY WATSON
Mining Group

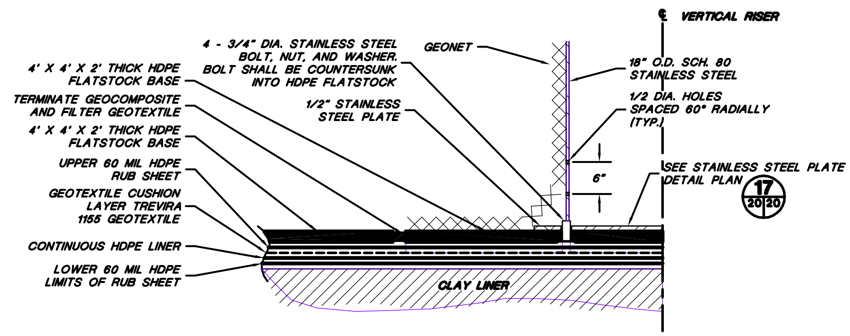
Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 34

AutoCAD FILE: GM-FLOW.DWG PROJECT NUMBER: 602-0200



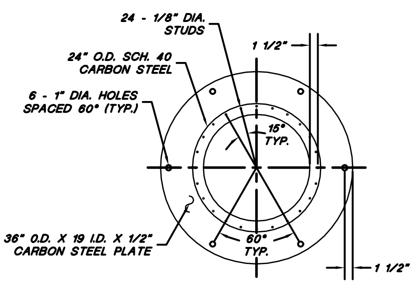
14 (20|20) VERTICAL RISER FOUNDATION DETAIL

SCALE 0 0.5' 1' Feet



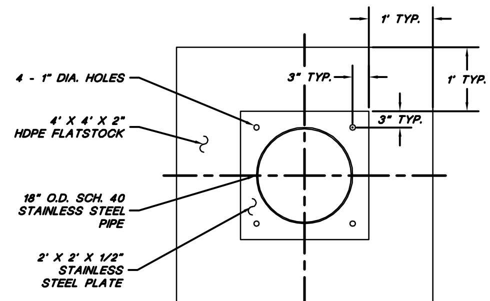
22 (20|20) VERTICAL RISER BASE DETAIL

SCALE 0 0.5' 1' Feet



15 (20|20) STEEL PLATE DETAIL

SCALE 0 1' 2' Feet



17 (20|20) STAINLESS STEEL PLATE DETAIL

SCALE 0 1' 2' Feet

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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0	PART B PERMIT APPLICATION	12/12/97	PGC/JJP	E.Simonsen	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

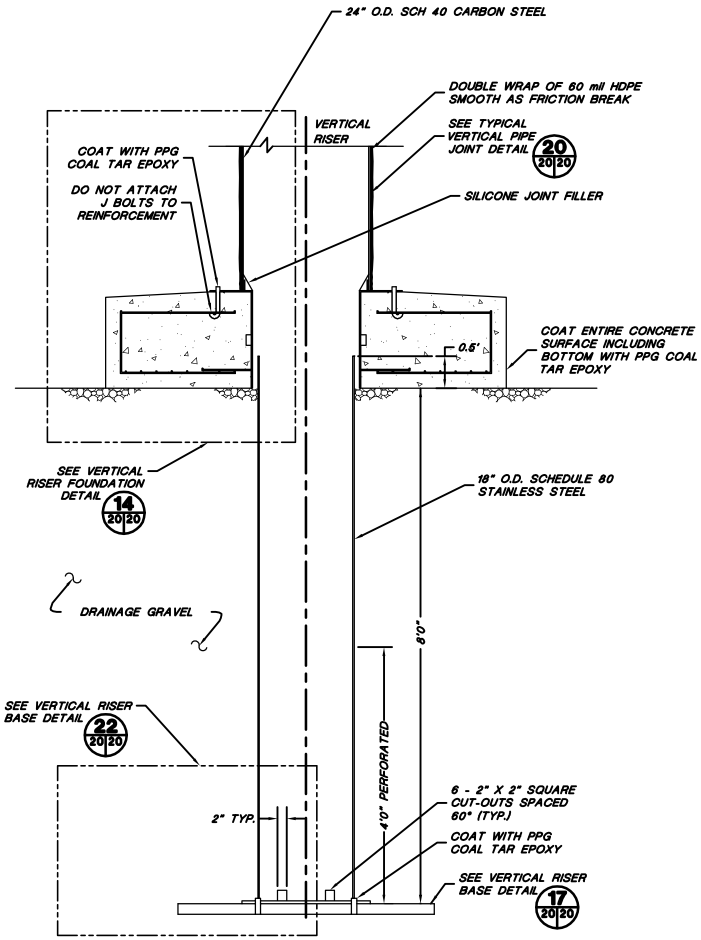
DRAWING TITLE:

VERTICAL RISER DETAILS

TerraMatrix MONTGOMERY WATSON Mining Group

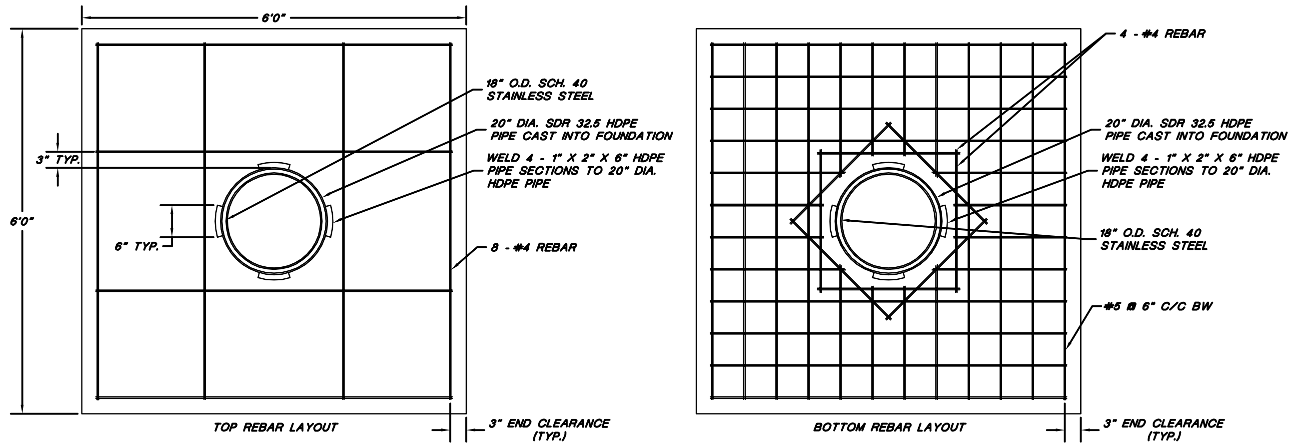
Sheet 2 Of 2 Sheets
SCALE: As Noted
DRAWING No. 20

AutoCAD FILE: GLF-SRD-24.DWG
PROJECT NUMBER: 602-0200



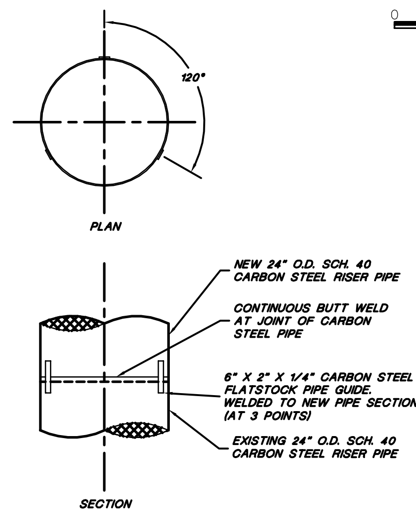
16 (17|20) **VERTICAL RISER SECTION**

SCALE 0 1' 2' Feet



21 (20|20) **VERTICAL RISER BASE DETAIL**

SCALE 0 1' 2' Feet



20 (20|20) **TYPICAL VERTICAL RISER PIPE JOINT**

SCALE 0 1' 2' Feet

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

VERTICAL RISER DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

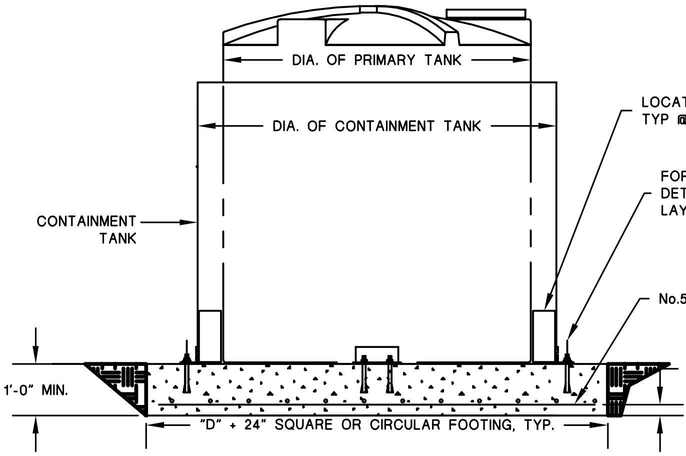
Sheet 1 Of 2 Sheets

SCALE: As Noted

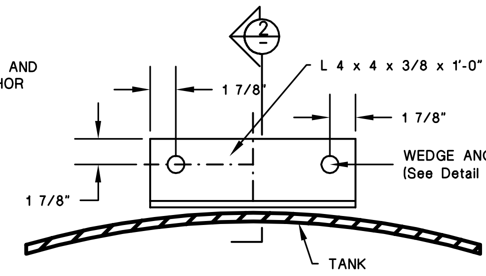
DRAWING No. 20

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

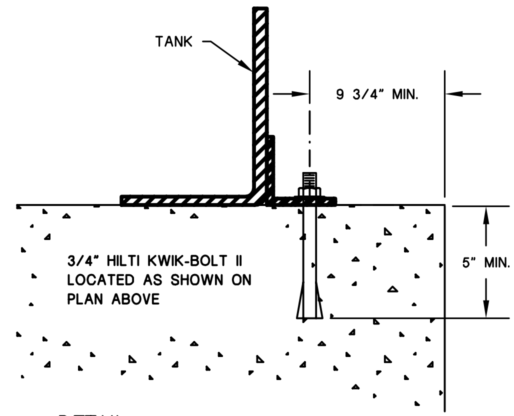
AutoCAD FILE: GLF-SRD1.DWG PROJECT NUMBER: 602-0200



1 ELEVATION



S2 ANCHOR TYPE S2



1 DETAIL

TANK DATA						ANCHORAGE REQUIREMENTS		
PRIMARY MODEL NO.	SECONDARY MODEL NO.	CAPACITY (GALS.)	DIAMETER (FT.)	HEIGHT (FT.)	WEIGHT (LBS.)	ANCHOR LAYOUT	CABLE Hc	CABLE DIAMETER
10 VCT 09K	12 VOC 15E	9000	10	16.08	7000	D		

GENERAL NOTES

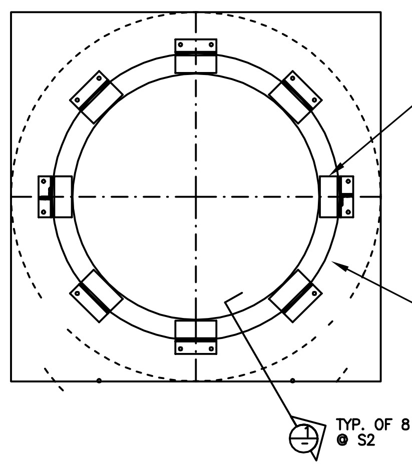
1. TANK RESTRAINT ANCHORAGES, CABLES DESIGNED FOR SEISMIC AND WIND FORCES PER THE UNIFORM BUILDING CODE, 1997 EDITION.
2. MATERIALS SHALL CONFORM TO THE REQUIREMENTS OF THE UBC AND THE FOLLOWING CRITERIA:

   STRUCTURAL STEEL: ASTM A36

   CONCRETE: COMPRESSIVE STRENGTH (f'c) = 2500 PSI, MAX. SLUMP = 4 INCHES

   REINFORCEMENT: ASTM A615. YIELD STRENGTH (Fy) = 40,000 PSI

   ANCHORS: HILTI "KWIK-BOLT" OR WEJ-IT "ANKR-TITE". INSTALL PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.
3. REMOVE ALL SHARP EDGES THAT MAY DAMAGE OR CAUSE WEAR TO CABLES.
4. ALL GALLONAGES AND DIMENSIONS ARE NOMINAL.



C ANCHOR LAYOUT 'C'

PROFESSIONAL ENGINEER'S STATEMENT

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Date ***Patrick G. Corser, NM P.E. 12236***

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0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	E.Simonsen	P.Corser

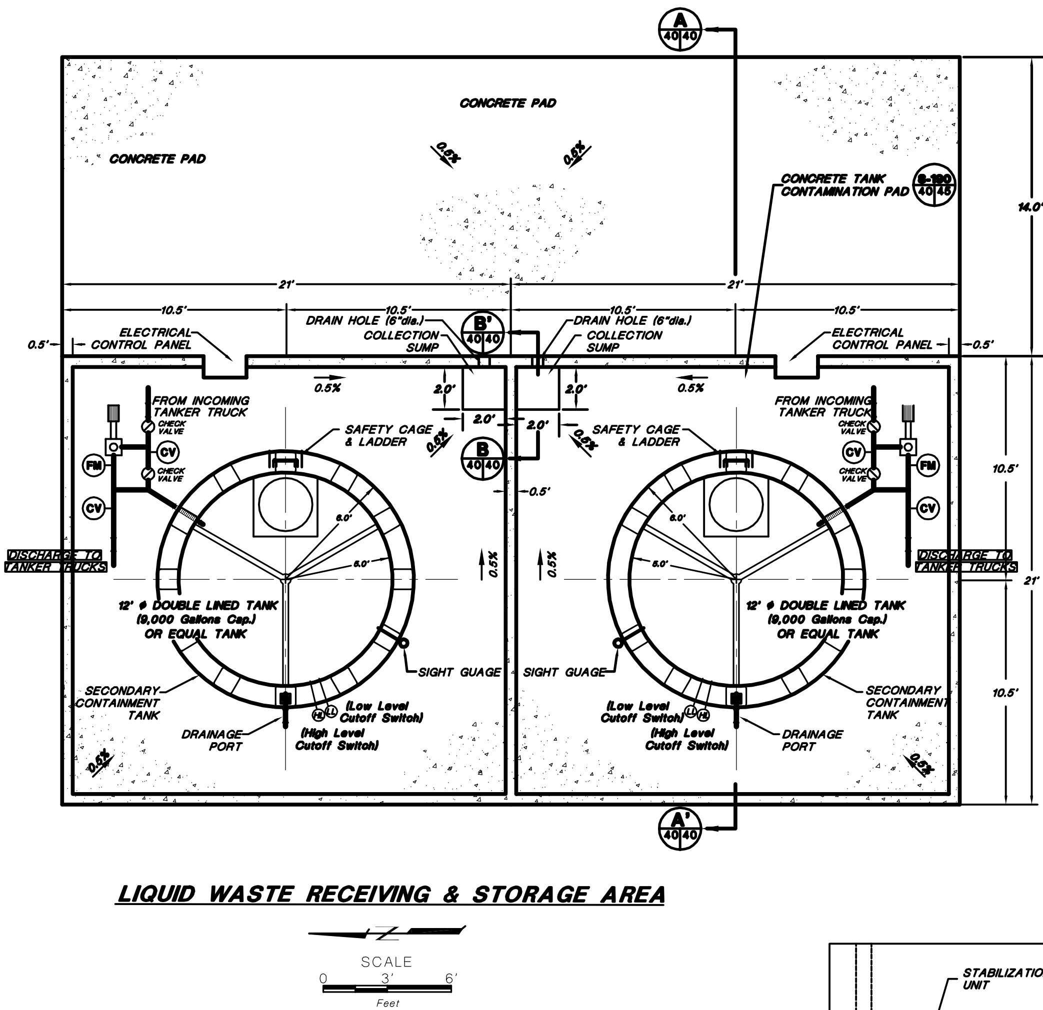
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
LIQUID WASTE RECEIVING AND STORAGE UNIT LAYOUT

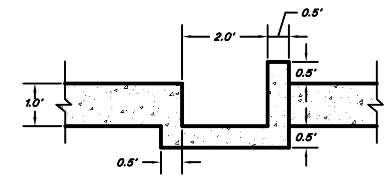
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 2 Of 2 Sheets
SCALE: See Scale Bar
DRAWING No. 40

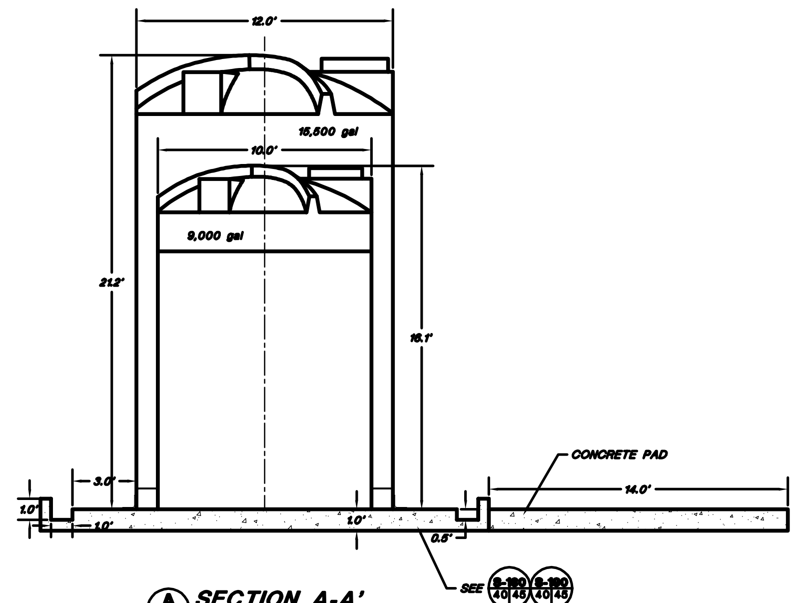
AutoCAD FILE: GLF-LWRSFL-sheet2 PROJECT NUMBER: 602-0200



LIQUID WASTE RECEIVING & STORAGE AREA



SECTION B-B'



SECTION A-A'

NOTES:

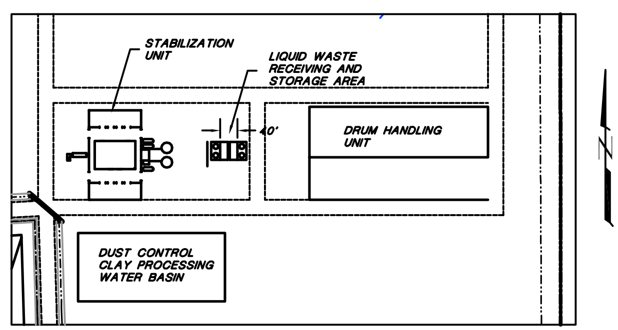
1. FOR GENERAL NOTES AND LEGEND INFORMATION SE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. FOR CONCRETE DETAILS SEE DRAWING 45.
3. TWO TANKS WILL BE CONSTRUCTED INITIALLY TO SERVICE SITE EXCAVATIONS. TWO ADDITIONAL TANKS MAY BE ADDED AT A LATER DATE TO ACCOMODATE ANY INCREASES IN LIQUID WASTE VOLUME.
4. PIPING WILL BE INSTALLED ACCORDING TO API PUBLICATION 1615 (NOVEMBER 1979) OR ANSI STANDARD B 31.2 AND ANSI STANDARD B 31.4.
5. PIPING LOCATION WILL BE DETERMINED IN THE FIELD.
6. DETAILS OF THE DOUBLE LINED TANKS ARE PROVIDED IN SHEET 2.

PATRICK G. CORSER, NEW MEXICO, 12236, REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date — Patrick G. Corser, NM P.E. 12236



LIQUID WASTE RECEIVING & STORAGE AREA LOCATION

Not For Construction

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4	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
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2	SEPTEMBER 1999 REVISION	09/01/99	P.Corser	T.Smith	P.Corser
1	NOVEMBER 1998 REVISION	10/30/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	E.Simonsen	P.Corser

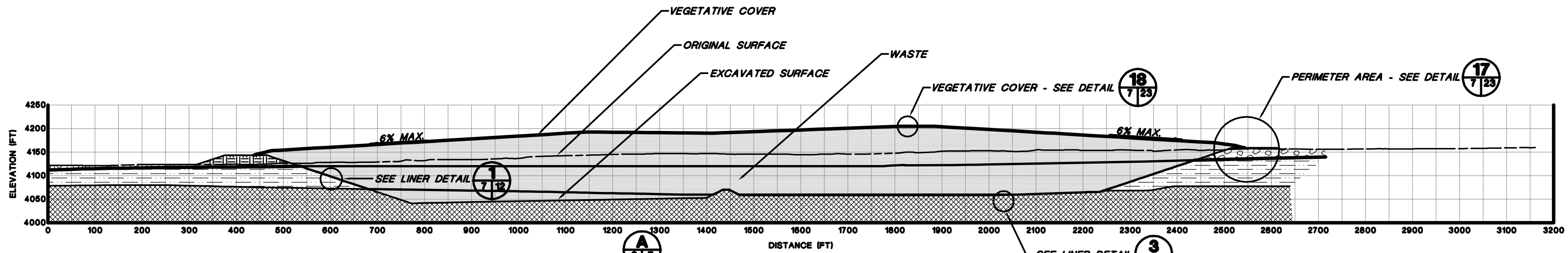
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
LIQUID WASTE RECEIVING AND STORAGE UNIT LAYOUT

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 2 Sheets
SCALE: See Scale Bar
DRAWING No. 40

AutoCAD FILE: GLF-LWRSFLDWG
PROJECT NUMBER: 602-0200

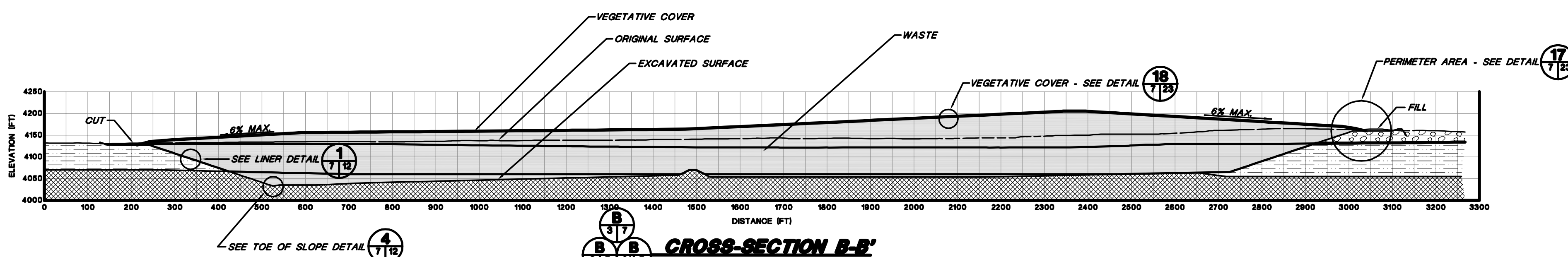


A 3 7 | A 6 7 | A 21 7 | A 22 7

CROSS-SECTION A-A'

HORIZONTAL SCALE
0 120' 240'

VERTICAL SCALE
0 120' 240'



B 3 7 | B 6 7 | B 21 7 | B 22 7

CROSS-SECTION B-B'

HORIZONTAL SCALE
0 120' 240'

VERTICAL SCALE
0 120' 240'

NOTES:
1. CROSS-SECTIONS NOT CUT PERPENDICULAR TO COVER CONTOURS; THEREFORE TRUE COVER SLOPES NOT SHOWN.
2. EXTENT OF GEOLOGIC UNITS IS INFERRED BASED ON SUBSURFACE EXPLORATION PROGRAM.
3. SYMBOLS FOR GEOLOGIC UNITS ARE SHOWN ON DRAWING 2.
4. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

TRIASSIC PARK
WASTE DISPOSAL FACILITY

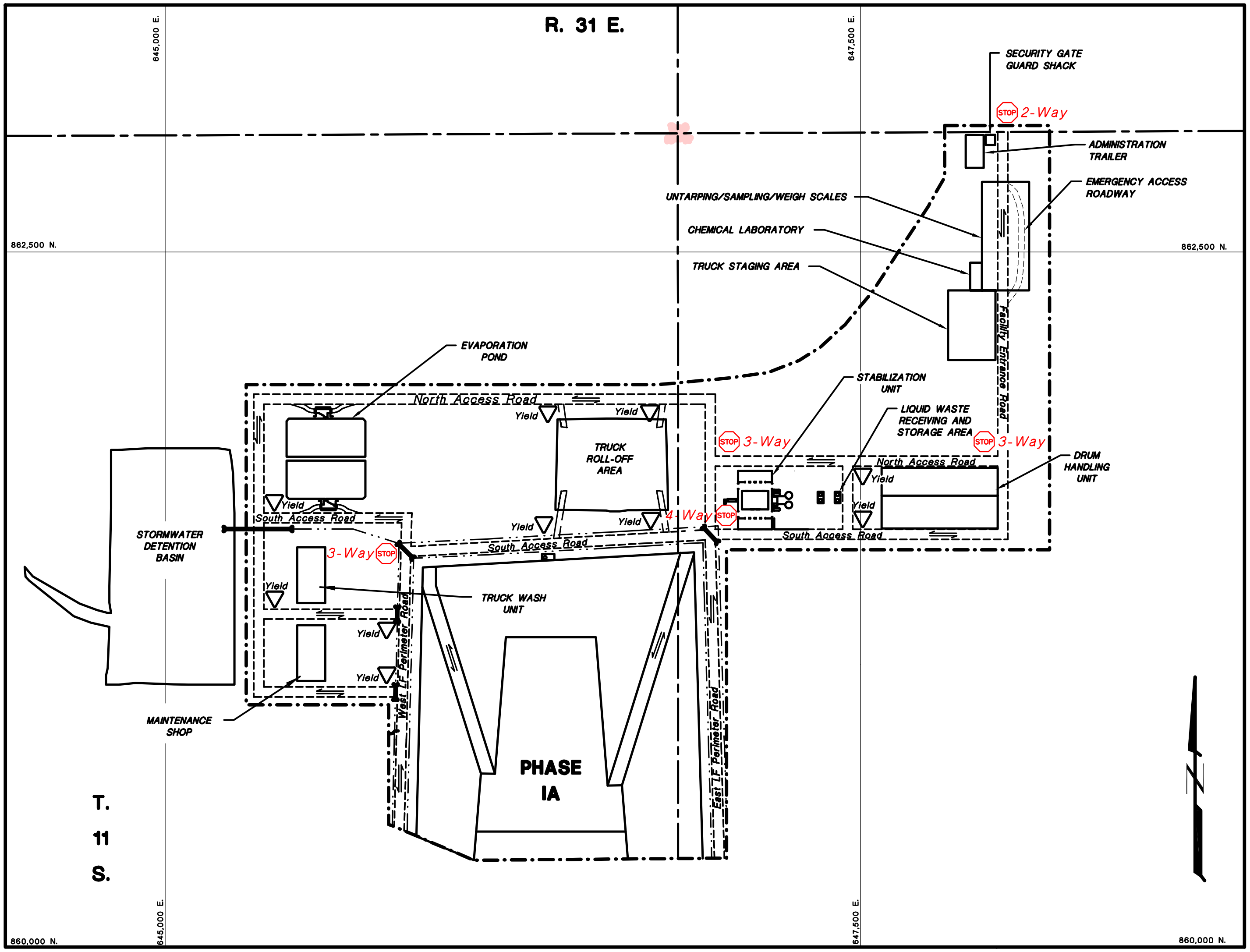
DRAWING TITLE:

LANDFILL CROSS-SECTIONS

TerraMatrix
MONTGOMERY WATSON
Mining Group

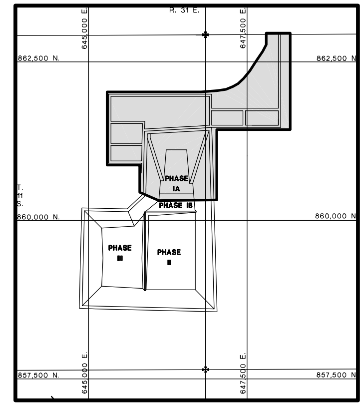
Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 7

AutoCAD FILE: GANDY-TXSEC2.DWG
PROJECT NUMBER: 602-0200



SCALE
0 200 400
Feet

MAP KEY



NOTES:

1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. UNIMPROVED ROADS AND CONSTRUCTION HAUL ROADS NOT SHOWN. GRAVEL LINED ACCESS ROADS ARE 2 WAY TRAFFIC. ALL SITE ACCESS ROADS SPEED LIMIT IS 15 MPH, CONSTRUCTION HAUL ROAD SPEED LIMIT IS 35 MPH.

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY	

TRIASSIC PARK WASTE DISPOSAL FACILITY

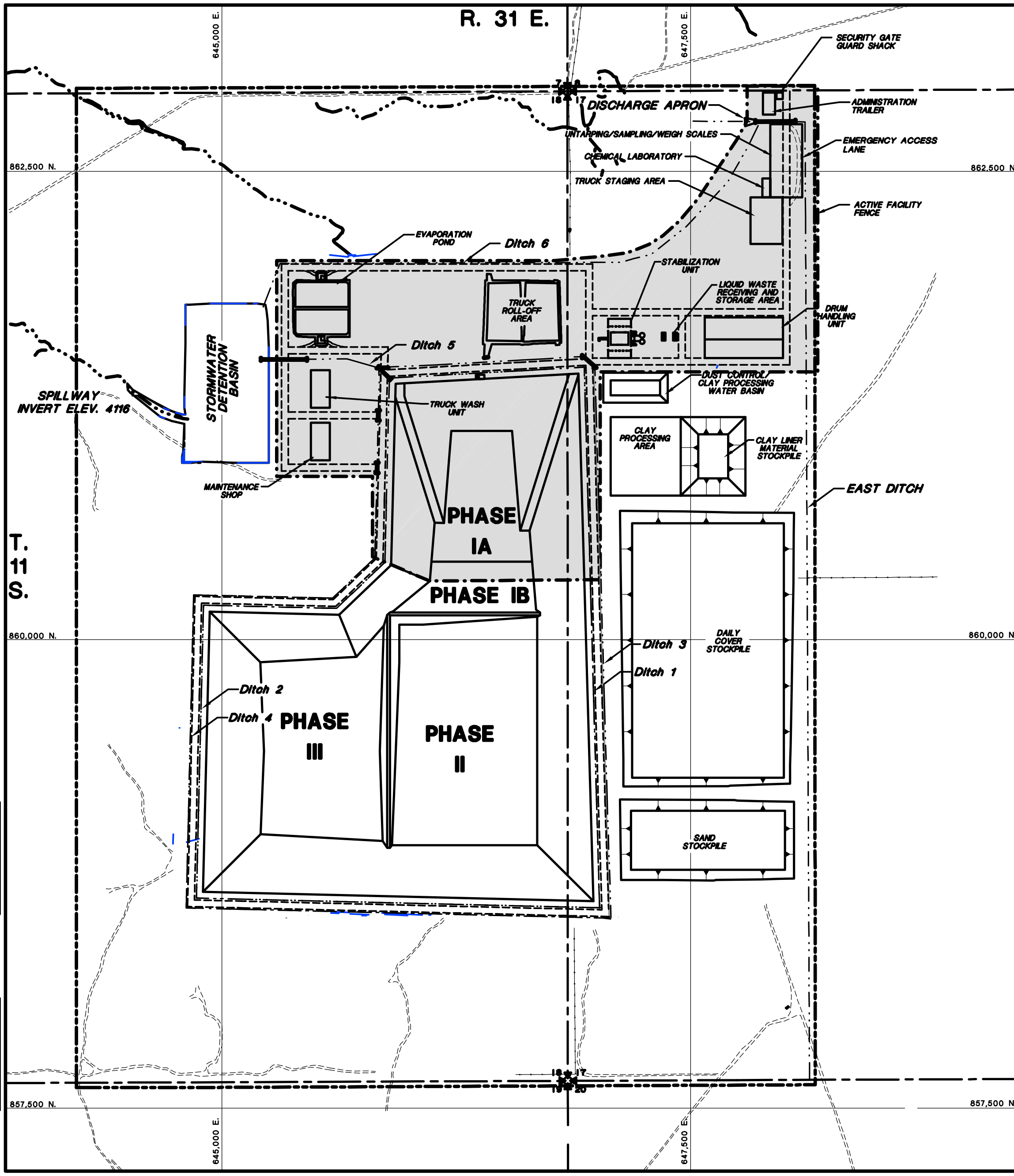
DRAWING TITLE:

TRAFFIC PLAN

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 2 Of 2 Sheets
SCALE: As Noted
DRAWING No. 26

AutoCAD FILE: GANDY-TRAVEL2.DWG PROJECT NUMBER: 602-0200



LEGEND

(shaded, dash-dot border)	LIMITS OF LANDFILL OPERATIONS AND WASTE PROCESSING AREA
(open box)	CONSTRUCTION OPERATIONS AREA

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

N

SCALE
300' 0 300' 600'

Not For Construction

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PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

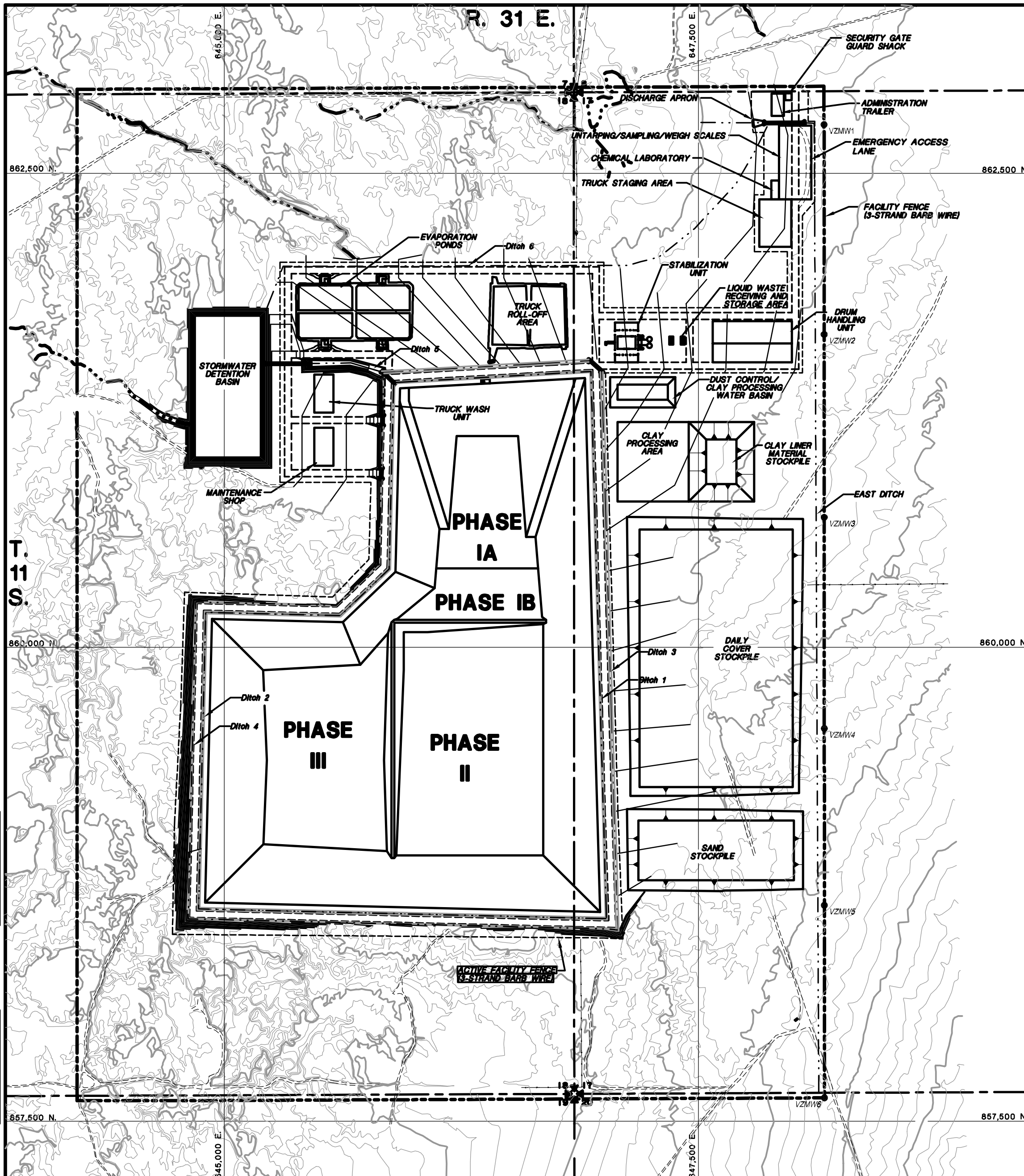
TRAFFIC PLAN

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 2 Sheets

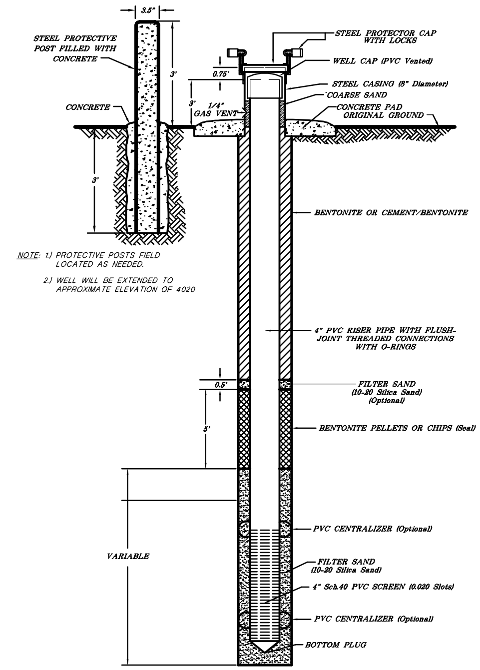
SCALE: AS NOTED

DRAWING No. 26



AutoCAD FILE: GANDY-TOPO3A.DWG PROJECT NUMBER: 602-0200

TYPICAL VADOSE ZONE MONITORING WELL INSTALLATION DETAIL



NOTE: 1.) PROTECTIVE POSTS FIELD LOCATED AS NEEDED.
2.) WELL WILL BE EXTENDED TO APPROXIMATE ELEVATION OF 4020

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.
3. THE VADOSE ZONE MONITORING WELLS WILL BE EXTEND TO ELEVATION 4020, APPROXIMATELY.

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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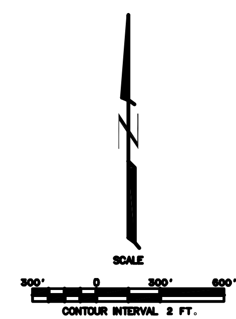
Date Patrick G. Corser, NM P.E. 12236

LEGEND

EXISTING CONTOUR
REGRADED CONTOUR
VZMW2 ● VADOSE ZONE MONITORING WELLS
FACILITY AND ACTIVE FACILITY FENCES (3-Strand Barb Wire)



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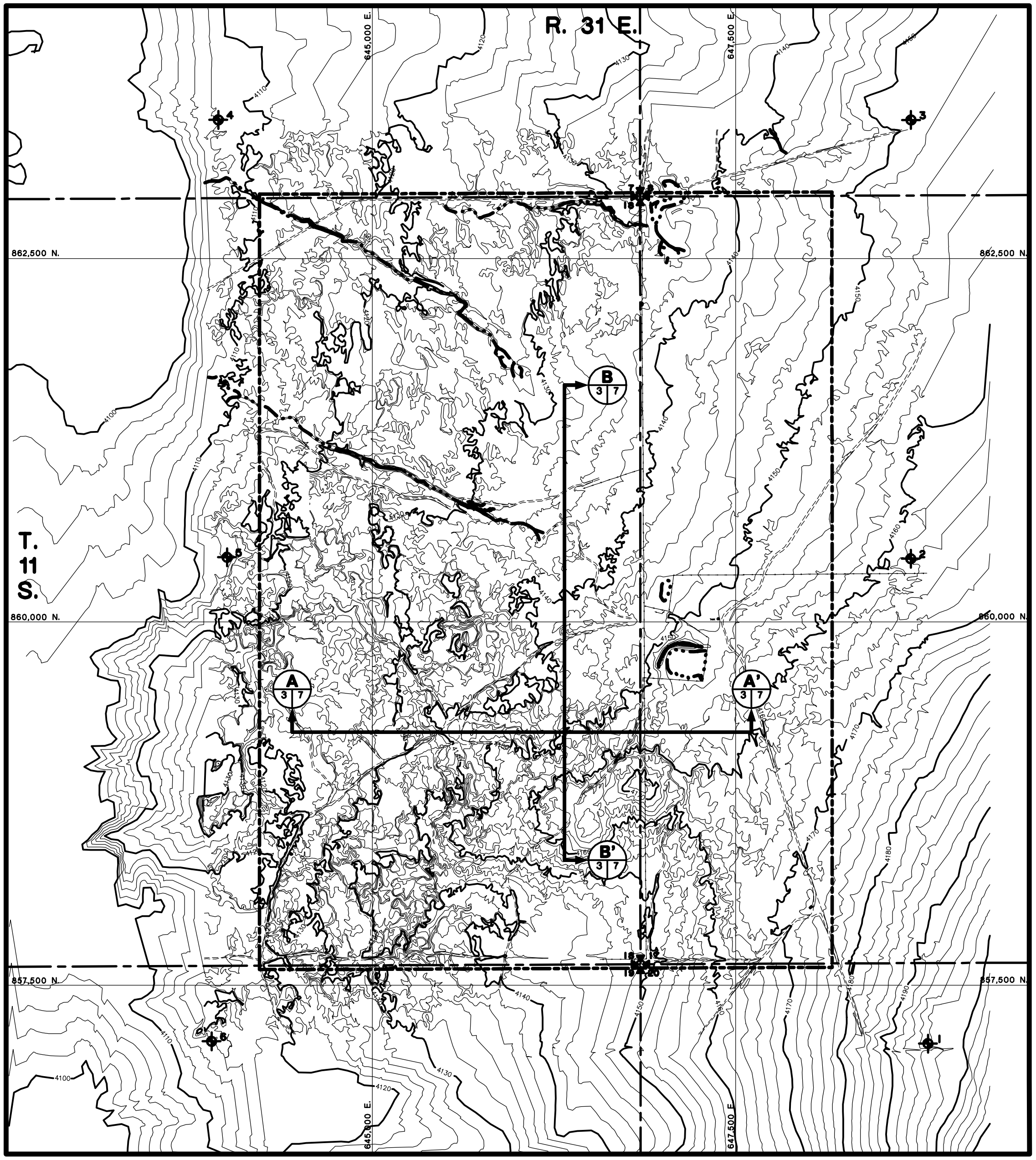
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

FACILITY LAYOUT

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 4



SURVEY CONTROL POINTS

CONTROL POINT NUMBER	NORTHING	EASTING	ELEVATION
1	857,099.19	648,823.16	4,197.55
2	860,435.24	648,704.91	4,161.92
3	863,453.55	648,706.31	4,152.96
4	863,454.95	643,940.29	4,105.99
5	860,445.06	644,000.06	4,113.51
6	857,114.96	643,893.71	4,116.20

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEY PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING. ADDITIONAL TOPO TAKEN FROM MESCALERO POINT, NEW MEXICO 7.5 MINUTE SERIES, DATED 1973.
3. SURVEY CONTROL POINTS SET IN FIELD WITH REBAR AND CAP BY JOHN WEST ENGINEERING COMPANY, AUGUST 1997.

SCALE

400' 0 400' 800'

CONTOUR INTERVAL 2 FT.

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:

EXISTING TOPOGRAPHY

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 1 Of 1 Sheets

SCALE: AS NOTED

DRAWING No. 3

AutoCAD FILE: GANDY-TOPO1.DWG PROJECT NUMBER: 602-0200

CHANNEL DESIGNS

Ditch	25-yr,24-hr Flow Q (cfs)	Slope (%)	Bottom Width (BW) (ft)	Sideslope H:1V	Depth of Flow (D) (ft) 1	Velocity (fps) 2	Freeboard (ft)	Maximum Total Depth (ft)	Erosion Protection	2-yr,24-hr Flow Q (cfs)	Velocity (fps)
1	34.2	0.5-2.0	0	2	2.1	6.7	1.0	3.1	None	4.8	4.1
2	62.2	0.5-1.0	0	2	2.6	6.0	1.0	3.6	None	8.3	3.6
3	126.6	0.5-1.0	5.0	3	2.4	5.8	1.0	3.4	None	40.0	4.8
		1.1-2.0	5.0	3	2.1	6.6	1.0	3.1	Riprap D50=6"		
4	6.8	0.5-1.0	0	2	1.1	3.5	1.0	2.1	None	7	7
5	217.3	0.5-1.0	10.0	3	2.3	7.3	1.0	3.3	None	53.6	4.8
6	30.1	0.5-1.0	0	2	2.0	5.0	1.0	3.0	None	7	7
7 Lower	7.3	1.0	0	1.5	0.9	6.0	1.0	1.9	HDPE	7	7
7 Upper	7.3	10	0	1.5	0.6	14.2	1.0	1.6	HDPE	7	7
8 Lower	19.3	1.0	0	1.5	1.3	7.6	1.0	2.3	HDPE	7	7
8 Upper	19.3	10	0	1.5	0.8	18	1.0	1.8	HDPE	7	7
East	272.8	0.5-0.8	16.0	3	2.5	5.5	1.0	3.5	Gravel D50=3"	7	7
Final Cover Road Side	31.5	0.5-2.4	0	3	1.8	5.5	1.0	2.8	Gravel D50=3"	7	7
Spillway	358(6)	0.5	20.0	3	2.6	4.9	1.0	3.4	Gravel D50=3"	7	7
9,10	90.4	0.5	3.0	3	2.1	4.7	1.0	3.1	NONE	7	7

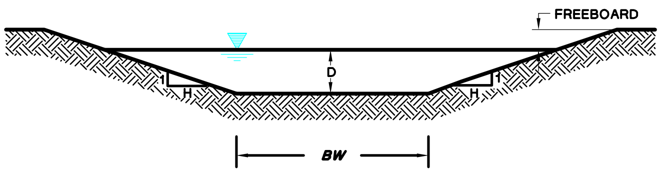
NOTES:
(1) Maximum allowable velocity for channels without erosion protection 5 fps
(2) Channels with velocities greater than 5 fps for the 25-yr event and less than the 5 fps for the 2 year storm will not be lined.
(3) Maximum allowable velocity for gravel lined channels is 6 fps.
(4) Depth of Flow determined from minimum grade of Channel.
(5) Flow Velocity determined from maximum grade of Channel.
(6) Design Flow for Spillway is 100YR - 24 HR.
(7) The velocity calculations were not required for the 2-year storm because the 25YR-24HR rain event flow velocity was less than 5 fps, so the 2YR-24HR rain event flow event flow velocity would also be less than 5 fps, or because erosion protection had already been specifed.

GENERAL NOTES:
1. STORM WATER DETENTION BASIN TO BE LINED WITH SINGLE 60 mil HDPE LINER.

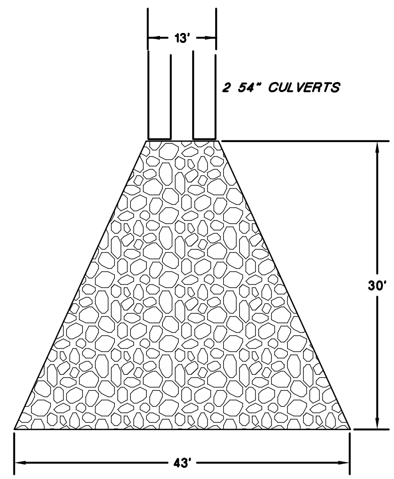
CULVERT DESIGNS

Culvert On Ditch	Flow (cfs)	Culvert Capacity (cfs)	No. Of Culverts	Culvert Diameter (in)	Total Capacity (cfs)
East	272.8	155	2	54	310
3	126.6	50	3	36	150
4	6.8	9	1	18	9
5	217.3	135	2	54	270
1 and 2	96.4	50	2	36	100
8	19.3	50	1	36	50
9 and 10	90.4	50	2	36	100

NOTES: (1) Culverts were sized assuming a Headwater/Culvert Diameter= 1.5.

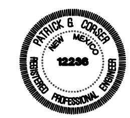


TYPICAL CHANNEL



NOTE:
RIP RAP D_{50} = 2', DEPTH OF ROCK 3'

25 / 25 | 25 RIP RAP OUTLET APRON DETAIL
Not To Scale



PROFESSIONAL ENGINEER'S STATEMENT

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Date ________ Patrick G. Corser, NM P.E. 12236

Not For Construction

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3	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
2	NOVEMBER 1999 UPDATES	11/02/99	J.Troncoso	M.Mathison	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

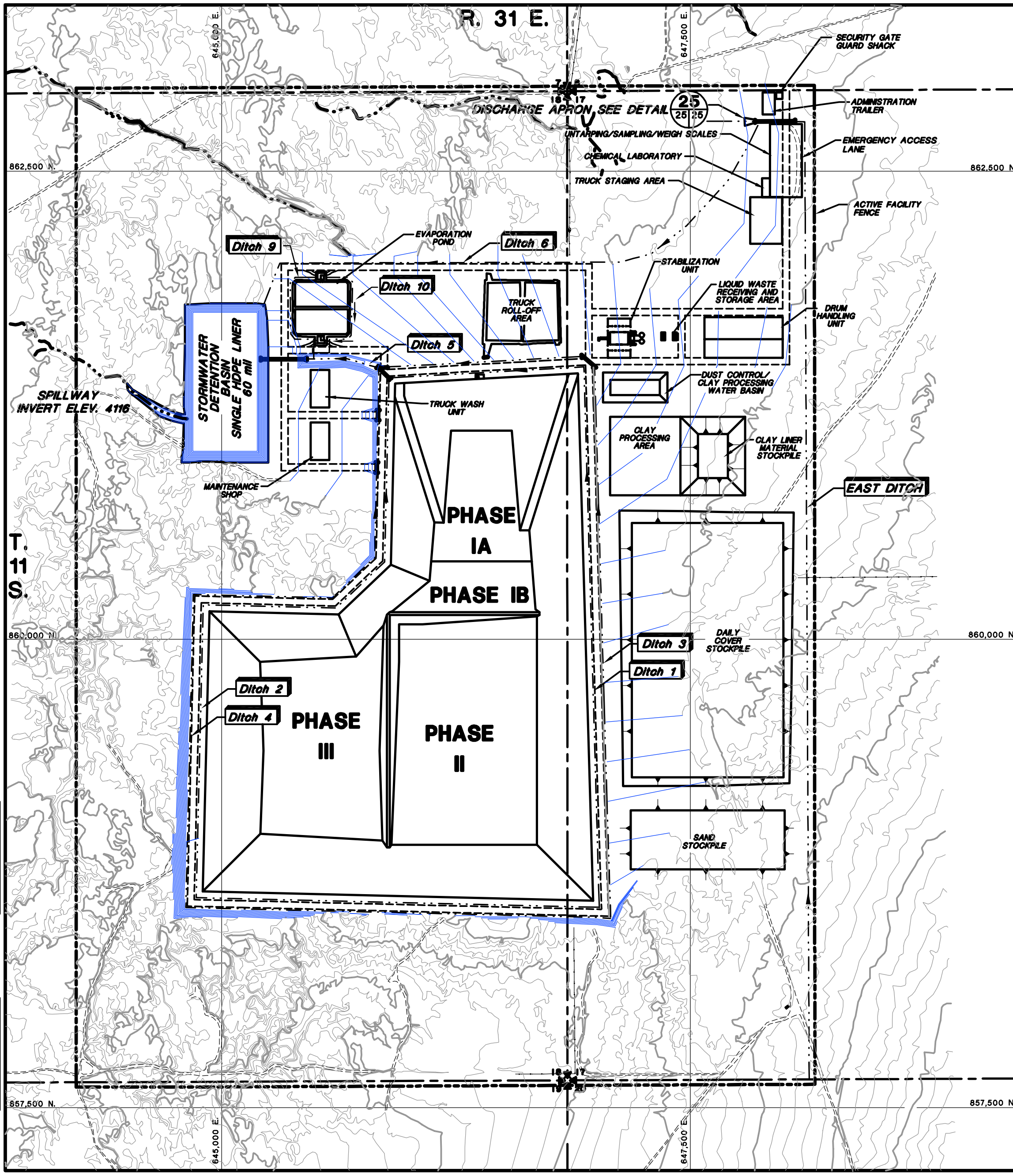
DRAWING TITLE:
SURFACE WATER CONTROL DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 2 Of 2 Sheets
SCALE: Not to Scale
DRAWING No. 25

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: GANDY-SRFWTRDTLS.DWG PROJECT NUMBER: 602-0200



NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. DITCHES 7 & 8 ARE SHOWN ON DRAWING 13.

SCALE

300' 0 300' 600'

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:

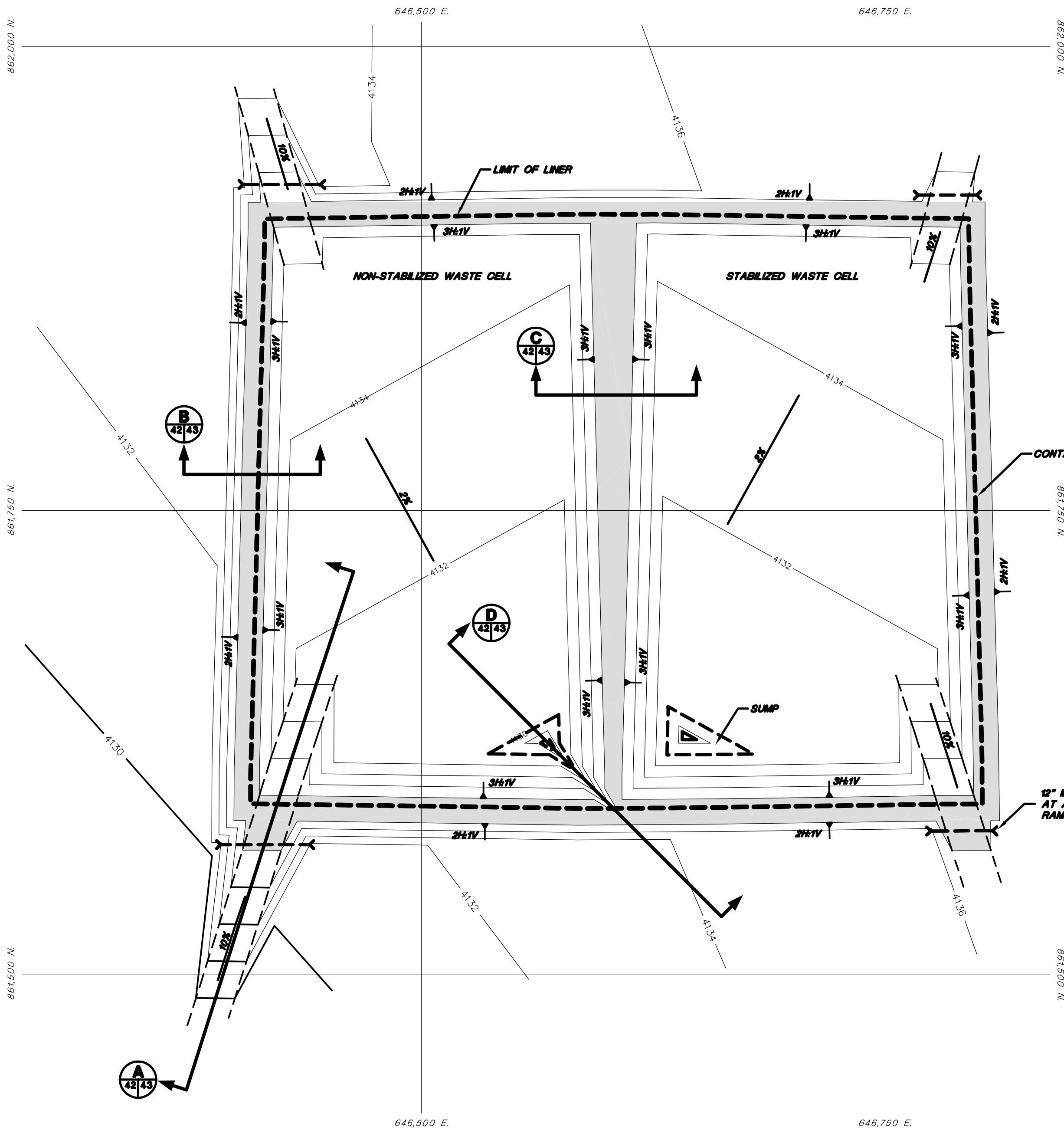
SURFACE WATER CONTROL FEATURES

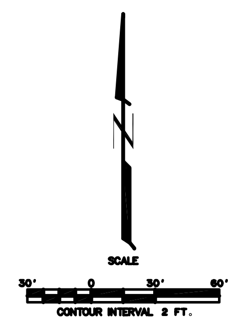
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 2 Sheets

SCALE: AS NOTED

DRAWING No. 25





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PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.SMITH	P.CORSER

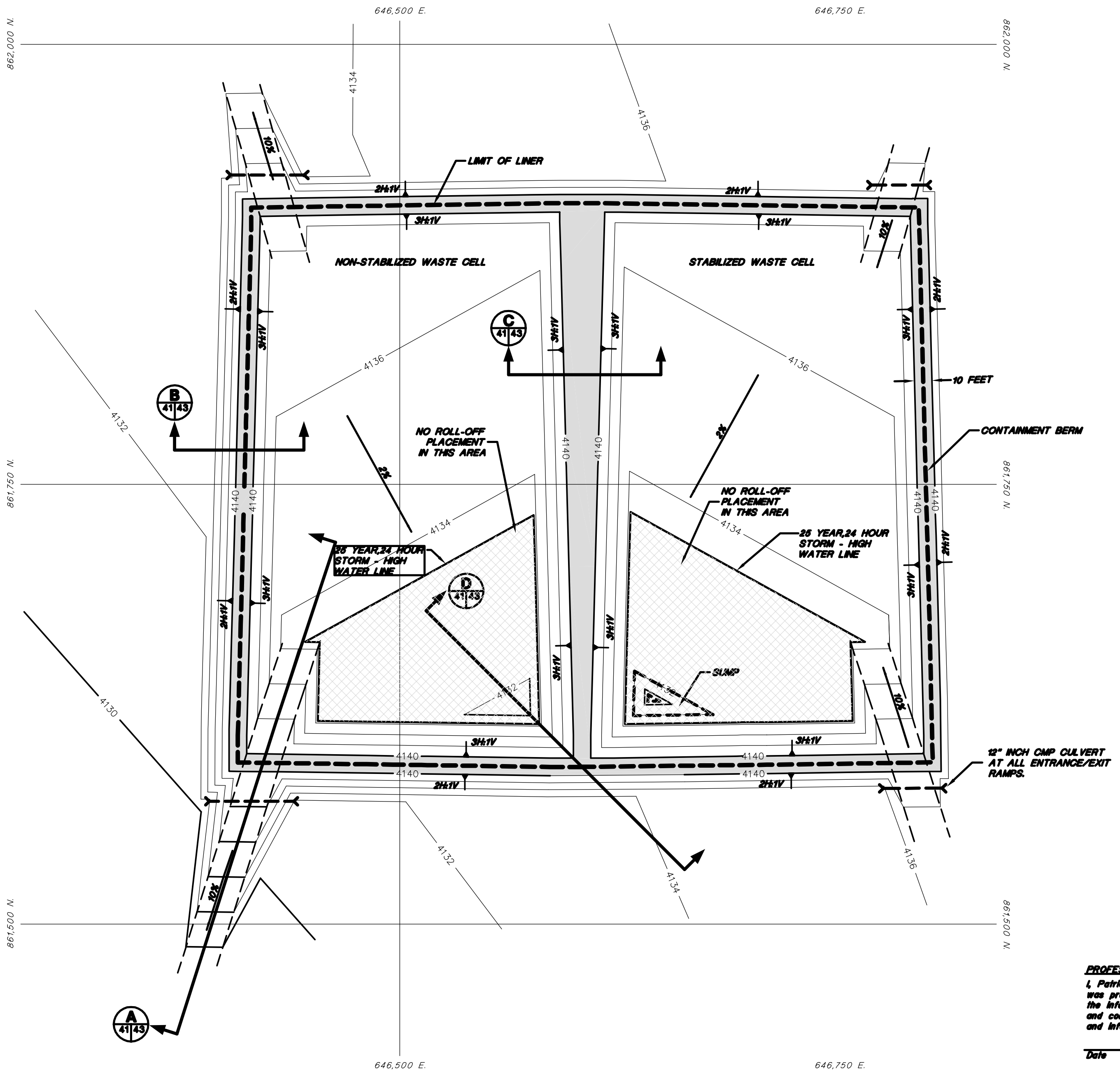
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
TRUCK ROLL-OFF AREA SUBGRADE CONTOURS

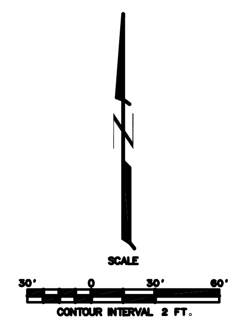
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 42

AutoCAD FILE: GANDY-ROSUBGR.DWG PROJECT NUMBER: 602-0200



NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".



Not For Construction

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3	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
2	SEPTEMBER 1999 REVISION	09/01/99	P.Corser	T.Smith	P.Corser
1	NOVEMBER 1998 REVISION	10/30/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.SMITH	P.CORSER

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
TRUCK ROLL-OFF AREA DRAINAGE SURFACE CONTOURS

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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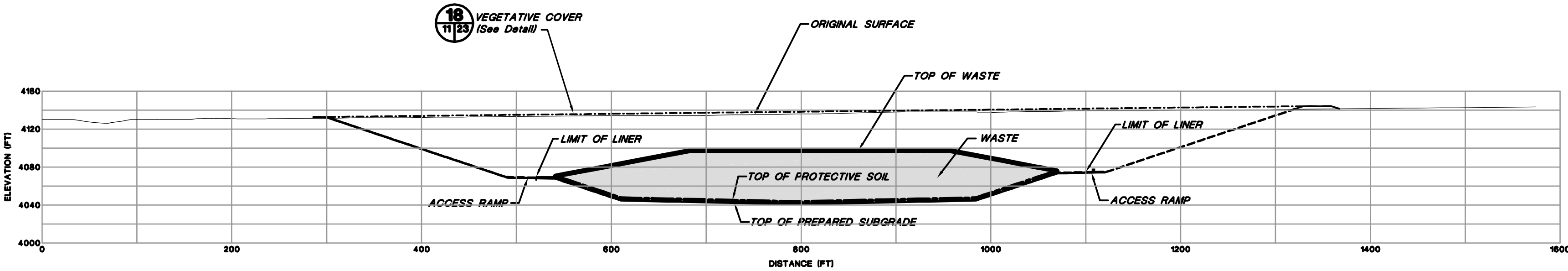
Date ______ Patrick G. Corser, NM P.E. 12236

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 41

AutoCAD FILE: GANDY-RODRAIN.DWG PROJECT NUMBER: 602-0200

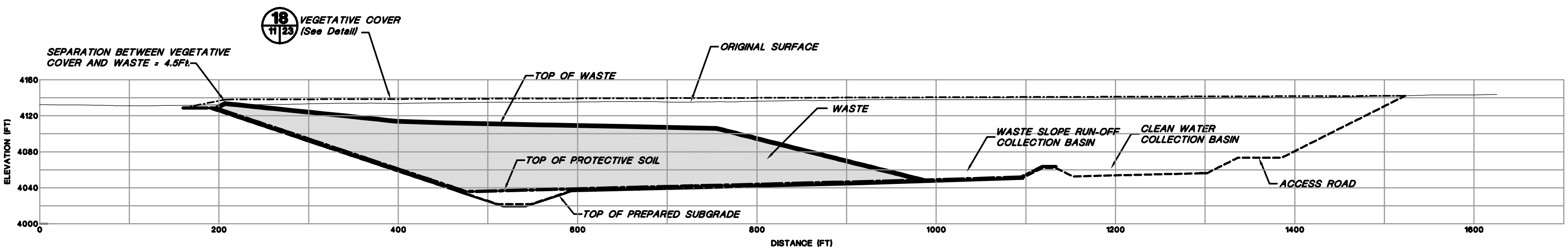


PHASE 1A CROSS-SECTION C-C'

C 9 11 — C 10 11

HORIZONTAL SCALE 0 60' 120'

VERTICAL SCALE 0 60' 120'



PHASE 1A CROSS-SECTION D-D'

D 8 11 — D 9 11 — D 10 11

HORIZONTAL SCALE 0 60' 120'

VERTICAL SCALE 0 60' 120'

NOTES:

1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

2. DAILY COVER WILL CONSIST OF SOIL SPREAD ON TOP OF THE WASTE PLACEMENT AREA. MINIMUM DAILY COVER THICKNESS WILL BE APPROXIMATELY 0.5 FEET.

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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2	NOVEMBER 1999 UPDATES	11/02/99	J.Troncoso	M.Mathisen	P.Corser
1	NOVEMBER 1998 REVISION	10/28/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

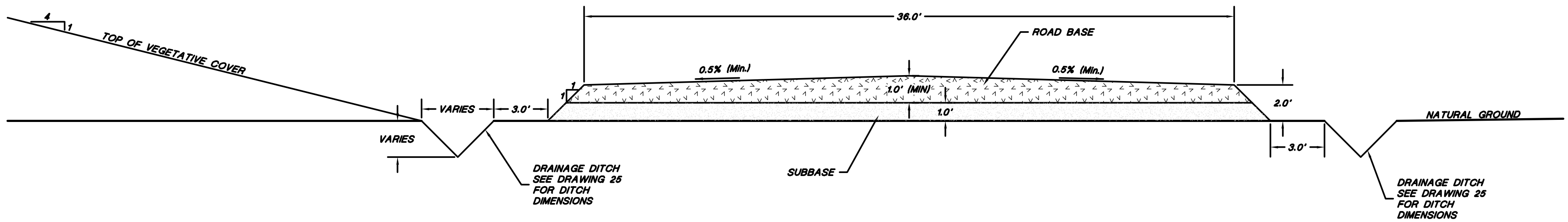
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
PHASE 1A CROSS-SECTIONS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 11

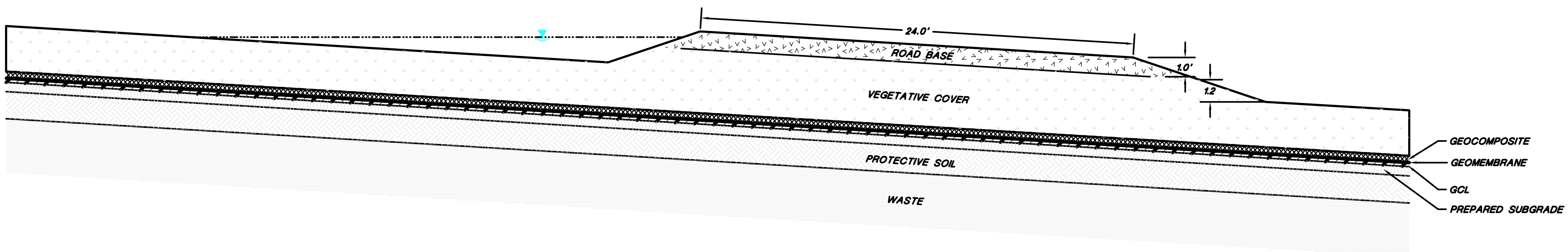
AutoCAD FILE: GANDY-PHXSEC.DWG PROJECT NUMBER: 502-0200



23 (22|27) PERIMETER ROAD DETAIL

HORIZONTAL SCALE
0 3' 6'

VERTICAL SCALE
0 3' 6'



24 (22|27) COVER ACCESS ROAD AND DITCH DETAIL

HORIZONTAL SCALE
0 3' 6'

VERTICAL SCALE
0 3' 6'

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. ROADBASE GRAVEL THICKNESS MAY BE REDUCED BASED ON EVALUATION OF SUBGRADE CONTOURS.

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT
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Date — Patrick G. Corser, NM P.E. 12236

AutoCAD FILE: GANDY-PCORRIDOR.DWG PROJECT NUMBER: 602-0200

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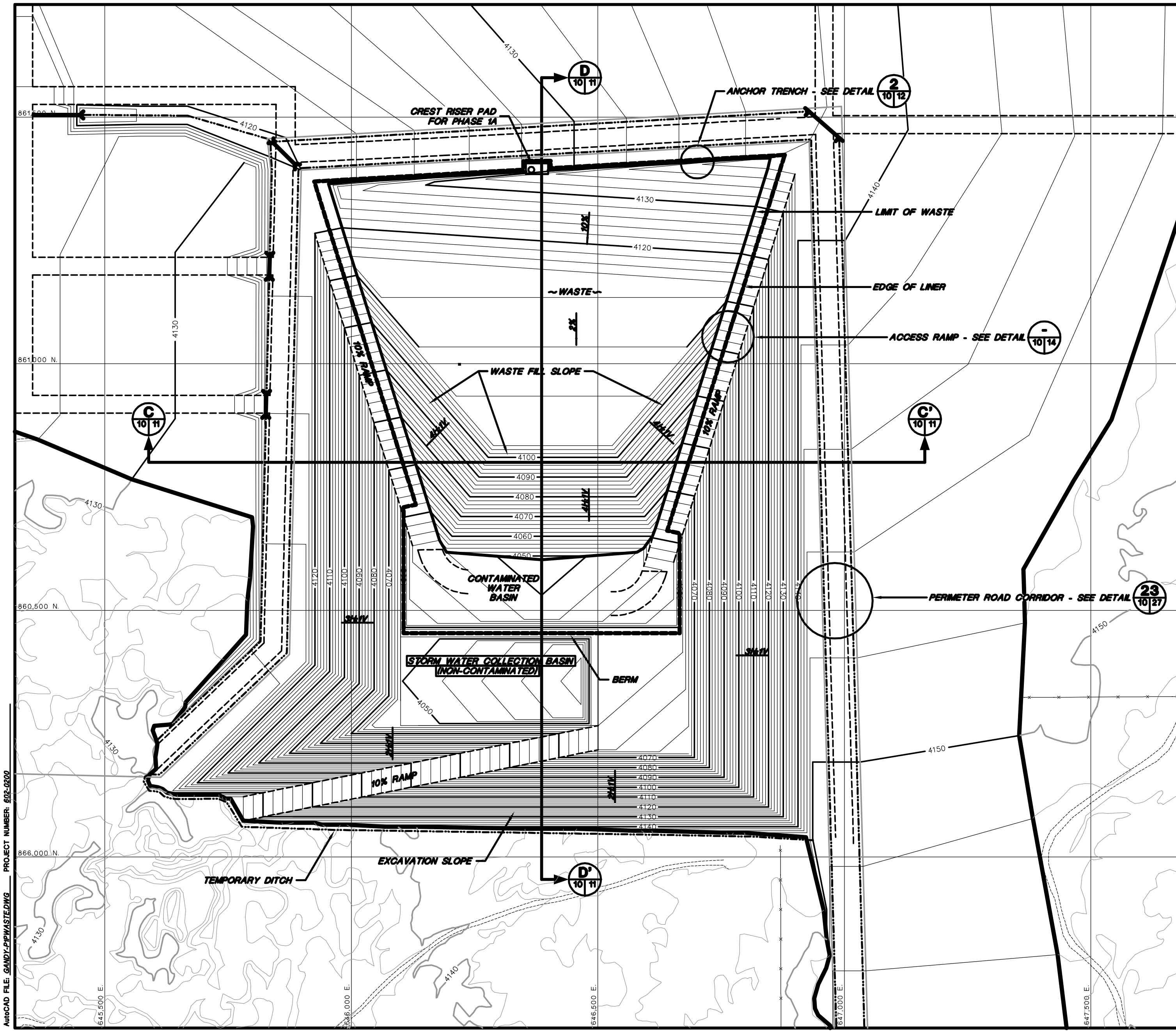
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	TWS	PGC

TRIASSIC PARK
WASTE DISPOSAL FACILITY

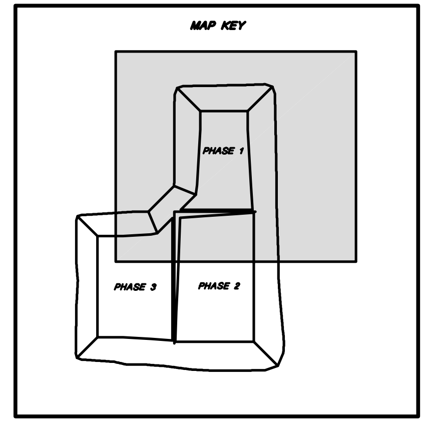
DRAWING TITLE:
PERIMETER ROAD DETAILS

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 27



AutoCAD FILE: GANDY-P/PWASTE.DWG PROJECT NUMBER: 602-0300



NOTES:

1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.
3. WASTE FILL VOLUME FOR PHASE 1A: 553,200 CY

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

SCALE

100' 0 100' 200'

CONTOUR INTERVAL 2 FT.

Not For Construction

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4	October 2000 Revision	10/4/00	J.Pelloer	K.Conrath	P.Corser
3	November 1999 Updates	1/02/99	J.Troncoso	M.Mathisen	P.Corser
2	SEPTEMBER 1999 REVISION	9/21/99	P.Corser	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pelloer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

TRIASSIC PARK

WASTE DISPOSAL FACILITY

DRAWING TITLE:

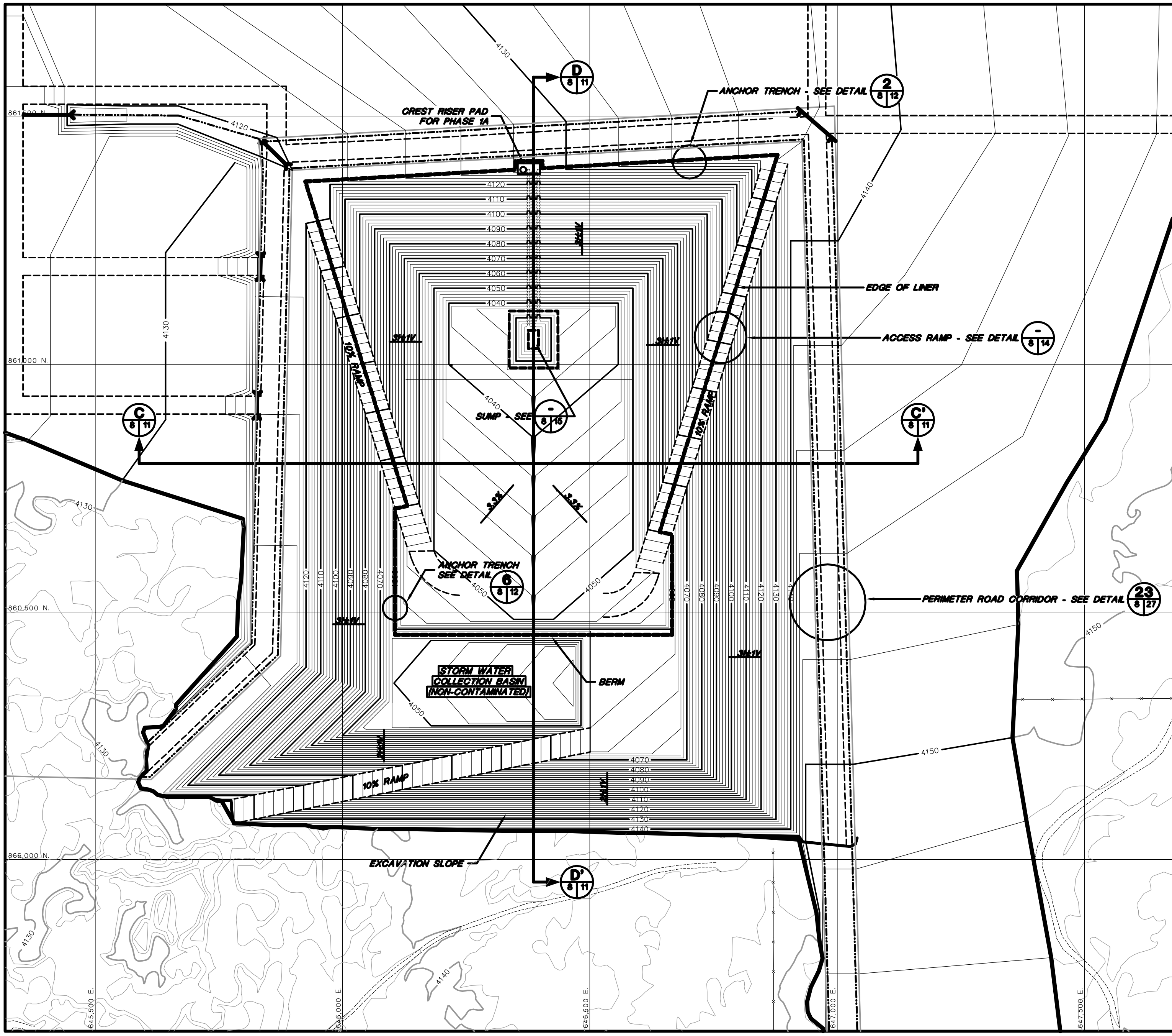
FILLING PLAN - PHASE 1A

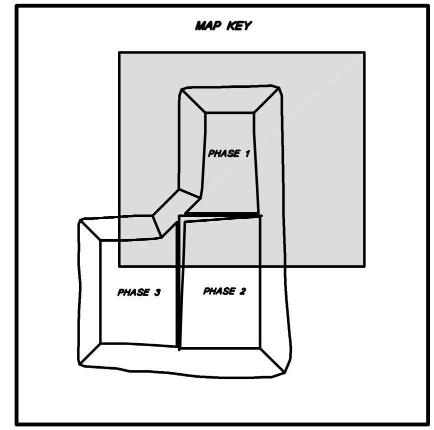
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets

SCALE: AS NOTED

DRAWING No. 10





NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

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Date   Patrick G. Corser, NM P.E. 12236

SCALE
100' 0 100' 200'
CONTOUR INTERVAL 2 FT.

Not For Construction

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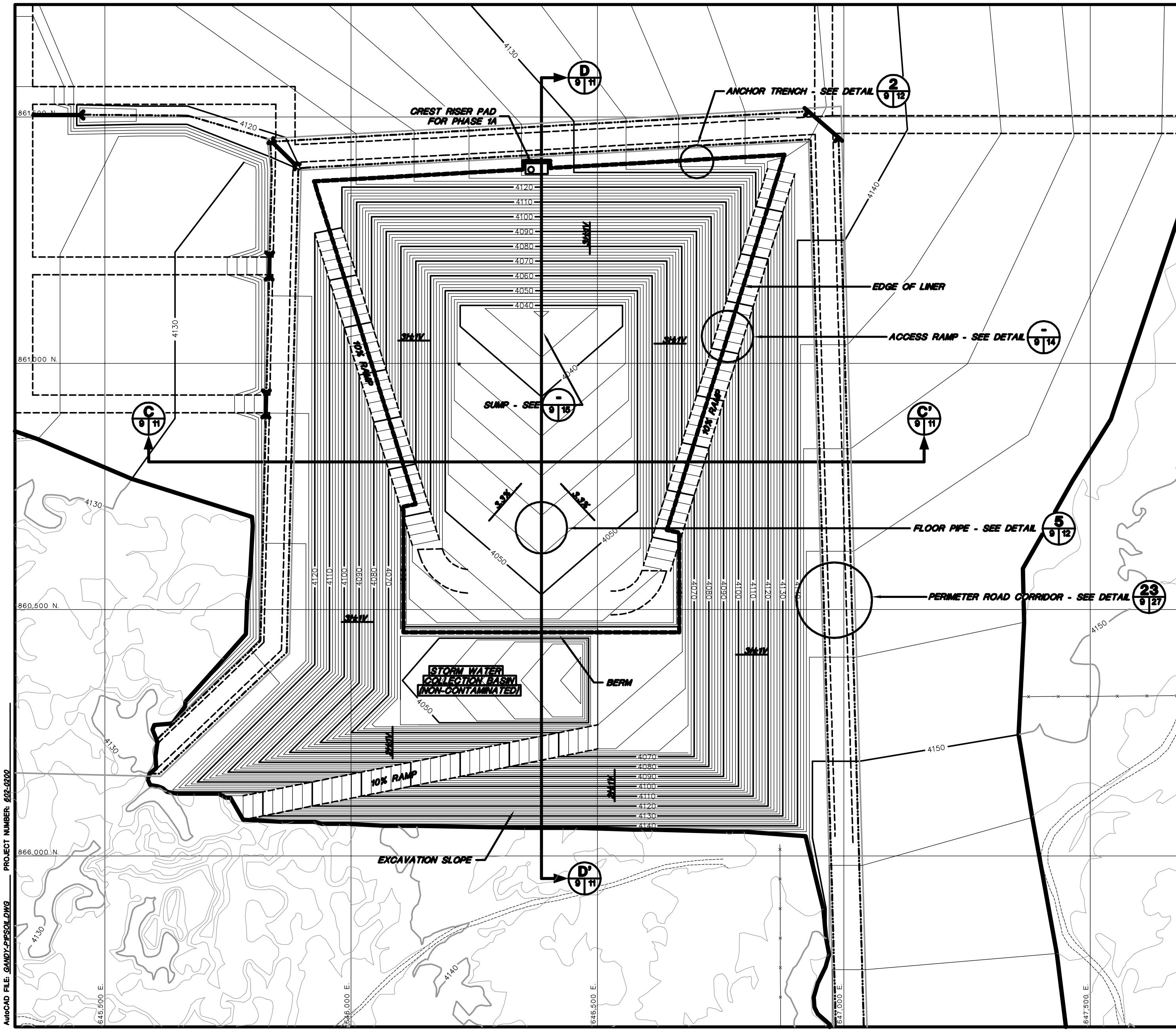
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

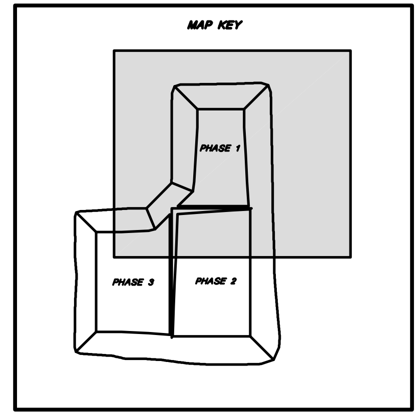
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
DETAILED EXCAVATION PLAN - PHASE 1A

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 8





NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.

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SCALE
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CONTOUR INTERVAL 2 FT.

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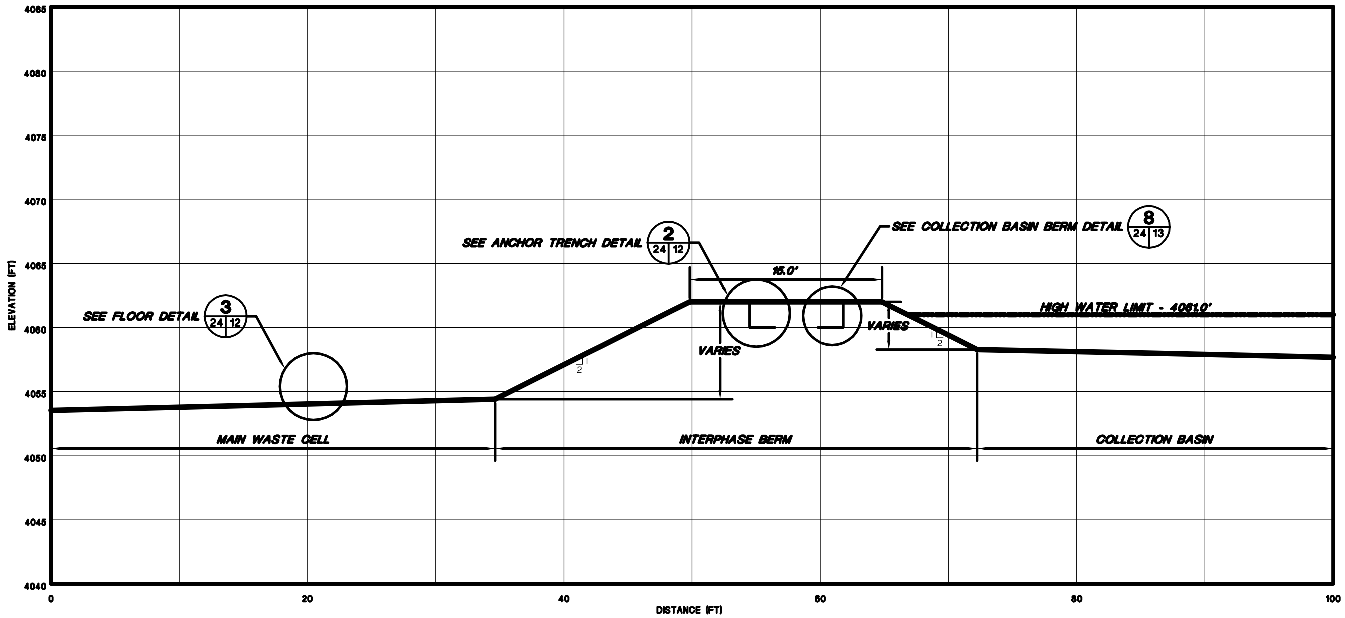
0	PART B PERMIT APPLICATION	12/12/97	PGC/JJP	T.Smith	P.Corser

TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
TOP OF PROTECTIVE SOIL LAYER - PHASE 1A

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 9



M 13|24 **INTERPHASE BERM CROSS-SECTION M**

HORIZONTAL SCALE 0 5 10

VERTICAL SCALE 0 5 10

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: GANDY-IPBERM PROJECT NUMBER: 602-0200

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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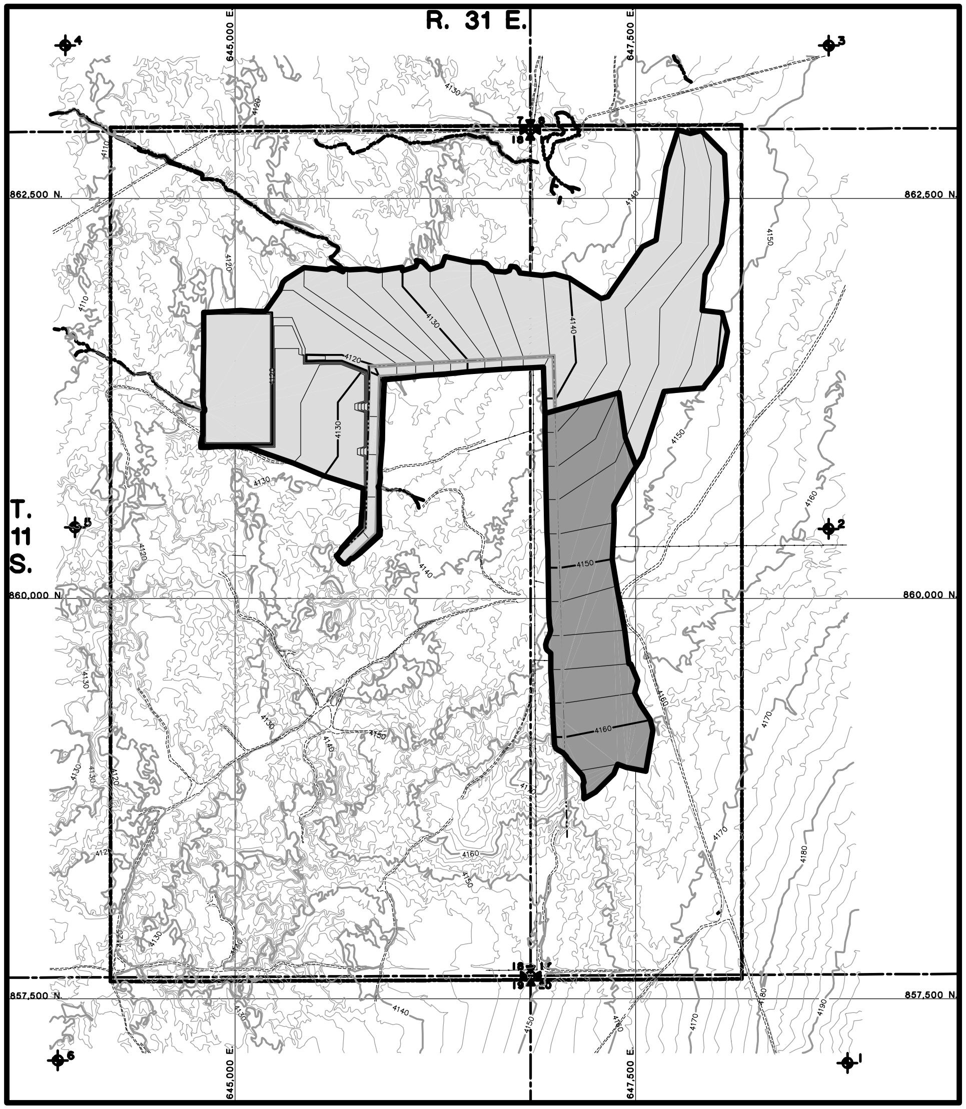
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
INTERPHASE BERM SECTION

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 24



LEGEND

REGRADE AREA - CUT - 229,200 cy
REGRADE AREA - FILL - 75,100 cy

NOTES:
1. FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST 1997 BY KOOGLE AND POULS ENGINEERING.
3. SURVEY CONTROL POINTS SET IN FIELD WITH REBAR AND CAP BY BY JOHN WEST ENGINEERING COMPANY, AUGUST 1997.

SCALE
400' 0 400' 800'
CONTOUR INTERVAL 2 FT.

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	T.Smith	P.Corser

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
INITIAL SITE GRADING PLAN

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 5

AutoCAD FILE: GANDY-IGRADE.DWG PROJECT NUMBER: 602-0200

LEGEND

GENERAL LINES

- FACILITY BOUNDARY AND ACTIVE FACILITY FENCE
- 4150 — EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- SUBGRADE EXCAVATION CONTOURS
- TOP OF CLAY LINER
- TOP OF SUBGRADE LAYER
- TOP OF PROTECTIVE SOIL
- TOP OF WASTE
- TOP OF EXISTING SURFACE
- EXISTING GRAVEL ROAD
- EXISTING DRAINAGE
- SECTION LINE
- EDGE OF REGRADE
- GRADE BREAK LINE
- NEW SURFACE WATER DRAINAGE DITCHES
- EDGE OF LINER

GEOSYNTHETIC TYPES

- GEOMEMBRANE
- GEOTEXTILE
- GEONET
- GEOCOMPOSITE
- GCL

MISCELLANEOUS

- FENCE
- SLOPE
- SECTION CORNER
- SURVEY CONTROL POINT
- CULVERT
- NOMINAL DIAMETER
- DIRECTION OF FLOW

FILL PATTERNS

- CLAY LINER
- DRAINAGE GRAVEL
- FOUNDATION/PIPE BEDDING SAND
- SUBGRADE
- PREPARED SUBGRADE
- SUBBASE
- PROTECTIVE SOIL
- VEGETATIVE COVER
- CONCRETE
- ROAD-BASE
- STRUCTURAL FILL
- ALLUVIAL DEPOSITS
- UPPER DOCKUM
- LOWER DOCKUM
- WASTE
- SELECT SUBBASE

KEY

A 6|6 — A' 6|6

CROSS-SECTION LOCATION

DETAIL/SECTION NUMBER

DRAWING No. WHERE DETAIL/SECTION IS REFERENCED

DRAWING No. WHERE DETAIL/SECTION IS SHOWN

GENERAL NOTES

1. DRAWINGS PRESENT FINAL DESIGNS FOR THE RCRA PERMITTED FACILITIES. DETAILS ON THE RCRA COMPONENTS OF THE FACILITIES MAY BE SUPPLEMENTED DURING THE BIDDING AND CONSTRUCTION PHASE. GANDY MARLEY WILL SUPPLY THE ADDITIONAL DETAILS ON THE NON-RCRA COMPONENTS OF THE DESIGN TO NMED FOR REVIEW AND APPROVAL PRIOR TO THE START OF CONSTRUCTION.
2. DESIGN DRAWINGS WERE PREPARED FOR PART "B" PERMIT SUBMITTAL.
3. DESIGN DRAWINGS TO BE USED IN CONJUNCTION WITH CONSTRUCTION SPECIFICATIONS AND CONSTRUCTION QUALITY ASSURANCE PLAN.
4. THIS SET OF DRAWINGS TO BE USED FOR PART B PERMIT APPLICATION. DRAWINGS ARE NOT TO BE USED FOR CONSTRUCTION. ADDITIONAL WORK TO BE COMPLETED TO ISSUE DRAWINGS FOR CONSTRUCTION INCLUDE THE FOLLOWING:
   - RECEIPT OF PART B PERMIT
   - SURVEY GRID POINT LISTING FOR CONSTRUCTION STAKING
   - REVIEW AND APPROVAL OF CONTRACTOR EQUIPMENT, MATERIALS, PROCEDURES, SUBMITTALS AND SHOP DRAWINGS.
5. TOPOGRAPHY FROM AERIAL SURVEYS PERFORMED AUGUST, 1997, KOOGLE & POULS ENGINEERING.
6. PROTECTIVE SOIL CONSISTS OF SELECT ONSITE SOILS.
7. GEOCOMPOSITE CONSISTS OF GEOTEXTILE BONDED TO GEONET.
8. GEOMEMBRANE IS A MINIMUM 60 mil HDPE.
9. 48-in. WIDE USED CONVEYOR BELT SHALL NOT HAVE STEEL WIRE REINFORCEMENTS OR OTHER PROTRUSIONS WHICH MAY DAMAGE UNDERLYING GEOMEMBRANE.
10. EVAPORATION POND TOPOGRAPHY ON DRAWING 29 IS TOP OF CLAY LINER.
11. ACTUAL SIZE, LOCATION, AND ORIENTATION OF STABILIZATION FACILITY AND ANCILLARY STRUCTURES AND EQUIPMENT TO BE DETERMINED DURING FINAL DESIGN.
12. TOTAL CAPACITY OF COLLECTION BASIN POND NEEDED: 6.0 AC-FT.
13. ELECTRICAL AND PIPING TO BE DESIGNED BY CONTRACTOR. SHOP DRAWINGS TO BE SUBMITTED FOR REVIEW AND APPROVED BY ENGINEER.
14. ALL ANCILLARY EQUIPMENT WILL BE SUPORTED AND PROTECTED AGAINST PHYSICAL DAMAGE AND EXCESSIVE STRESS DUE TO SETTLEMENT, VIBRATION, EXPANSION, OR CONSTRUCTION, AND WILL BE INSTALLED ACCORDING TO API PUBLICATION 1615 (NOVEMBER 1979) OR ANSI STANDARD B31.2 AND ANSI STANDARD B31.4.
15. ALL GEOSYNTHETIC MATERIALS HAVE BEEN EXAGGERATED FOR CLARITY.
16. ALL CONCRETE SURFACES WHICH ARE EXPOSED TO POTENTIALLY HAZARDOUS MATERIALS AND ARE INTENDED AS CONTAINMENT FEATURES OR DIP PADS SHALL BE EPOXY COATED.
17. ALL PIPING WITHIN LINED FACILITIES WILL BE SINGLE WALL PIPE. DOUBLE WALL PIPE WILL BE USED FOR ALL PIPING OUTSIDE OF LINED FACILITIES.
18. LCRS - LEACHATE COLLECTION REMOVAL SYSTEM
19. LDRS - LEAKAGE DETECTION REMOVAL SYSTEM
20. USCS - UNIFIED SOIL CLASSIFICATION SYSTEM IS A SYSTEM WHICH CLASSIFIES SOIL TYPES ACCORDING TO SOIL TEXTURE AND GRAIN SIZE.
21. CONCRETE STRUCTURAL DETAILS ARE SHOWN ON DRAWING 45. THESE APPLY TO ANY CONCRETE SHOWN THROUGHOUT THE DRAWING SET.
22. DAILY COVER WILL CONSIST OF SOIL SPREAD ON TOP OF THE LANDFILL WASTE PLACEMENT AREA TO A DEPTH OF APPROXIMATELY 0.5 FEET.
23. PERMIT APPLICATION APPLIES TO PHASE 1A.

PATRICK G. CORSER — NEW MEXICO — 12236 — REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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Date — Patrick G. Corser, NM P.E. 12236

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TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
INDEX, LEGEND AND GENERAL NOTES

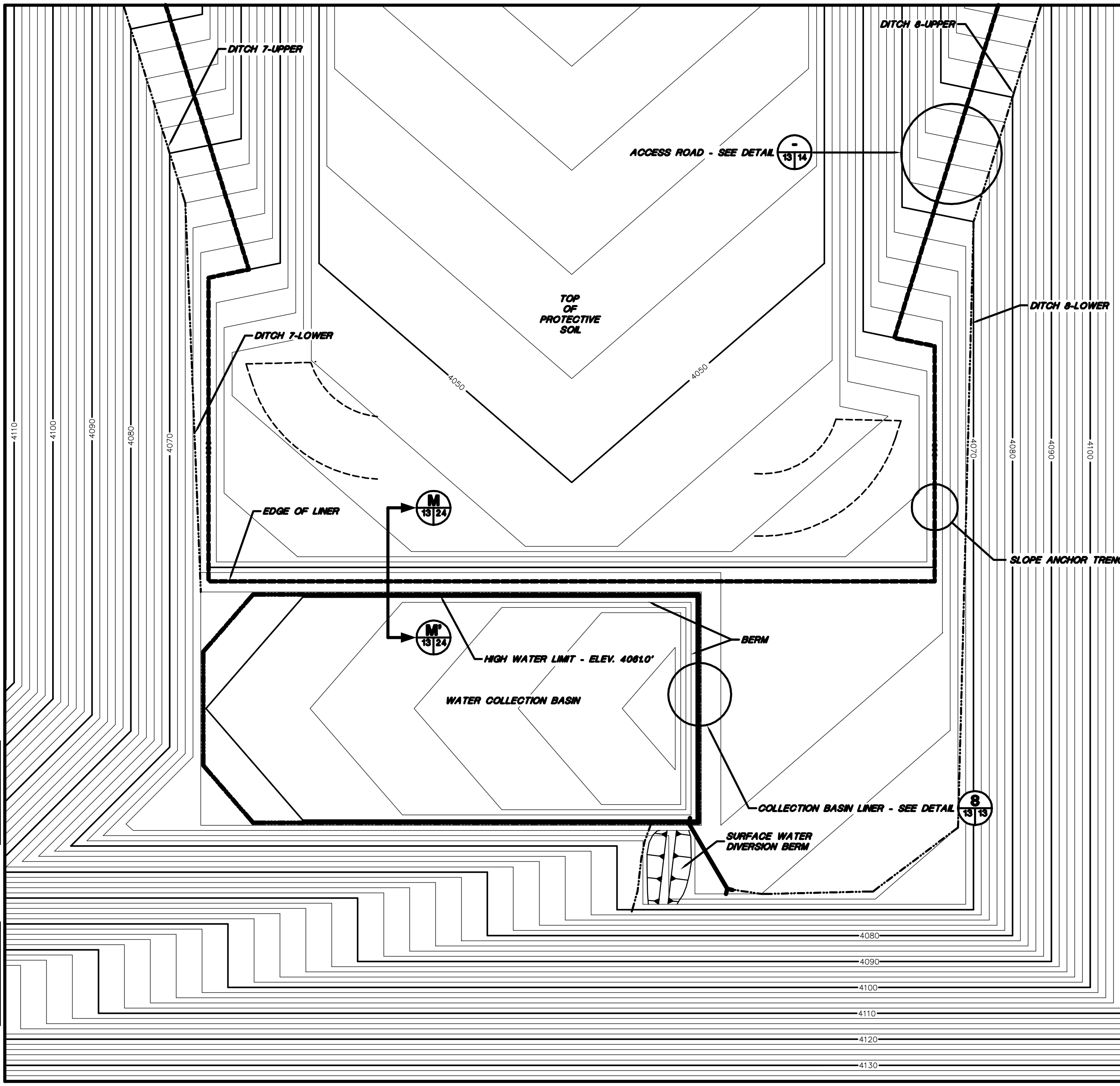
TerraMatrix
MONTGOMERY WATSON
Mining Group

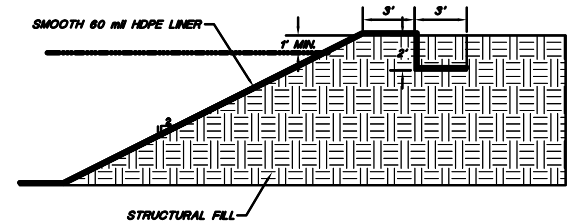
Sheet 1 Of 1 Sheets

SCALE: Not to Scale

DRAWING No. 2

AutoCAD FILE: GANDY-IDX.DWG
PROJECT NUMBER: 602-0200





8 COLLECTION BASIN BERM DETAIL

13 13

NOT TO SCALE

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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SCALE

40' 0 40' 80'

CONTOUR INTERVAL 2 FT.

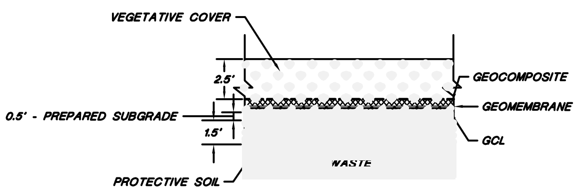
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
COLLECTION BASIN PLAN AND DETAILS

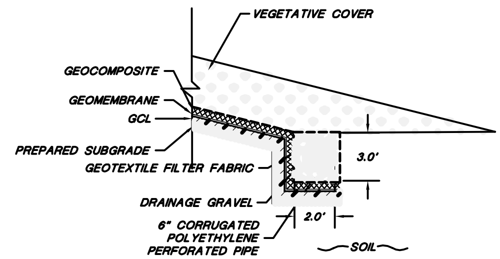
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 13

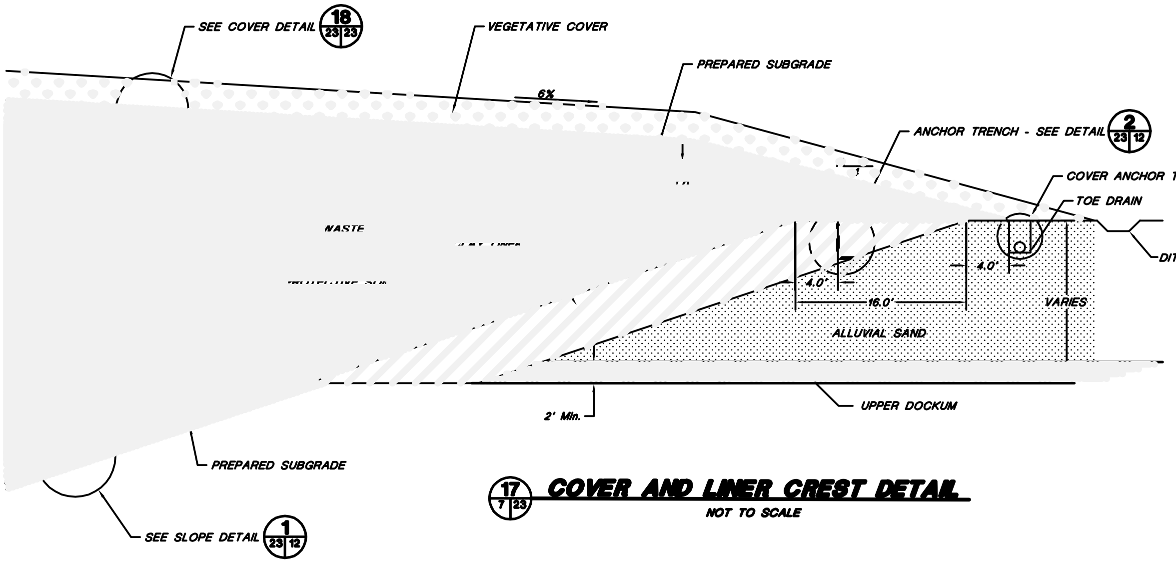
AutoCAD FILE: GANDY-CPOND.DWG PROJECT NUMBER: 602-0200



18 23|23 **COVER DETAIL**
NOT TO SCALE



19 23|23 **COVER ANCHOR TRENCH DETAIL**
NOT TO SCALE



17 7|23 **COVER AND LINER CREST DETAIL**
NOT TO SCALE

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: GANDY-COVERDETAIL PROJECT NUMBER: 602-0200

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TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
FINAL COVER DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: AS NOTED
DRAWING No. 23

DESIGN DRAWINGS
TRIASSIC PARK WASTE DISPOSAL FACILITY
CHAVES COUNTY, NEW MEXICO

DECEMBER 1997 (Revised October 2000)

RCRA PART B APPLICATION

Not For Construction (See Notes Drawing 2)

LIST OF DRAWINGS

Group	DRAWING NO.	DRAWING TITLE
GENERAL	1	COVER SHEET *(2 Sheets)*
GENERAL	2	INDEX, LEGEND AND GENERAL NOTES
FACILITY	3	EXISTING TOPOGRAPHY
FACILITY	4	FACILITY LAYOUT
FACILITY	5	INITIAL SITE GRADING PLAN
LANDFILL	6	ULTIMATE LANDFILL EXCAVATION PLAN
LANDFILL	7	LANDFILL CROSS-SECTIONS
LANDFILL	8	DETAILED EXCAVATION PLAN - PHASE 1A
LANDFILL	9	TOP OF PROTECTIVE SOIL LAYER - PHASE 1A
LANDFILL	10	FILLING PLAN - PHASE 1A
LANDFILL	11	PHASE 1A CROSS-SECTIONS
LANDFILL	12	LINER DETAILS
LANDFILL	13	COLLECTION BASIN PLAN AND DETAILS
LANDFILL	14	LANDFILL ACCESS RAMP DETAILS
LANDFILL	15	SUMP PLAN VIEW - PHASE 1A
LANDFILL	16	SUMP CROSS-SECTIONS - PHASE 1A
LANDFILL	17	TYPICAL SUMP DETAIL CROSS-SECTION
LANDFILL	18	VADOSE, LDRS, LCRS CROSS-SECTIONS AND DETAILS
LANDFILL	19	CREST RISER PAD AND LEACHATE STORAGE TANK PLAN VIEW AND CROSS-SECTIONS *(3 Sheets)*
LANDFILL	20	VERTICAL RISER DETAILS *(2 Sheets)*
LANDFILL	21	FINAL GRADING PLAN - TOP OF WASTE CONTOURS
LANDFILL	22	FINAL GRADING PLAN - TOP OF VEGETATIVE COVER CONTOURS
LANDFILL	23	FINAL COVER DETAILS
LANDFILL	24	INTERPHASE BERM SECTION
LANDFILL	25	SURFACE WATER CONTROL FEATURES *(2 Sheets)*
LANDFILL	26	TRAFFIC PLAN *(2 Sheets)*
LANDFILL	27	PERIMETER ROAD DETAILS
EVAPORATION POND	28	EVAPORATION POND SUBGRADE CONTOURS - PHASE 1
EVAPORATION POND	29	EVAPORATION POND CLAY LINER CONTOURS - PHASE 1
EVAPORATION POND	30	EVAPORATION POND CROSS-SECTIONS
EVAPORATION POND	31	EVAPORATION POND TRUCK DISCHARGE STATION *(2 Sheets)*
EVAPORATION POND	32	EVAPORATION POND LDRS AND VADOSE PLAN AND DETAILS
STABILIZATION UNIT	33	STABILIZATION UNIT GENERAL ARRANGEMENT
STABILIZATION UNIT	34	STABILIZATION UNIT WASTE FLOW DIAGRAM
STABILIZATION UNIT	35	STABILIZATION UNIT BIN DESIGN
STABILIZATION UNIT	36	STABILIZATION BIN DESIGN DETAILS *(2 Sheets)*
DRUM HANDLING UNIT	37	DRUM HANDLING UNIT GENERAL ARRANGEMENT
DRUM HANDLING UNIT	38	DRUM HANDLING UNIT DETAILS
DRUM HANDLING UNIT	39	DRUM HANDLING UNIT SUMP DETAILS *(2 Sheets)*
	40	LIQUID WASTE RECEIVING AND STORAGE UNIT LAYOUT *(2 Sheets)*
TRUCK ROLL-OFF AREA	41	TRUCK ROLL-OFF AREA DRAINAGE SURFACE CONTOURS
TRUCK ROLL-OFF AREA	42	TRUCK ROLL-OFF AREA SUBGRADE CONTOURS
TRUCK ROLL-OFF AREA	43	TRUCK ROLL-OFF AREA LINER DETAILS *(2 Sheets)*
	44	TRUCK WASH LAYOUT AND DETAILS *(2 Sheets)*
	45	CONCRETE AND GRATING DETAILS *(5 Sheets)*

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date ______ *Patrick G. Corser, NM P.E. 12236*

PREPARED BY:

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 2 Of 2 Sheets
DWG.: *GANDY-COVER2*

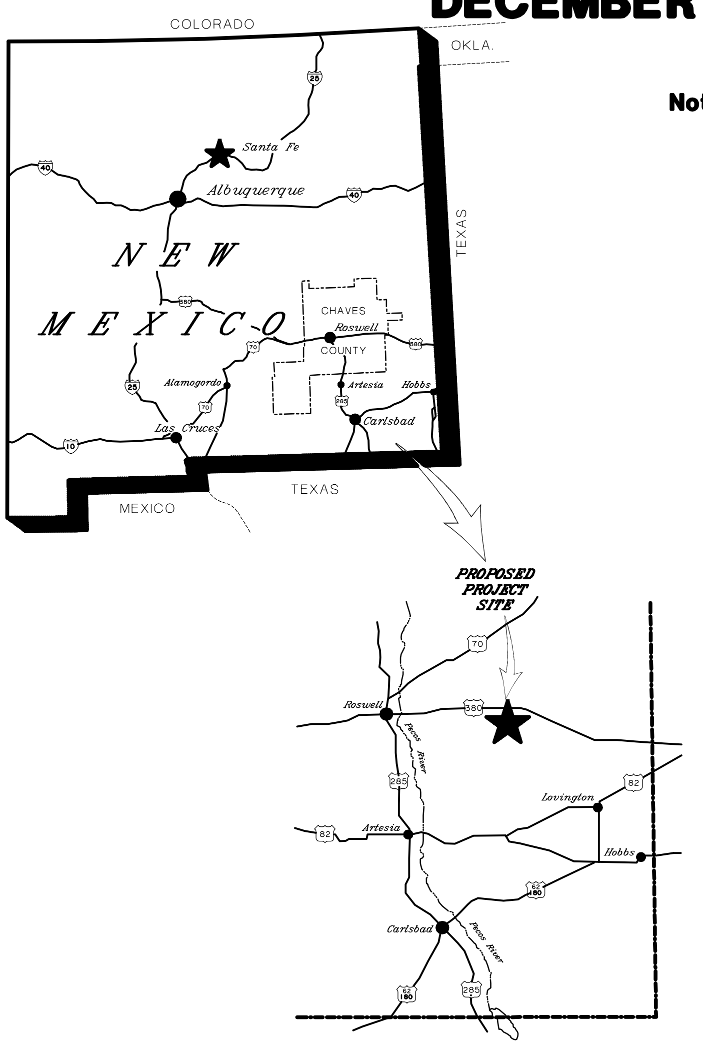
DRAWING No.:	REV.
1	*1*

DESIGN DRAWINGS
TRIASSIC PARK WASTE DISPOSAL FACILITY
CHAVES COUNTY, NEW MEXICO

DECEMBER 1997 (Revised October 2000)

RCRA PART B APPLICATION

Not For Construction (See Notes Drawing 2)



LIST OF DRAWINGS

DRAWING NO.	*DRAWING SERIES*
1 - 2	GENERAL
3 - 5	FACILITY
6 - 27	LANDFILL
28 - 32	EVAPORATION PONDS
33 - 36	STABILIZATION UNIT
37 - 39	DRUM HANDLING UNIT
40	LIQUID WASTE STORAGE AREA
41 - 43	TRUCK ROLL-OFF AREA
44	TRUCK WASH LAYOUT AND DETAILS
45	CONCRETE AND GRATING DETAILS

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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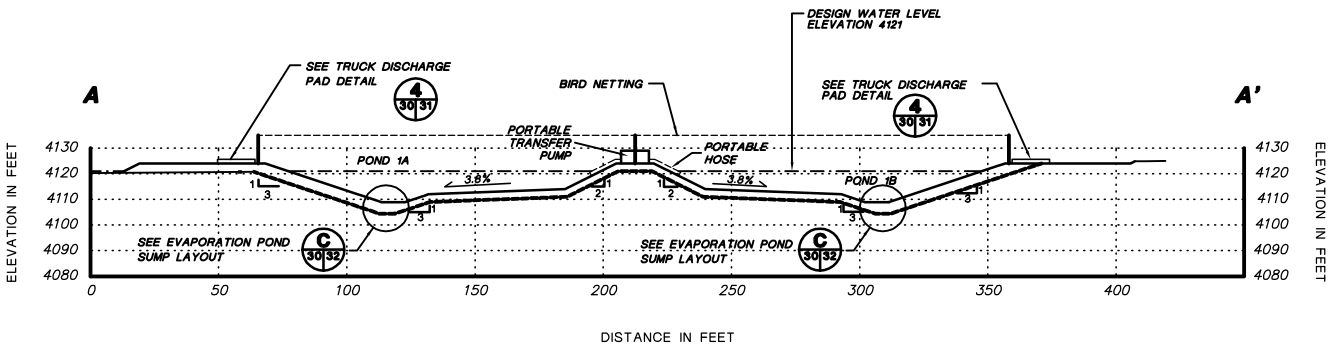
PREPARED BY:

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 2 Sheets
DWG.: *GANDY-COVER1*

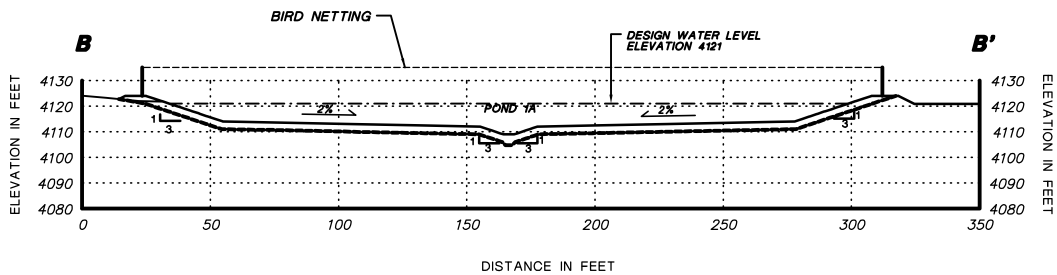
DRAWING No.:	REV.
1	1



A 28 30 A 29 30 **CROSS-SECTION A-A'**

HORIZONTAL SCALE
0 25' 50'

VERTICAL SCALE
0 25' 50'



B 28 30 B 29 30 **CROSS-SECTION B-B'**

HORIZONTAL SCALE
0 25' 50'

VERTICAL SCALE
0 25' 50'

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

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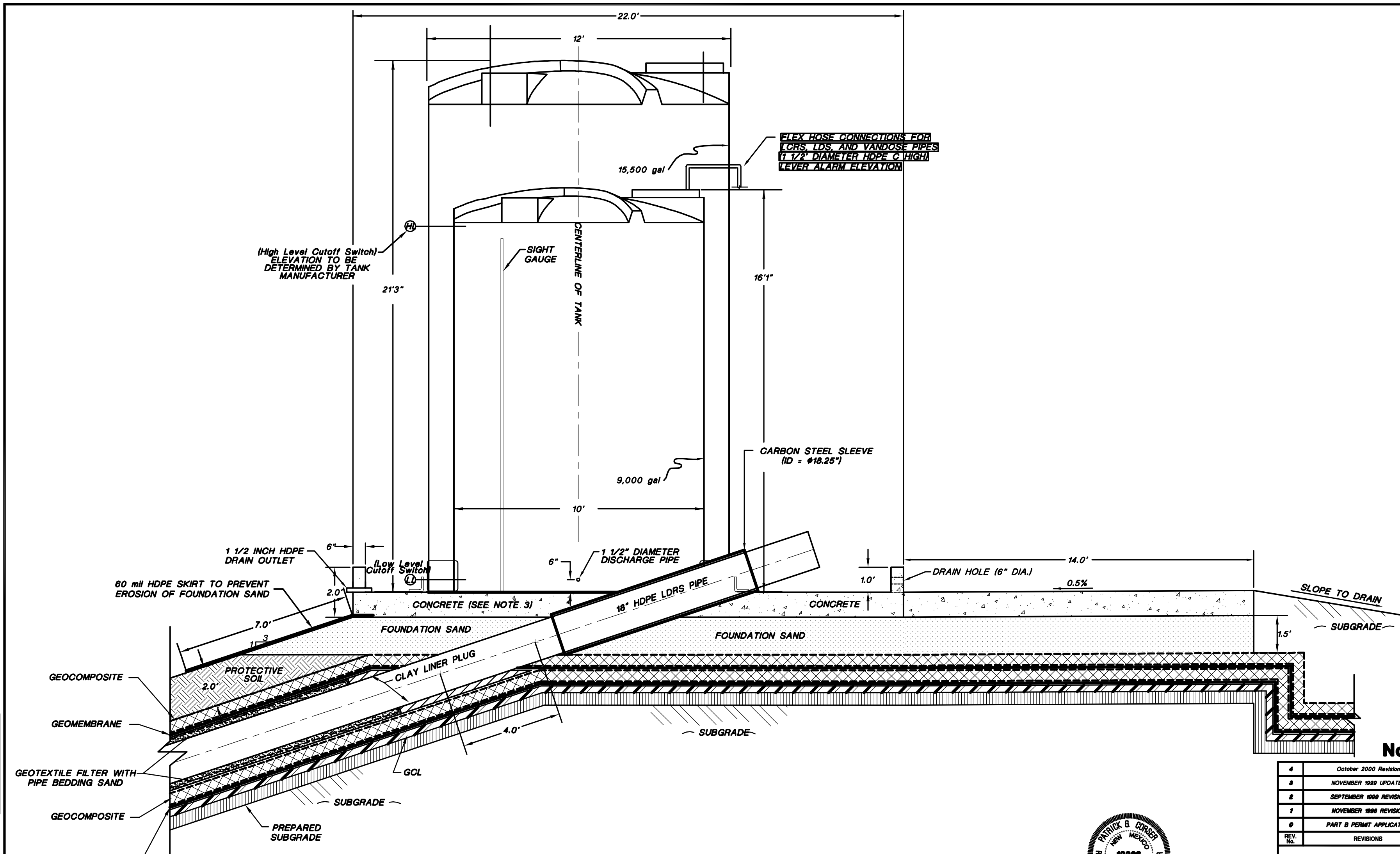
TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
EVAPORATION POND CROSS SECTIONS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 30

AutoCAD FILE: EPSECS28.DWG
PROJECT NUMBER: 602-0200



L 19 | 19 **CREST RISER PAD AND LEACHATE STORAGE TANK CROSS-SECTION**

SCALE
0 2.0' 4.0'
Feet

NOTE:

1) FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

2) PIPE CONNECTION AND TANK ACCESSORIES TO BE SPECIFIED BY TANK SUPPLIER.

3) FOR CONCRETE DETAILS SEE DRAWING 45.

PATRICK G. CORSER
NEW MEXICO
12236
REGISTERED PROFESSIONAL ENGINEER

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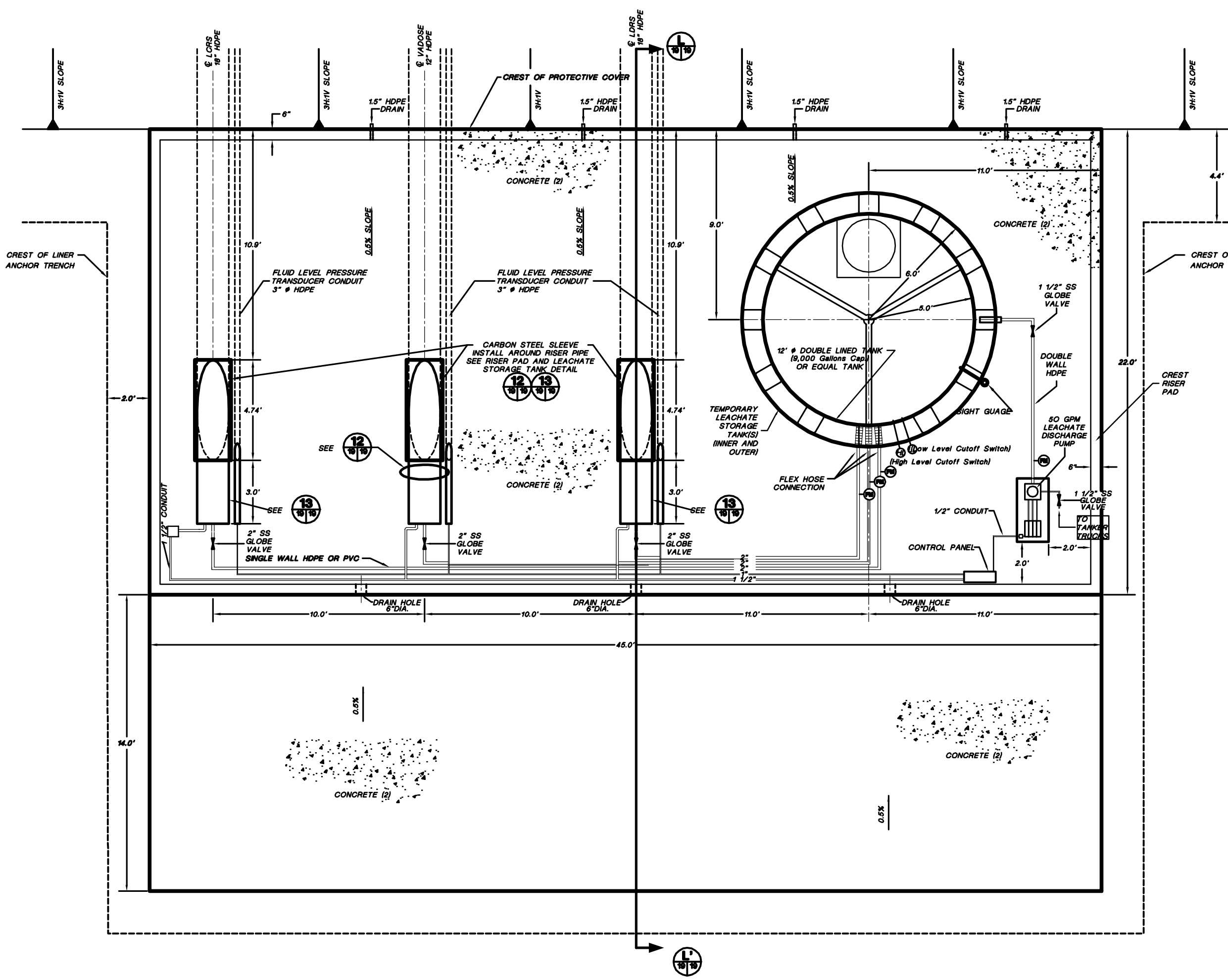
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
CREST RISER PAD AND LEACHATE STORAGE TANK PLAN VIEW AND CROSS-SECTIONS

TerraMatrix
MONTGOMERY WATSON
Mining Group

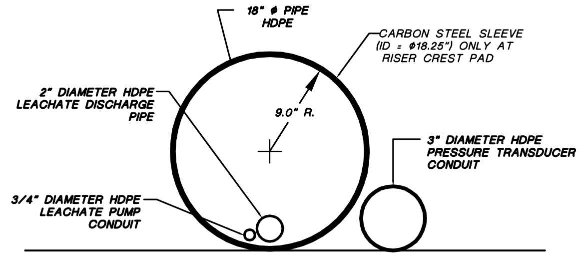
Sheet 3 Of 3 Sheets
SCALE: See Scale Bar
DRAWING No. 19

AutoCAD FILE: CRPLST-XSEC.DWG   PROJECT NUMBER: 602-0200



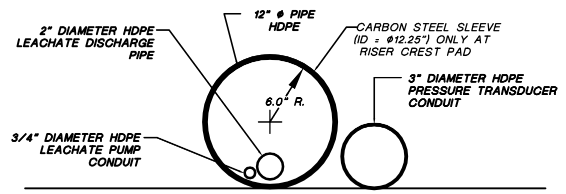
CREST RISER PAD AND LEACHATE STORAGE TANK - PLAN VIEW

SCALE 0 3.0' 6.0' Feet



13 (19/19) LCRS AND LDRS RISER PIPE DETAIL

SCALE 0 0.5' 1.0' Feet



12 (19/19) VADOSE RISER PIPE DETAIL

SCALE 0 0.5' 1.0' Feet

Not For Construction

NOTE:
1) FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".
2) FOR CONCRETE DETAILS SEE DRAWING 45.
3) PIPING SYSTEM WILL COMPLY WITH API PUBLICATION 1615 (NOVEMBER 1979) OR ANSI STANDARD B 31.2 AND ANSI STANDARD B 31.4.

PATRICK G. CORSER — NEW MEXICO — 12236 — REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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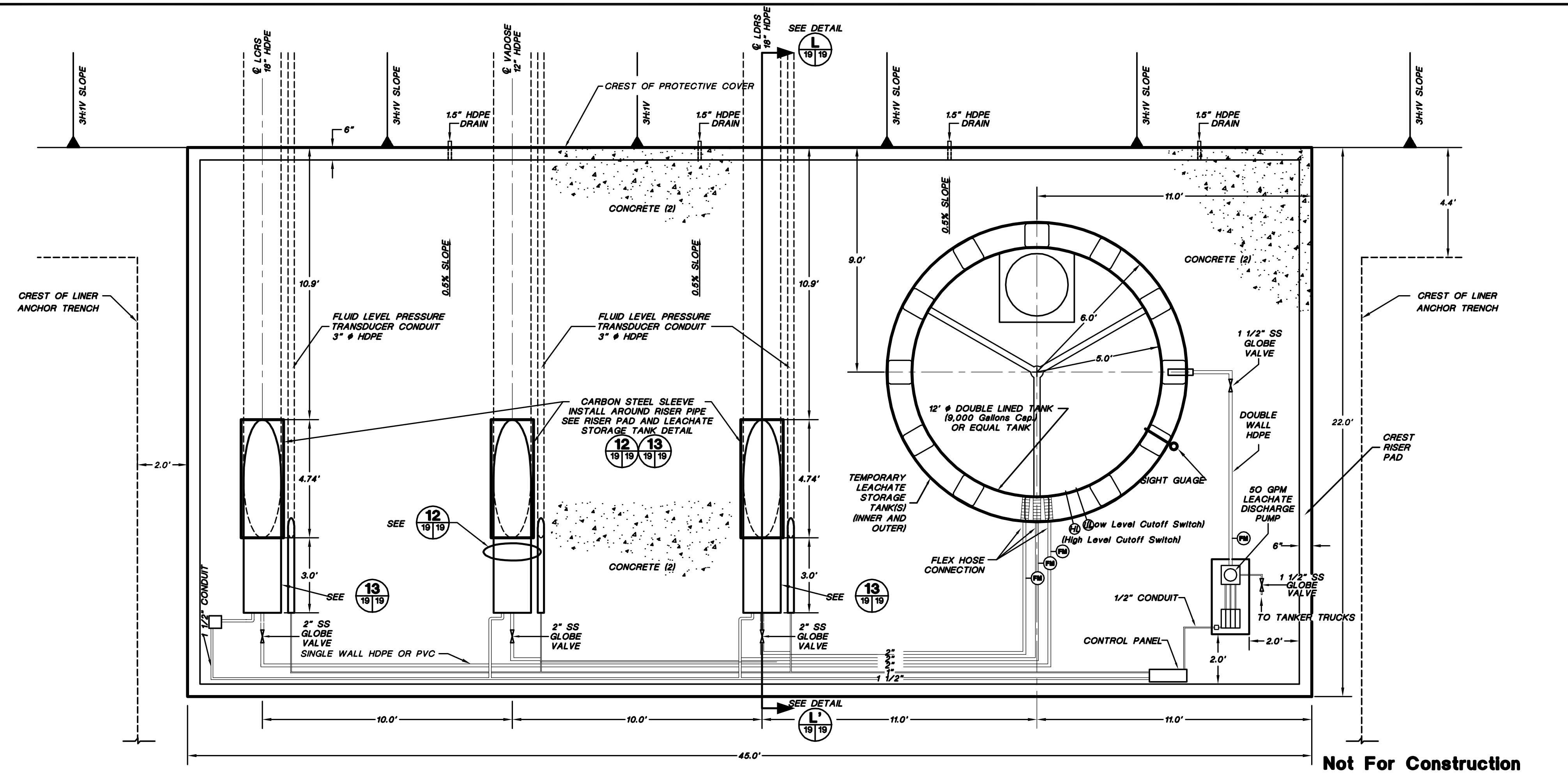
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
CREST RISER PAD AND LEACHATE STORAGE TANK PLAN VIEW AND CROSS-SECTIONS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 2 Of 3 Sheets
SCALE: See Scale Bar
DRAWING No. 19

AutoCAD FILE: CRPLST-DETAIL3.DWG　PROJECT NUMBER: 602-0200



CREST RISER PAD AND LEACHATE STORAGE TANK - PLAN VIEW

SCALE
0 2.0' 4.0'
Feet

Not For Construction

NOTE:
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1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	M.Mathisen	P.Corser

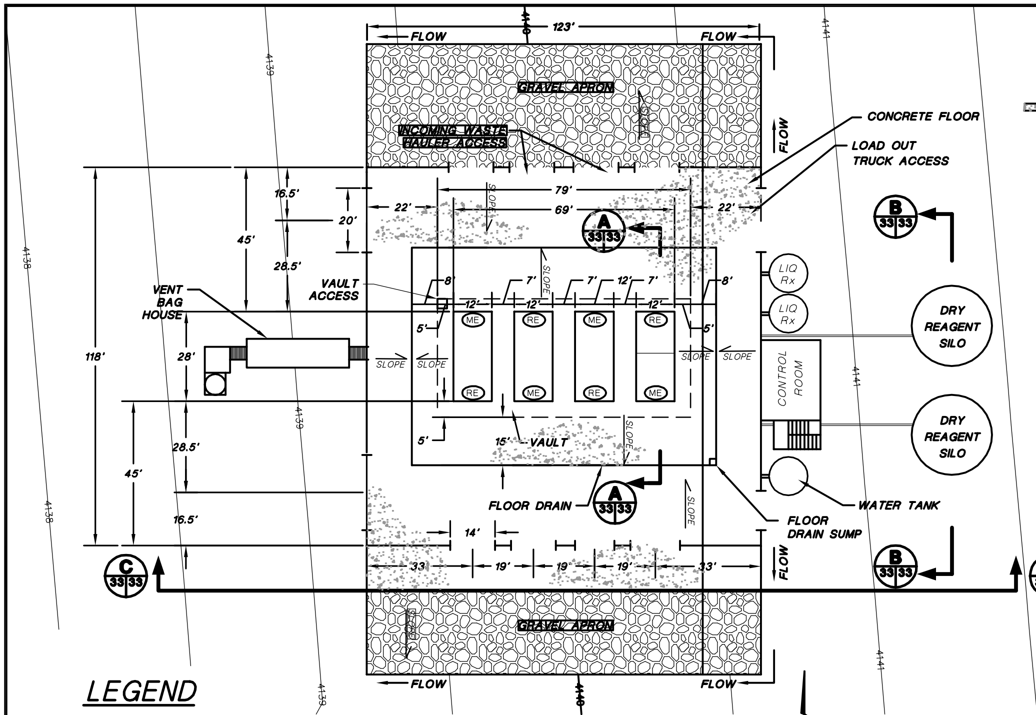
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
CREST RISER PAD AND LEACHATE STORAGE TANK PLAN VIEW AND CROSS-SECTIONS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 3 Sheets
SCALE: See Scale Bar
DRAWING No. 19

AutoCAD FILE: CRPLST-DETAIL.DWG PROJECT NUMBER: 602-0200

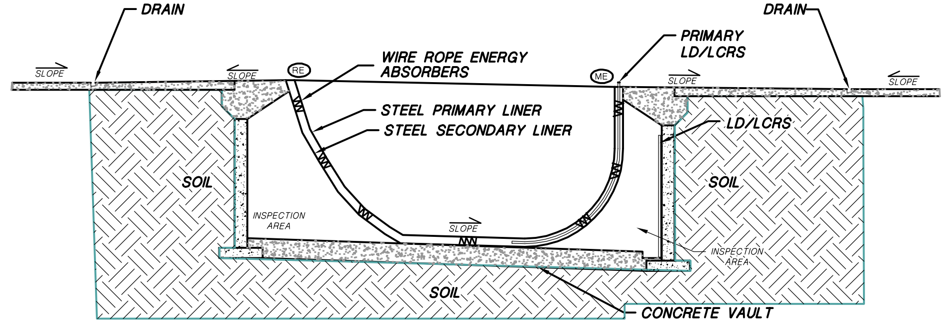


LEGEND

(RE) RECEIVING END
(ME) MIXING END

STABILIZATION BUILDING FLOOR PLAN

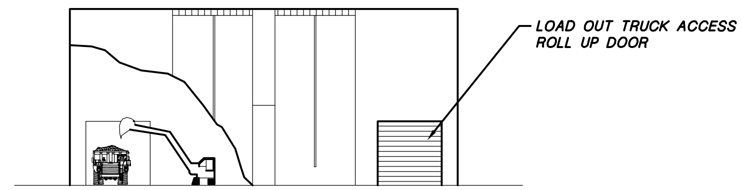
SCALE
20' 0 20' 40'



A 33|33 TYPICAL BIN & VAULT SECTION

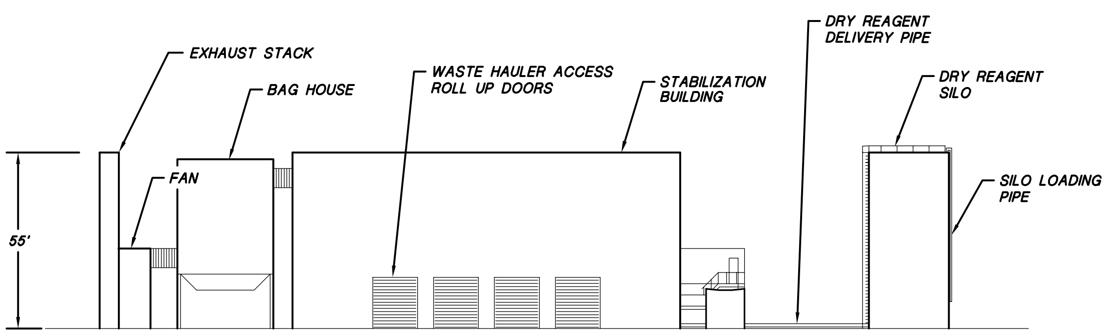
SCALE
5' 0 5' 10'

NOTE:
SEE DRAWING 35 FOR BIN DETAILS



B 33|33 TYPICAL END ELEVATION

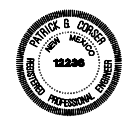
Not To Scale



C 33|33 TYPICAL FRONT ELEVATION

Not To Scale

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".



PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date — Patrick G. Corser, NM P.E. 12236

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
4	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
3	NOVEMBER 1999 UPDATES	11/02/99	J.Troncoso	M.Mathisen	P.Corser
2	SEPTEMBER 1999 REVISION	9/99	P.Corser	T.Clark	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

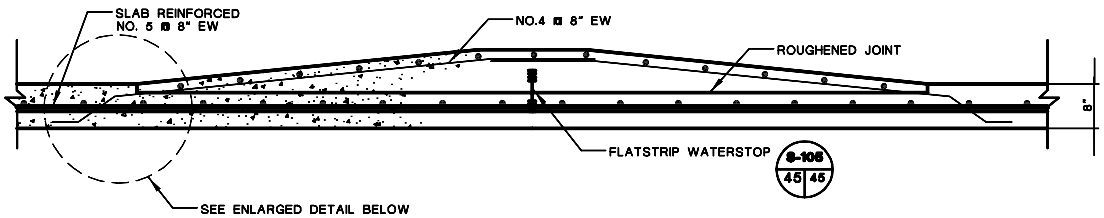
TRIASSIC PARK WASTE DISPOSAL FACILITY

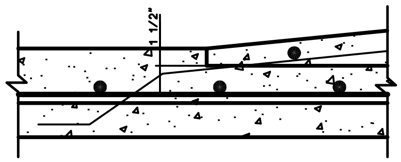
DRAWING TITLE:
STABILIZATION UNIT GENERAL ARRANGEMENT

TerraMatrix
MONTGOMERY WATSON
Mining Group

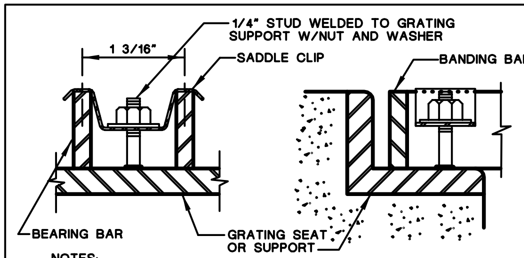
Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 33

AutoCAD FILE: CONCSTABF.DWG
PROJECT NUMBER: 602-0200





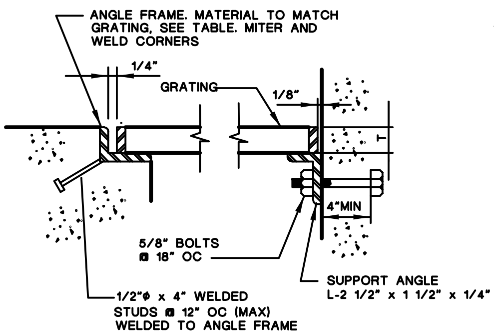
S-201 38 | 45 ACCESS RAMP SECTION



NOTES:

1. PROVIDE 4 CLIPS PER GRATING PANEL, APPROX 4" FROM PANEL CORNERS. MAXIMUM CLIP SPACING AT 36" OC
2. STUD, NUT, WASHER AND CLIP TO BE THE SAME MATERIAL AS THE GRATING EXCEPT FOR ALUMINUM USE SS

S-517 - | 45 GRATING ANCHOR DETAIL



NOTES:

1. GRATING DEPTH TO BE DETERMINED BY MANUFACTURER AND APPROVED BY ENGINEER (UNO)
2. ALL ENDS AND OPENINGS SHALL BE BANDED
3. ALL GRATING SHALL BE SECURED IN PLACE WITH REMOVABLE FASTENERS, SEE DETAIL S-517
4. GRATING SHALL BE DESIGNED FOR A 5-TON FORKLIFT LOAD
5. BEARING BARS SHALL BE DEPTH T x 3/16" @ 1 3/16" OC CROSS BARS SHALL BE @ 4" OC

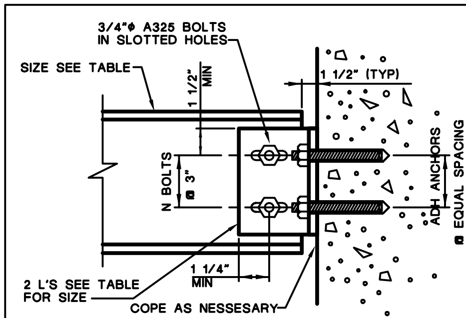
S-502 - | 45 GALVANIZED STEEL GRATING

USE STEEL ANGLE SUPPORTS AND BOLTS GALVANIZE AFTER FABRICATION

GRATING FRAME TABLE

GRATING DEPTH T	FRAME ANGLE	GRATING DEPTH T	FRAME ANGLE
1"	1 3/4 x 1 1/4 x 1/4	2"	*2 1/2 x 2 1/2 x 1/2
1 1/4"	2 x 1 1/2 x 1/4	2 1/4"	2 1/2 x 2 1/2 x 1/4
1 1/2"	1 3/4 x 1 3/4 x 1/4	2 1/2"	3 x 2 1/2 x 1/2
1 3/4"	2 x 2 x 1/4		

* OR USE 2 1/2 x 2 1/2 x 1/4 WITH 1/4" SHIM PLATE WELDED TO BOTTOM



CONNECTION SCHEDULE

BEAM SIZE	ANGLE SIZE	NO. OF BOLTS (N)	ADHESIVE ANCHORS NUMBER AND SIZE
W8	3 1/2 x 3 1/2 x 3/8	2	2 - 3/4" ϕ @ 6"

S-503 - | 45 BEAM TO CONCRETE CONNECTION

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pelliser	K.Conrath	P.Corser
1	NOVEMBER 1999 UPDATES	11/02/99	J.Trocosso	M.Mathisen	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	J.BEYER	P.CORSER

PROFESSIONAL ENGINEER'S STATEMENT

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Date *Patrick G. Corser, NM P.E. 12236*

Not For Construction

TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
CONCRETE AND GRATING DETAILS

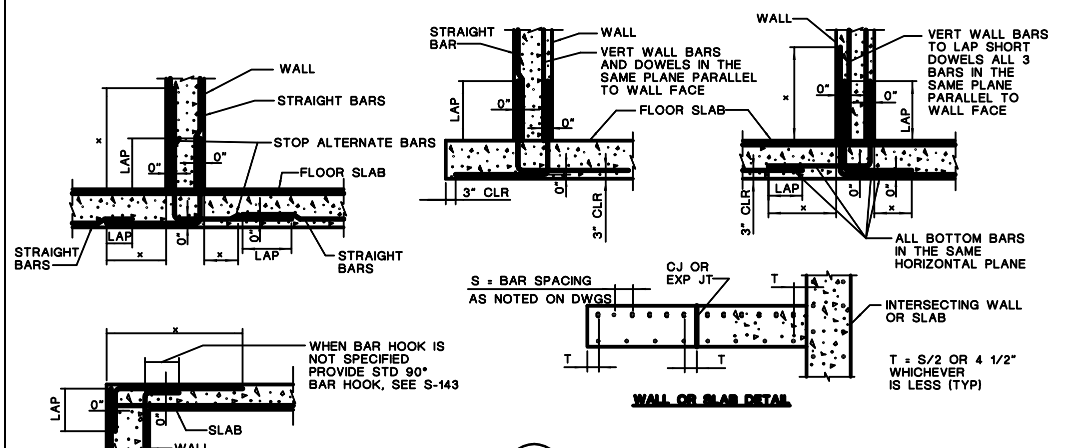
TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 5 Of 5 Sheets
SCALE: AS NOTED
DRAWING No. 45

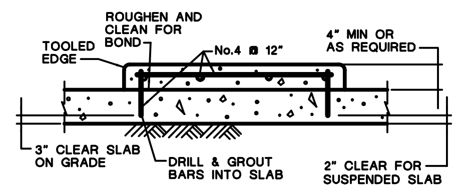
A — DETAIL/SECTION NUMBER
6 | 6
DRAWING No. WHERE DETAIL/SECTION IS REFERENCED
DRAWING No. WHERE DETAIL/SECTION IS SHOWN

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

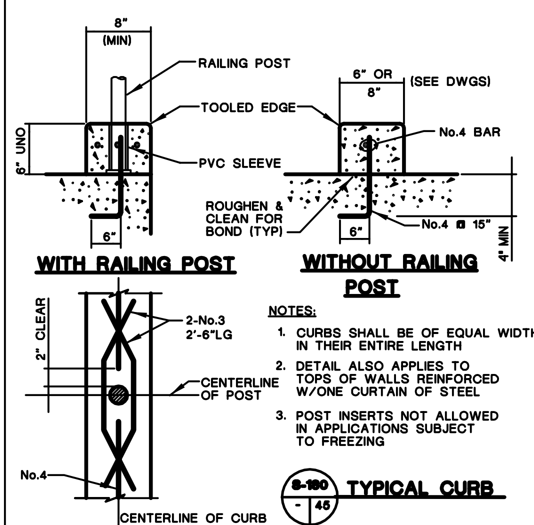
AutoCAD FILE: CONC-DTLS-IE.DWG PROJECT NUMBER: 602-0200



S-149 / 45 **STANDARD FOR REINFORCING BAR DETAILING**



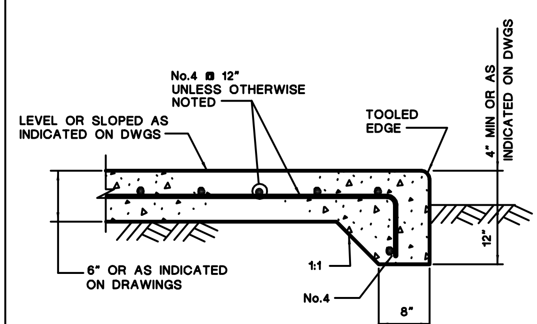
S-191 / 45 **HOUSEKEEPING PAD**



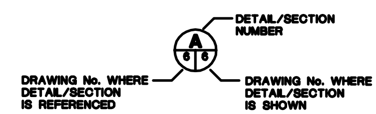
NOTES:

1. CURBS SHALL BE OF EQUAL WIDTH IN THEIR ENTIRE LENGTH
2. DETAIL ALSO APPLIES TO TOPS OF WALLS REINFORCED W/ONE CURTAIN OF STEEL
3. POST INSERTS NOT ALLOWED IN APPLICATIONS SUBJECT TO FREEZING

S-180 / 45 **TYPICAL CURB**



S-190 / 45 **SLAB ON GRADE**



NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

PATRICK G. CORSER — NEW MEXICO — 12236 — REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

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Date — *Patrick G. Corser, NM P.E. 12236*

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0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	J.BEVER	P.CORSER

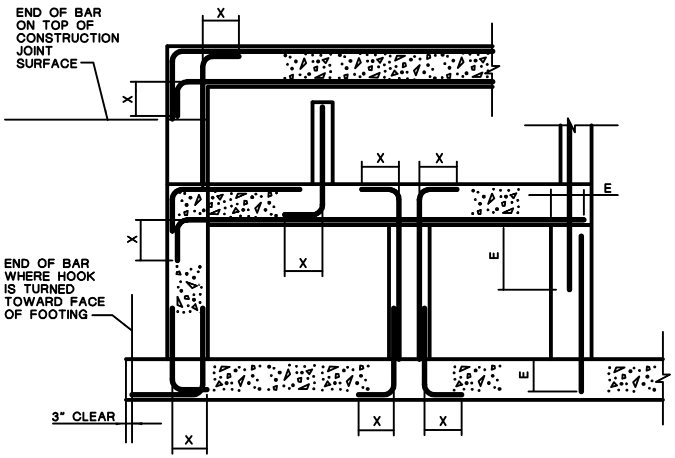
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
CONCRETE AND GRATING DETAILS

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 4 Of 5 Sheets
SCALE: AS NOTED
DRAWING No. 45

AutoCAD FILE: CONC-DTLS-1D.DWG PROJECT NUMBER: 602-0200



SECTION

LENGTH (INCHES)			
BAR SIZE	HOOK X	LAP	EMBEDMENT E
No.3	6"	18"	12"
No.4	8"	18"	14"
No.5	10"	23"	18"
No.6	12"	28"	22"
No.7	14"	33"	25"
No.8	16"	SEE TABLE BELOW	SEE TABLE BELOW
No.9	19"		
No.10	22"		
No.11	24"		

LENGTH (INCHES)						
REBAR SIZE	FOR 1" TO < 2" CONCRETE COVER		FOR 2" TO < 3" CONCRETE COVER		FOR 3" AND LARGER CONCRETE COVER	
	REBAR SPACING (CENTER TO CENTER)		REBAR SPACING (CENTER TO CENTER)		REBAR SPACING (CENTER TO CENTER)	
	< 8"	≥ 8"	< 8"	≥ 8"	< 8"	≥ 8"
LAP						
No.8	62"	62"	37"	37"	37"	37"
No.9	99"	79"	69"	55"	49"	42"
No.10	125"	100"	88"	70"	63"	50"
No.11	154"	123"	108"	86"	77"	62"
EMBEDMENT E						
No.8	48"	48"	29"	29"	29"	29"
No.9	77"	61"	54"	43"	38"	33"
No.10	97"	77"	68"	54"	49"	39"
No.11	119"	95"	84"	67"	60"	48"

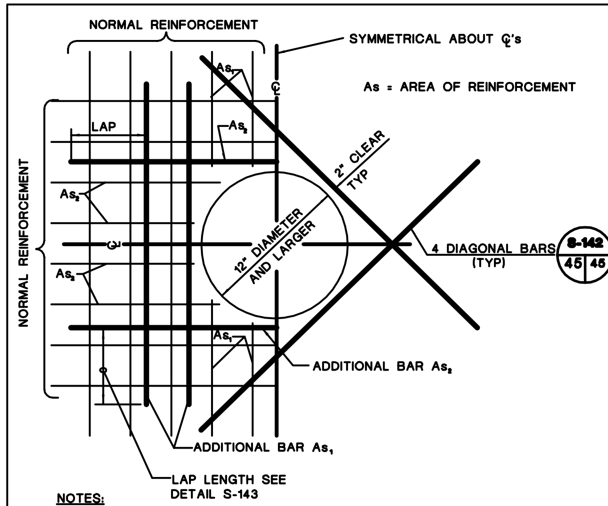
NOTES:

1. USE LAP LENGTHS AS DETERMINED FROM THESE TABLES UNLESS SHOWN OTHERWISE
2. THE TABLES SHOWN ARE FOR f'C=4000 PSI AND fy=60,000 PS1
3. MULTIPLY THE LAP & E SHOWN IN THESE TABLES BY 1.3 FOR WALL HORIZONTAL REBARS AND SLAB BARS WITH 12" OR MORE FRESH CONCRETE UNDERNEATH
4. WHEN BARS OF DIFFERENT SIZE ARE LAP SPLICED, LAP LENGTH SHALL BE THE LARGER OF:
   EMBEDMENT LENGTH OF LARGER BAR
   LAP LENGTH OF SMALLER BAR
5. UNLESS NOTED OTHERWISE USE REBAR COUPLERS FOR SPLICES OF No.11 AND LARGER BARS
6. ALL DOWEL BARS SHALL EXTEND AN EMBEDMENT LENGTH E INTO ANOTHER MEMBER OR ACROSS A CONSTRUCTION JOINT UNLESS SHOWN TO SPLICE WITH OTHER BARS OR TO EXTEND TO THE FAR FACE OF THE MEMBER AND END WITH A STANDARD HOOK

S-143 / - / 45

STANDARD 90° BAR HOOKS, EMBEDMENT LENGTHS AND LAP LENGTHS

UNLESS OTHERWISE NOTED ON DRAWINGS



NOTES:

1. CUT NORMAL REINFORCEMENT AT OPENINGS:
   As_1 AND As_2 = 1/2 AREA OF CUT BARS TO BE ADDED ON EACH SIDE OF OPENING
2. ADDITIONAL BARS As_1 AND As_2 TO BE PLACED:
   A) AT CENTERLINE OF WALLS OR SLABS WHERE ONE LAYER OF REINFORCEMENT IS PROVIDED
   B) AT EACH FACE OF WALLS OR SLABS WHERE TWO LAYERS OF REINFORCEMENT ARE PROVIDED
3. INCREASE SIZE OF ADDITIONAL BARS AS NEEDED TO FIT WITHIN A DISTANCE OF 2 X WALL/SLAB THICKNESS FROM OPENING, PROVIDE 2" MIN CLEAR BETWEEN BARS
4. THIS DETAIL TO BE USED ONLY WHEN NO OTHER DETAIL IS INDICATED ON THE DRAWINGS
5. WHERE A SLAB OR INTERSECTING WALL CONNECTS WITHIN ONE WALL THICKNESS OF THE OPENING, ADDITIONAL BARS ON THAT SIDE MAY BE OMITTED

S-144 / - / 45

ADDITIONAL REINFORCEMENT AT CIRCULAR OPENINGS (12" DIA OR LARGER)

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1	October 2000 Revisions	10/4/00	J.Pelliser	K.Conrath	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	J.BEVER	P.CORSER

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE: ***CONCRETE AND GRATING DETAILS***

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

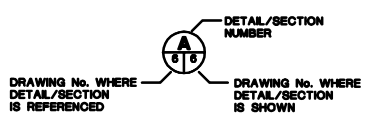
I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

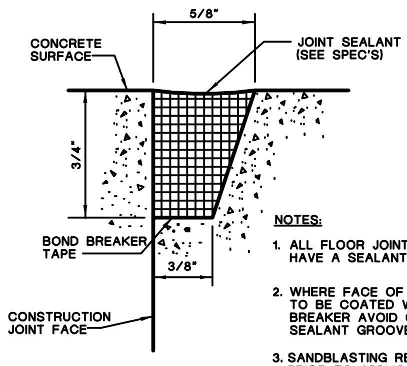
TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 3 Of 5 Sheets | SCALE: AS NOTED | DRAWING No. 45

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".



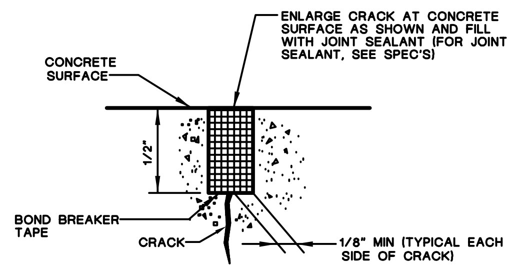
AutoCAD FILE: CONC-DTLS-1C.DWG PROJECT NUMBER: 602-0200



NOTES:

1. ALL FLOOR JOINTS SHALL HAVE A SEALANT GROOVE
2. WHERE FACE OF JOINT IS TO BE COATED WITH BOND BREAKER AVOID COATING SEALANT GROOVE
3. SANDBLASTING REQUIRED PRIOR TO APPLICATION OF PRIMER
4. USE BONDBREAKER TAPE ONLY ON SLIP DOWEL JOINTS

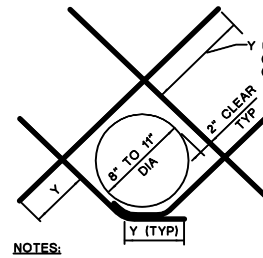
S-131 / 45 **SEALANT GROOVE**



NOTE:

PRIOR TO USE, STRUCTURES SHALL HAVE ALL CRACKS REPAIRED AS SHOWN IN THIS DETAIL

S-132 / 45 **CONCRETE CRACK REPAIR**

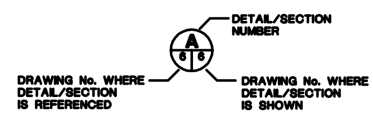


BAR SIZE	Y GRADE 60
No.4	15"
No.5	21"
No.6	24"
No.7	27"
No.8	36"
No.9	42"

NOTES:

1. CUT NORMAL REINFORCEMENT 2" CLEAR OF OPENING
2. DIAGONAL BARS TO BE PLACED:
   A) AT CENTERLINE OF WALL OR SLAB WHERE ONE LAYER OF REINFORCEMENT IS PROVIDED
   B) AT EACH FACE OF WALL OR SLAB WHERE TWO LAYERS OF REINFORCEMENT ARE PROVIDED
3. UNLESS OTHERWISE NOTED, SIZE OF DIAGONAL BARS SHALL BE THE SIZE OF THE LARGEST NORMAL REINFORCING BAR CUT
4. THIS DETAIL TO BE USED ONLY WHEN CALLED FOR ON THE DRAWINGS OR WHEN NO OTHER DETAIL IS SPECIFIED

S-142 / 45 **DIAGONAL REINFORCEMENT AT CIRCULAR OPENINGS (8" - 11" DIA)**



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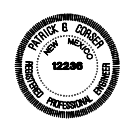
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	J.BEVER	P.CORSER



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TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE: ***CONCRETE AND GRATING DETAILS***

TerraMatrix MONTGOMERY WATSON Mining Group

Sheet 2 Of 5 Sheets

SCALE: AS NOTED

DRAWING No. 45

NOTE:
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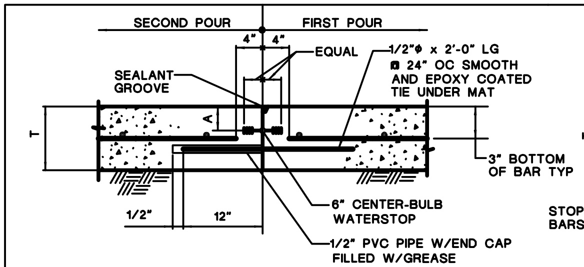
AutoCAD FILE: CONC-DTLS-1B.DWG PROJECT NUMBER: 602-0200

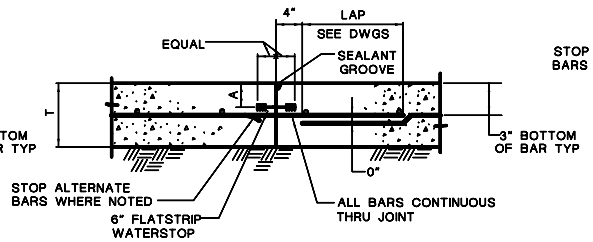


SINGLE MAT REINF - SLEEVE - TYPE JOINT

(TYP CONSTRUCTION JOINT UNLESS OTHERWISE NOTED)

S-110 / - / 45 **WITH WATERSTOP AND SEALANT GROOVE**

S-111 / - / 45 **NO WATERSTOP OR SEALANT GROOVE**

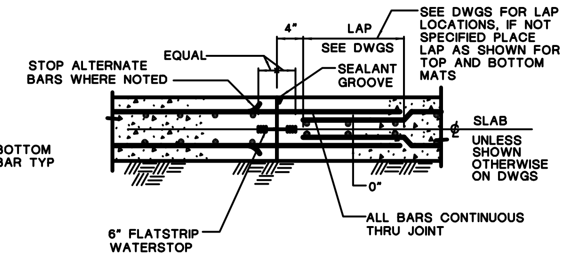


SINGLE MAT REINF - CONTINUOUS THRU JOINT

(ONLY WHEN SPECIFIED ON DRAWINGS)

S-112 / - / 45 **WITH WATERSTOP AND SEALANT GROOVE**

S-113 / - / 45 **NO WATERSTOP OR SEALANT GROOVE**



DOUBLE MAT REINF

S-114 / - / 45 **WITH WATERSTOP AND SEALANT GROOVE**

S-115 / - / 45 **NO WATERSTOP OR SEALANT GROOVE**

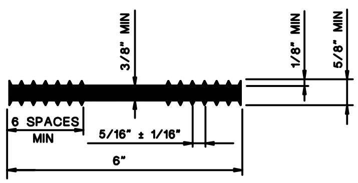
T	A
6"	2"
7"	2 1/2"
8"	2 1/2"

NOTES:

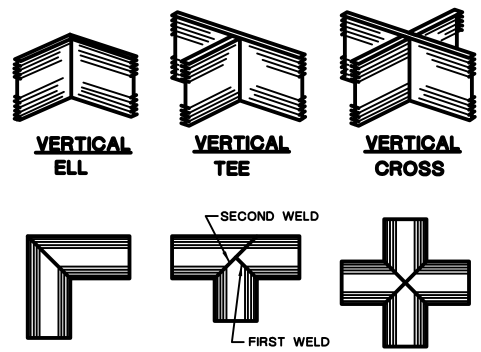
1. IN ALL CONSTRUCTION JOINTS WITH WATERSTOPS, APPLY 2 COATS OF BOND BREAKER TO FACE OF JOINT, AVOID COATING WATERSTOP (AND SEALANT GROOVE WHERE USED)
2. WATERSTOPS AND SEALANT GROOVES TO BE PROVIDED IN ALL WATER RETAINING SLABS, SEE DRAWINGS, FOR OTHER LOCATIONS WHERE THEY MAY BE REQUIRED
3. STAGGER SPLICES UNLESS NOTED OTHERWISE

SLAB-ON-GRADE CONSTRUCTION JOINTS

REV 011696



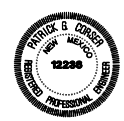
S-105 / 45 **6" FLATSTRIP WATERSTOP**



S-106 / 45 **PREFABRICATED WATERSTOPS JOINTS**

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

AutoCAD FILE: CONC-DTLS-1A.DWG   PROJECT NUMBER: 602-0200



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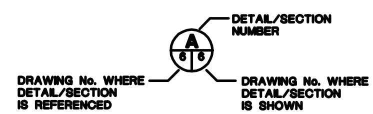

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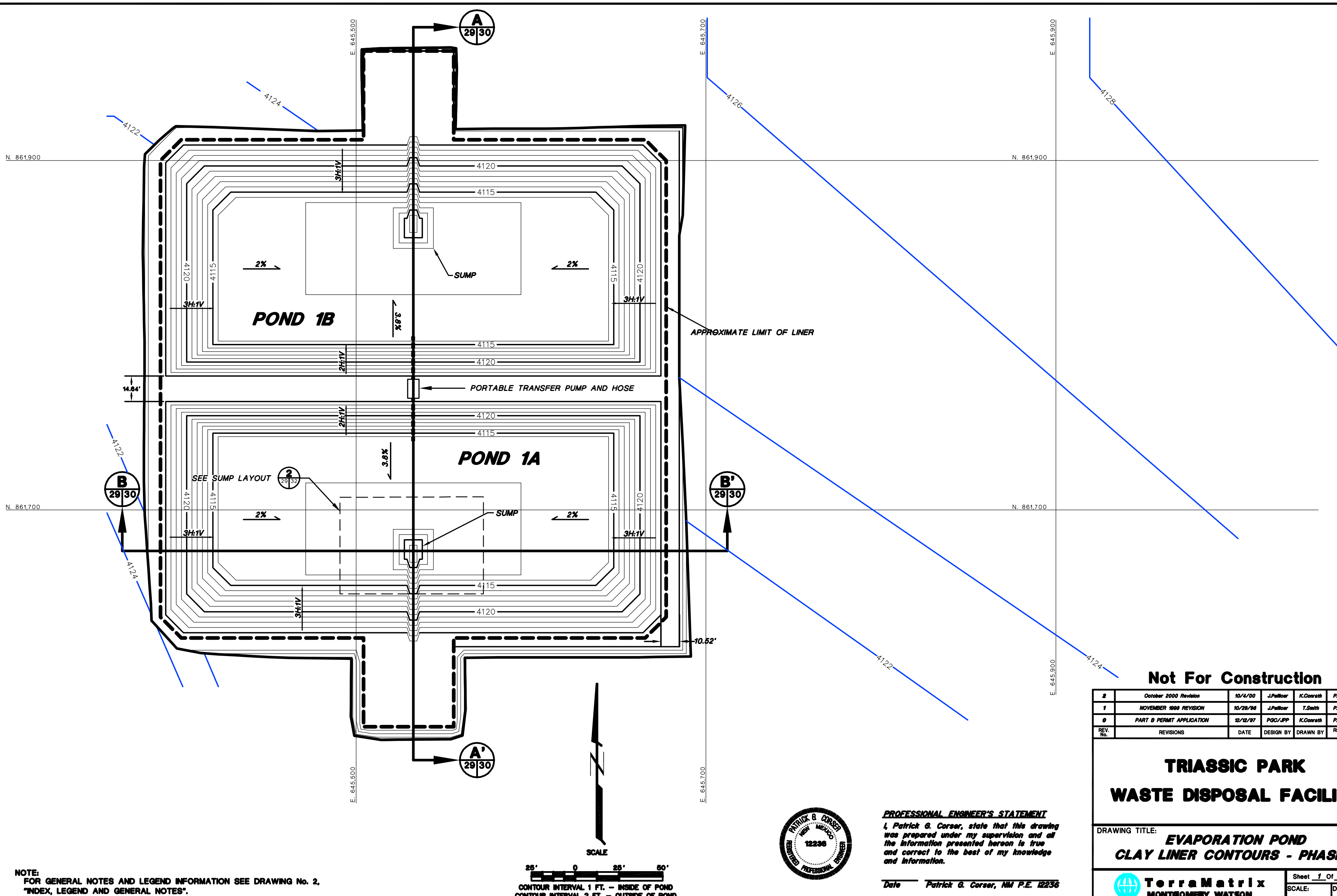
TRIASSIC PARK
WASTE DISPOSAL FACILITY

DRAWING TITLE:
CONCRETE AND GRATING DETAILS

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 5 Sheets
SCALE: AS NOTED
DRAWING No. 45



AutoCAD FILE: CLAY-CONT29.DWG PROJECT NUMBER: 602-0200

NOTE:
FOR GENERAL NOTES AND LEGEND INFORMATION SEE DRAWING No. 2, "INDEX, LEGEND AND GENERAL NOTES".

PATRICK G. CORSER NEW MEXICO 12236 REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER'S STATEMENT

I, Patrick G. Corser, state that this drawing was prepared under my supervision and all the information presented hereon is true and correct to the best of my knowledge and information.

Date *Patrick G. Corser, NM P.E. 12236*

Not For Construction

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	October 2000 Revision	10/4/00	J.Pellicer	K.Conrath	P.Corser
1	NOVEMBER 1998 REVISION	10/29/98	J.Pellicer	T.Smith	P.Corser
0	PART B PERMIT APPLICATION	12/12/97	PGC/JPP	K.Conrath	P.Corser

TRIASSIC PARK WASTE DISPOSAL FACILITY

DRAWING TITLE:
EVAPORATION POND CLAY LINER CONTOURS - PHASE 1

TerraMatrix
MONTGOMERY WATSON
Mining Group

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 29