White Sands Missile Range Environmental Document
Report WS-ES-EC-0445

FINAL

CORRECTIVE MEASURES IMPLEMENTATION REPORT

RHODES CANYON LANDFILL (WSMR-14; SWMUS 114 AND 115)

WHITE SANDS MISSILE RANGE INSTALLATION RESTORATION PROGRAM

September 2004

BAE SYSTEMS

White Sands Missile Range
Environment and Safety Directorate
White Sands Missile Range, New Mexico 88002
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CORRECTIVE MEASURES IMPLEMENTATION REPORT FOR THE RHODES CANYON LANDFILL (WSMR-14; SWMUs 114 AND 115)

Submitted to:

U.S. Army
White Sands Missile Range
Environment and Safety Directorate
White Sands Missile Range, New Mexico 88002-5048

September 2004

Submitted by:

BAE SYSTEMS
Building 126
White Sands Missile Range, New Mexico 88002

CERTIFICATION OF CLOSURE

This is to certify that corrective measures at Solid Waste Management Units 114 and 115 (Rhodes Canyon Landfill) located at the White Sands Missile Range in Sierra County, New Mexico were completed in accordance with the work plan entitled *REVISED Rhodes Canyon Corrective Measures Implementation Work Plan (WSMR-14, SWMU 114 and 115)* (dated June 2003), and as approved by the New Mexico Environment Department's Hazardous Waste Bureau on 16 October 2003. The details of the corrective measures and any deviations from the work plan are contained within this report. Final closure of the solid waste management units is pending completion of the post closure care period and approval by the New Mexico Environment Department. In accordance with 40 CFR 264.115, the following closure certification statement is provided below:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Leonard Habel, P.E.
Sr. Environmental Engineer
North Wind, Inc.
New Mexico License Number 15610
Date

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EXECUTIVE SUMMARY

The Rhodes Canyon Landfill consists of two adjoining areas just west of the Rhodes Canyon Range Center at the White Sands Missile Range (WSMR). One area is irregularly shaped, as defined by an electromagnetic survey, and was the disposal area for solid waste generated at the Range Center between the mid-1950s until it closed in 1976. The other area, is well defined, having been established as a state approved solid waste landfill in 1976. It ceased operations in 1987.

The two sites were identified as requiring corrective action under the White Sands Missile Range's HSWA RCRA Part B permit. WSMR prepared and submitted a corrective measures implementation (CMI) work plan for the construction of a soil cover on top of both areas. The New Mexico Environment Department (NMED) approved the work plan following the public review and comment period.

The natural soil cover was constructed between April and July 2004. A 5-acre parcel was excavated adjacent to site to provide fill material for construction of the soil cover. An 18-foot wide swale was installed down the center of the cover to channel water off it and into the borrow pit. An eight foot chain link fence was installed around the perimeter of the site. Warning signs were posted at the entrance and periodically along its length to prevent damage to the cover by unwitting personnel and wildlife. Hydroseeding was applied to promote re-vegetation and minimize erosion.

The natural soil cover was designed to prevent direct contact with the waste and to minimize infiltration of rainwater which has the potential to carry contaminants from the solid waste into the underlying groundwater. Additional activities will continue at the site under a post-closure care program to ensure the integrity of the cap and the effectiveness of the remedy.

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CORRECTIVE MEASURES IMPLEMENTATION REPORT FOR THE RHODES CANYON LANDFILL (WSMR-14; SWMUS 114 AND 115)

1.0 INTRODUCTION

1.1 Objectives and Scope

The primary objectives of this report are to:

- Serve as the Construction Completion Report as referred to in the Rhodes Canyon Landfill Corrective Measures Implementation (CMI) Work Plan
- Document the construction activities completed.
- Explain any deviations from the CMI Work Plan.
- Provide as built drawings of the landfill cap and perimeter fencing.

The scope of this document covers the solid waste management units (SWMU) 114 and 115, also known as the Rhodes Canyon Landfill.

1.2 Location

The Rhodes Canyon Landfill consists of two adjoining areas (Figure 1-1) just west of the Rhodes Canyon Range Center which were used for disposal of solid waste. The Range Center is located within the White Sands Missile Range approximately 20 miles west of Tularosa and 6 miles east of the San Andres Mountains at the intersection of Range Road 6 and Range Road 7 in Otero County, New Mexico (Figure 1-2).

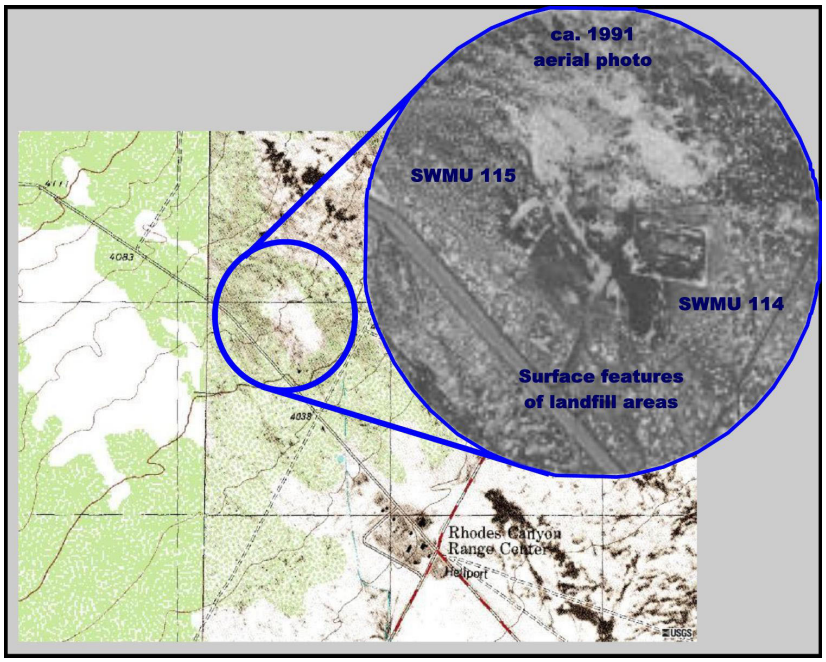

Figure 1-1. Topographic map with enlarged landfill areas.

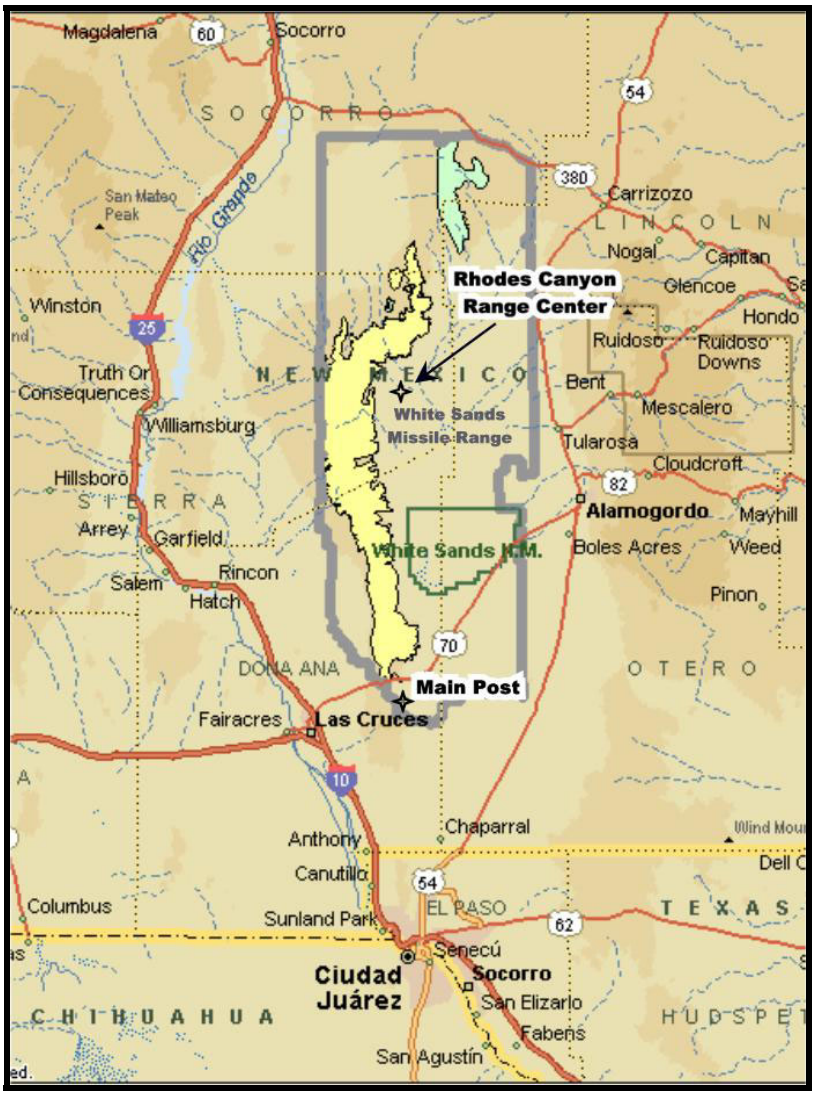

Figure 1-2. General Site Location Map.

1.3 Site Descriptions and Operational History

The original landfill, designated as SWMU 115, received missile debris and sanitary waste from the Rhodes Canyon Range Center (RCRC; Photograph 1-1) and up-range impact areas (U.S. Army Toxic and Hazardous Materials Agency (USTHMA), 1979). The startup date of the landfill is unknown, but is presumed to be during the mid-1950s when the RCRC was established. The Range Center provided communications and maintenance support for missile missions conducted within the mid-range area (U.S. Army, 1976).

The landfill is presumed to have been a trench-type cut and cover landfill, based on existing practices at the time. A geophysical survey conducted during 1992 affirmed this and suggested that they formed two irregularly shaped areas (ITC, 1992).

Refer to Figures 1-3 and 1-4 for the irregular shaped areas superimposed on aerial photographs of the site taken in 1944 and 1991, respectively.

Photograph 1-1. RCRC. (looking SE, ca. 1976)

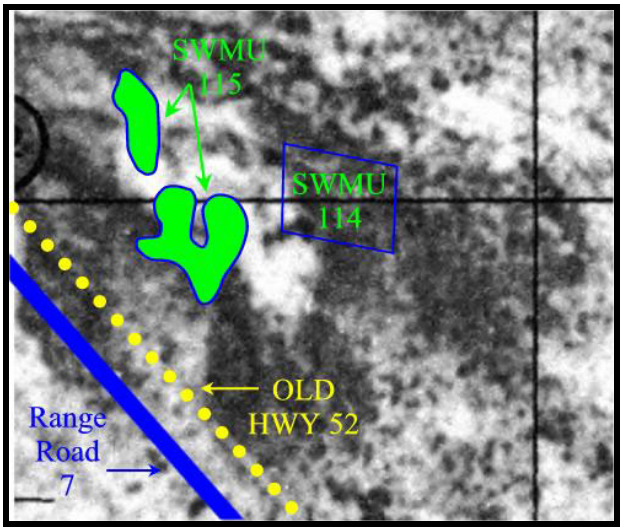

Figure 1-3. Trench areas.
(over. 1944 photo)

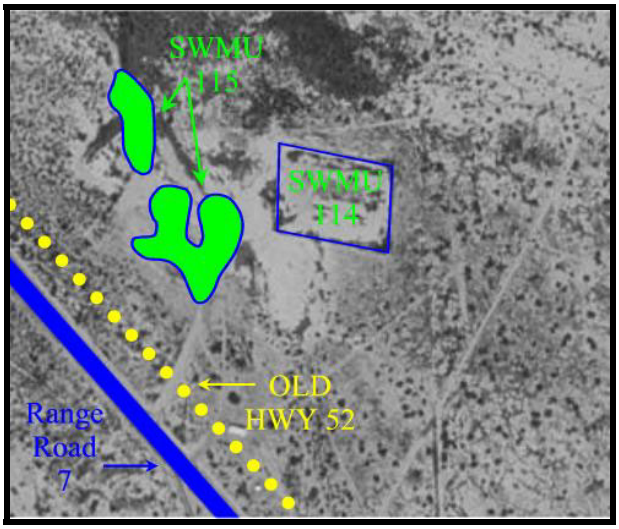

Figure 1-4. Trench areas.
(over. 1991 photo)

The original landfill (Photograph 1-2) was closed in 1976 when a state approved landfill was established. The new landfill (Photograph 1-3), known as SWMU 114, was also a trench-type cut and cover landfill. The boundaries were clearly visible by an 8-foot chain link fence. It received office refuse and construction debris from support operations at RCRC (A.T. Kearney, Inc., 1988).

Photograph 1-2. SWMU 115. (2004)

Photograph 1-3. SWMU 114. (1988)

The landfill was operated in compliance with the New Mexico Solid Waste Regulations (U.S. Army Environmental Hygiene Agency (USAEHA, 1981). It was last used in September 1987, according to facility personnel (A.T. Kearney, Inc., 1988).

1.4 Regulatory Background

Congress established the Defense Environmental Restoration Program (DERP) in 1986, which is the current statutory framework for DoD's environmental restoration program, also known as the Installation Restoration Program (IRP). The DERP has been codified in Section 2701 of Title 10 of the U.S. Code.

Initiation of the IRP began in August 1988 with a RCRA Faciltiy Assessment (RFA) of WSMR, performed by A.T. Kearney for the EPA, Region VI. This report identified 138 SWMUs and 26 Areas of Concern (AOC). The results of this RFA were used by the EPA to prepare the HSWA Corrective Action Module of the RCRA Part B Permit. The EPA approved and issued the Permit to WSMR on 29 September 1989. Stipulations of the Permit required WSMR to investigate and cleanup 92 SWMU sites and 4 AOCs, including SWMUs 114 and 115.

Seventy-one of the WSMR sites were entered into the IRP and listed in the Defense Site Environmental Restoration Tracking System (DSERTS). The Rhodes Canyon Landfills are identified in DSERTS with an IRP number, WSMR-14.

This site having been identified as a SWMU in the hazardous waste permit is also subject to the conditions in the permit and the corrective action requirements of 20 NMAC 4.1.

2.0 ENVIRONMENTAL SETTING

2.1 Climate

The White Sands Missile Range is located in south-central New Mexico in the Tularosa Basin. The basin floor has an elevation ranging from 3,900 to 4,000 feet mean sea level (MSL). The mountains which border the basin have an average elevation between 5,500 and 9,000 feet MSL.

> *The basin has an arid climate with annual rainfall averaging near twelve inches and a mean annual temperature of about 62 degrees Fahrenheit. Infrequent but prolonged wet spells can cause considerable runoff from some of the nearby mountains occasionally producing intermittent ponds and lakes that may persist for several months (Hatfield and Koperski, 2000).*

The Jallen Site weather station is located adjacent to the Rhodes Canyon landfill (Photograph 2-1). During 2003, it recorded temperatures ranging between 106 and 9 ºF with an estimated average temperature of 64 ºF. Average wind speeds were 7.5 mph. Total annual rainfall was 6 inches with nearly half of it arriving in August.

During the soil cover construction (April thru July 2004) more than 5 inches of rain fell and temperatures averaged 74 ºF with highs in excess of 100 ºF.

2.2 Geology

2.2.1 Regional Geology

The site is located mid-range, along the western edge of the desert floor, about six miles east of the San Andres Mountain foothills (Photograph 2-2).

Photograph 2-1.
Jallen Site weather station.

Photograph 2-2.
San Andres Mountain above landfill (fence-line marked by poles).

> *The San Andres Mountains [are] a westward tilted block of Precambrian granite and Paleozoic-age limestone, dolomite, sandstone, and shale…. In general, the alluvial fan slopes smoothly eastward [off the mountain front], with a two degree downslope to the fault scarp "dropoff". In detail, the fan consists of three separate components, each at a slightly different elevation. The oldest component of the fan, whose surface ceased being fed by arroyos half a million years ago, is the highest, and its surface is underlain by one to three feet of caliche which is a soil feature formed during the half-million year period. Where the range boundary fault cuts this fan, the scarp is highest, up to 40 feet. The next younger component of the fan is at a somewhat lower elevation and exhibits a less well-developed caliche soil. Parts of this fan spilled across the fault scarp and now form much of the ground surface below the scarp. In places, however, this fan is also broken by the fault, forming a scarp up to perhaps 15 feet high. The youngest component of the fan is lowest in elevation, and, except alluvium in the bottoms of gullies that score the older fans, is found below (east of) the fault scarp. This alluvium is younger than 15,000 years old, exhibits little caliche soil development, and has not been displaced by the range-front fault.*
>
> *From the above relations, the fault scarp is estimated to be younger than about 100,000 to 200,000 years, which is the approximate age of the middle fan, and older than about 15,000 years, which is the age of the unfaulted youngest fan (Physical Science Laboratory, 1982).*

2.2.2 Local Geology and Soils

Subsurface geologic conditions at the Rhodes Canyon Landfill were characterized from stratigraphic descriptions logged during drilling activities for the WSMR Groundwater Monitoring Program in 1995. The deposits were characterized as thickly bedded clay with numerous, intermittent, thinly bedded units of unconsolidated sandy silt, sand, gravelly-sand, and gravel. The stratigraphy was said to be typical for basin fill/alluvial fan depositional cycles (Environmental Science & Engineering, Inc., 1996).

The federal Natural Resources Conservation Service mapped the soils in the area as Mimbres-Glendale associate (MG).

> *The Mimbres series consists of deep, well-drained soils. These soils formed in moderately fine textured recent alluvial sediments on alluvial fans and in broad waterways. Slope is 0 to 3 percent…. The vegetation is mid and short grasses, creosotebush, chamiz, and mesquite…. Mibres soils are moderately slowly permeable (Neher and Bailey, 1976).*

The Nickel-Tencee (NT) association and MG soils dominate the mountain front illustrating the source materials and soil forming processes for the subsurface geologic conditions at the site (Figure 2-1).

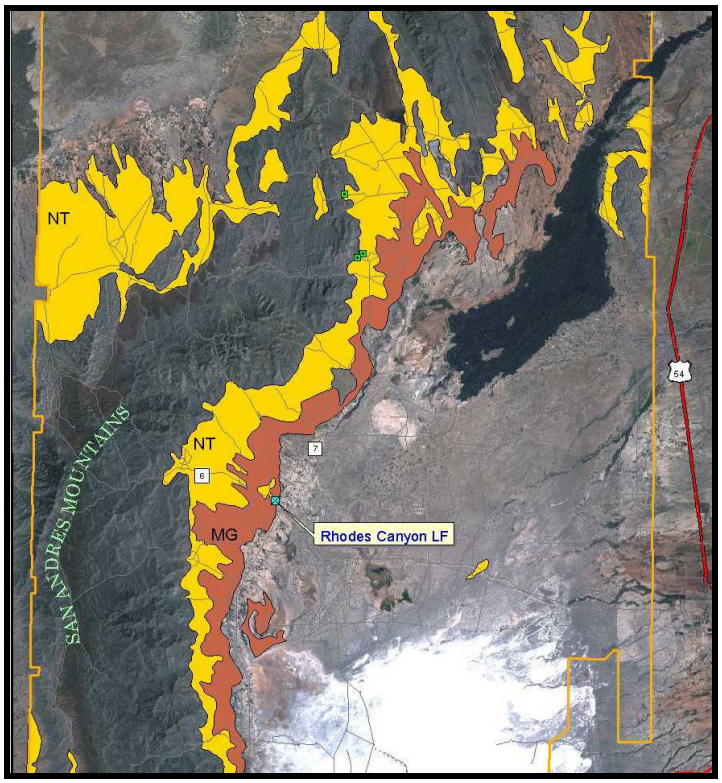

Figure 2-1. Site location relative to dominant soil mapping units.

2.3 Hydrogeology

2.3.1 Surface Water

Surface water in the area is limited to natural arroyos and small ephemeral ponds. Large drainage channels intercept runoff from the foothills, which might otherwise flow thru the site (Figure 2-2). This water is carried away from the channels and beyond the site thru natural arroyos to the north.

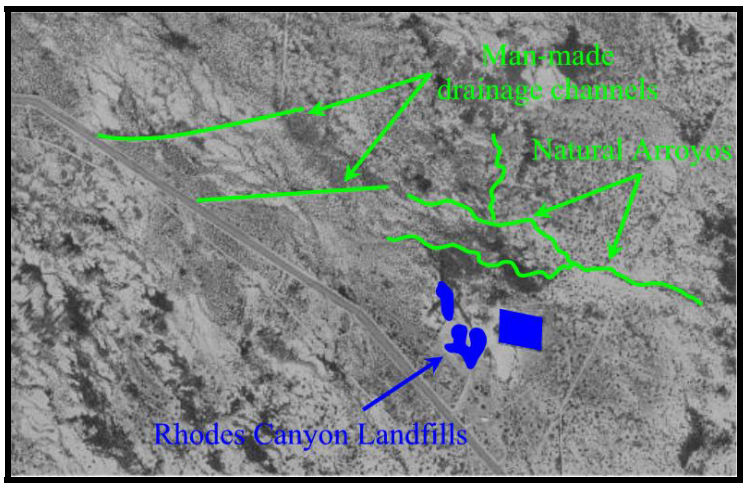

Figure 2-2. Intermittent Streams and Wells at NOP.

2.3.2 Site Hydrogeology

Recharge to the regional aquifer is from precipitation falling on the mountain ranges and alluvial fans, which border the bolson on the west. This precipitation infiltrates the unconsolidated, relatively coarse deposits of the Tertiary/Quaternary alluvial fan deposits and arroyos along the eastern flank of the San Andres Mountains. The resultant groundwater flows toward the center of the Tularosa Basin, generally to the east-southeast.

Dissolved constituents in the groundwater increase with distance eastward from the mountain front, reflecting the increased residence time of groundwater moving from the western bolson margin toward the center of the Tularosa Basin. However, groundwater flow direction within the western Tularosa Basin is presumed to discharge to the south as underflow in the contiguous northern Hueco Basin of western Texas.

Long term monitoring of the wells around the Rhodes Canyon Landfill has demonstrated that the groundwater in the vicinity flows to the southeast. The depth to groundwater at the sites of the wells varies between 71-feet and 80-feet.

The nearest potable water supply well is located at the High Energy Laser System Test Facility more than 30-miles to the south, though potable water is hauled to the site from the Stallion Range Center more than 50-miles to the north.

2.3.3 Groundwater Quality

Long term groundwater monitoring of the site has been conducted semi-annually since the installation of one up-gradient and three down-gradient wells in 1995. The constituents, which were found to exceed the NMWQCC standards, can be attributed to the physical and chemical weathering of geologic materials. These constituents include total dissolved solids, chloride, fluoride, nitrate/nitrite as N, sulfate, iron, strontium, and sodium. The results indicate that the presence or influence of contaminated leachate on those concentrations is minimal.

2.4 Land Use

The White Sands Missile Range covers approximately 3,200 square miles. It serves as an outdoor laboratory for flight and weapons training, large-scale experiments of advanced weapons and space flight systems and development of antimissile defense systems. The range is restricted to military, civilian and contract employees of the U.S. Army and other Department of Defense agencies.

The area occupied by the Rhodes Canyon Landfill may have been previously used for weapons testing prior to the landfill opening in the mid-1950s. Five cluster bombs were reported to have been discovered at the landfill during past field operations (WSMR, 1997). Today the area adjacent to the landfill is used as an instrumentation site.

3.0 SITE INVESTIGATIONS

A RCRA Facility Assessment (RFA) was completed in 1988 and concluded that there was a low potential of release to the groundwater, surface water, air or subsurface gas (Kearney 1988).

A Phase I RCRA Facility Investigation (RFI) was completed in 1992, which consisted of an electromagnetic study to delineate the extent of the debris and a soil gas survey to determine the presence and concentrations of subsurface volatile organic compound (VOC) vapors (ITC 1992). The electromagnetic study revealed the extent of the landfill cell, SWMU-115. The soil gas survey did not detect any VOCs, elevated microbial activity or methane. During the soil gas survey, several items of unexploded ordnance (UXO) were discovered and destroyed in place. The RFI recommended a Class 3 Permit Modification to terminate the RFI/CMS process and installation of a fence around the SWMU for safety reasons associated with the UXO.

The NMED declined to accept the no further action recommendation stated in the Phase I RFI in a letter dated November 20, 1992. They stated:

> *Landfills (or dump sites) that have been used since May 14, 1989 must be closed according to the current Solid Waste Management Regulations, which could involve among other things capping, ground water monitoring, and post-closure care. However, landfills that have been abandoned prior to May 14, 1989 have only to be closed according to the regulations in force at the time, which require no investigation. For this reason, we cannot agree to close out SWMUs 115… without further investigation. Specifically, information is needed to demonstrate that contaminants have not migrated beneath SWMU 115 (Morgon, 1992).*

The NMED restated their denial of the no further action recommendation and asked that additional sampling be conducted beneath SWMU 115 in letters dated January 22, 1993 and July 12, 1993. WSMR responded to NMED's concerns in a meeting September 29, 1993 by indicating that they were evaluating alternatives for closure, including a removal action. Therefore, further investigation of SWMU 115 during the Phase II RFI was not planned as was being suggested by the NMED.

WSMR installed four monitoring wells in March 1995 to characterize the groundwater beneath SWMU 115. Routine groundwater monitoring began later that same year. The wells have been sampled and analyzed semi-annually for an array of compounds that include: water quality parameters, dissolved ions, nutrients, total metals, dissolved metals, dissolved salts, volatile organic compounds, semi-volatile organic compounds, pesticides, herbicides, explosive residues and petroleum hydrocarbons. The monitoring results have not indicated a significant degradation in groundwater quality resulting from the landfills.

Nevertheless, corrective measures were pursued in order to comply with the NMED requirements, Solid Waste Management Regulations and to address visible breeches in the existing landfill covers. Construction of a permanent soil cover on top of SWMUs 114 and 115 was chosen as the presumptive remedy.

An archaeological survey was conducted since construction of the soil cover was near culturally sensitive areas previously identified by Laumbach (1981), Eidenbach et al. (1982), Clifton (1988) and Kirpatrick (1986b). The resulting Historic Property Identification report dated May 1998 concluded that the site was potentially eligible for the National Register of Historic Places and recommended a damage assessment be performed from the impact of the installation of monitoring well RMW-4 (HSR 1998).

A final archeology survey report was submitted in July 1999, which documented the collection and preservation of 457 stone artifacts found in the project area west of RMW-4 (HSR 1999). The survey recommended that an archeologist be present during any earthmoving activities and that an archeological survey be completed prior to any work adjacent to the site.

A corrective measures implementation (CMI) work plan was submitted in March 2002 formally proposing the soil cover as the presumptive remedy for SWMUs 114 and 115. The NMED in February 2003 concurred that WSMR had adequately characterized the landfills and requested that warning signs and perimeter fencing be provided in the final CMI work plan. The CMI work plan was approved by the NMED on October 16, 2003 following a 45 day public review and comment period. No public comments were received by the NMED.

4.0 CORRECTIVE ACTION

4.1 Synopsis of Construction Activities

A natural soil cover was constructed between April and July 2004. The cover was placed over top both SWMUs (114 and 115). The soil cover consisted of approximately 30 inches of native sand and a 6 inch vegetative layer. The fill material was excavated from a borrow area just north of monitoring well, RMW-3. A swale constructed of 40-mil high density polyethylene and medium stone was placed down the center of the cover to channel rainwater off the final grade of cover. The entire area was hydroseeded to promote re-vegetation for erosion control.

The final contours were designed to promote storm water runoff into the swale and away from the landfill. The cover is intended to prevent direct contact with the buried waste and minimize infiltration of storm water. Work in the culturally sensitive area was monitored by an archeologist.

4.1.1 Deviations from Work Plan

The fieldwork generally followed the procedures outlined in the work plan. Where the fieldwork (or this report) deviated from the plan it is discussed on the following pages.

<u>Swale</u> - The work plan (paragraph 4.1.2) indicated that the swale would be approximately 18-feet wide with the sides sloped at 1 : 3 (vertical : horizontal). The construction drawings included in an Appendix to the plan contradicted the text by indicating that 1 : 1 side slopes would be used. During construction the decision was made to use 1 : 1 side slopes. This provided for a wide base at the bottom of the channel, rather than a V-shape, thereby minimizing erosion beneath the swale should the liner be breached over the next 25 years.

The swale dimensions were further altered in the field by reducing its width in order to better secure the liner along its length. A 6-inch trench was cut on either side of the swale to bury the liner ends securely affixing it near the surface (Photograph 4-1). The completed width of the swale was reduced by less than two feet, which will have no measurable affect on its performance.

Photograph 4-1. Improved design for securing swale liner.

Vegetation - The work plan (paragraph 4.1.3) provided for a seed mixture consisting of four different varieties (Table 4-1). The actual seed mixture used (Table 4-2) was slightly different. Blue grama was substituted for Mesa dropseed and the mixture applied per acre varied modestly. The WSMR Range Manager was consulted during negotiations with the seed company and approved the final mixture. The final mixture was based on a compromise between seed availability and the desire to restore the site with native vegetation.

Table 4-1. Original Seed Mixture.

Common Name	Pounds per acre (pure live seed)
Alkali sacatone	1.0
Sand dropseed	0.5
Four-wing saltbush	6.0
Mesa dropseed	0.5

Table 4-2. Actual Seed Mixture Used.

Common Name	Variety	Origin	Pounds per acre (pure live seed)
Alkali sacaton	VNS	NM	0.7
Sand dropseed	VNS	KS	0.4
Four-wing saltbush	HIGH ELEV	NM	4.4
Blue grama	HACHITA	TX	1.5

Security - The work plan (paragraph 4.1.4) specified that warning signs would be posted every 300 feet around the perimeter of the security fence. The actual number of signs purchased and installed was reduced roughly by half in order to meet budget constraints. The original design was considered overly conservative. Additional signs may be posted in the future, should the reduced number seem inadequate.

The proposed fence boundary had been a four sided polygon. The fence boundary as constructed actually has eleven (11) sides. The design was modified to accommodate a larger borrow area and to limit encroachment on undisturbed land. The change in design has had no effect on the fences functionality or purpose.

The original fence design (as detailed in the Appendix to the work plan) called for middle rails and 8 ft copper grounding rods. Both were omitted from the final fence design. The middle rail was unnecessary to provide the structural support required for the intended purpose of the fence. Existing 8-foot chain link fences having a similar design (with no middle rail) were assessed and found to be in very good condition. Designs with the middle rail were found to be the exception and not the rule. Grounding rods were eliminated from the design since the fence was already grounded by the support poles which extend three feet into the earth.

Borrow Area - The design plans showed a borrow area limited to 3.3 acres north of RMW-3. During construction it was determined that the volume of material recoverable from that area would be inadequate to complete the soil cover. Therefore it was decided to expand the borrow area to the south west, nearly doubling its size. The borrow pit was sloped to drain away from the monitoring well and former landfills to allow for infiltration of surface water away from those locations. Expansion of the borrow pit was limited to previously disturbed areas in accordance with the requirements of the WSMR Real Property Planning Board.

Monitoring Well Installation – The CMI work plan included the installation of two new groundwater monitoring wells downgradient of the site. These wells were not installed as part of the activities described in this report, due to the changing of the environmental support contract. Upon installation (expected during early FY05), WSMR intends to notify the NMED of their completion. The new monitoring wells will be sampled annually as indicated in the approved CMI work plan.

4.2 Summary of Significant Construction Activities

The majority of construction activities for this corrective action took place between April and July 2004. The following sections describe the pre-construction, construction and restoration activities.

4.2.1 Pre-construction Activities

A site visit was held with the various WSMR utility services on February 2, 2004 to locate and mark any utilities within the work area. There were no utilities identified within the work area. Another site visit was conducted later the same day by an individual from Human Systems Research, Inc. (HSR) to identify the culturally sensitive areas. An orange fence was erected to demark the areas where a monitor from HSR was required prior to clearing and grubbing (Photograph 4-2).

Photograph 4-2.
Orange fencing demarking culturally sensitive areas.

Employees from the construction company and WSMR's environmental services contactor attended an unexploded ordnance (UXO) awareness course by personnel from WSMR's Explosive Ordnance Disposal (EOD) unit on February 24. Instructions were provided on identifying suspicious objects and contacting EOD for further assistance. The training was critical to conducting the work safely since UXOs had been previously discovered there and the area was strewn with various man made materials from the landfill. Furthermore, the construction activities would likely uncover additional items not visible from the surface. EOD conducted a surface sweep of the work area using all terrain vehicles on March 4, 2004. They found nothing significant and indicated that the area was relatively clear of ordnance on the surface.

A survey crew hired by the construction company began measuring the initial surface elevations on April 6, 2004. Clearing and grubbing of the site began on April 20 (Photograph 4-3). An empty transformer was uncovered during clearing. The transformer tag was removed and compared to WSMR's inventory. In addition, a wipe sample was collected and tested by WSMR's chemistry laboratory for the presence of PCBs. WSMR determined that the transformer had not contained PCBs previously. The transformer was disposed of thru the WSMR scrap yard since it contained no fluids and was not contaminated by PCBs.

Photograph 4-3. Clearing and grubbing of work site.

An archaeologist from HSR monitored the work in culturally sensitive areas to collect information and preserve any artifacts discovered. There findings are included in Appendix A.

All of the material generated by clearing and grubbing (other than the transformer) was placed in surface depressions where solid waste from the former landfills had been exposed. The material consisted of vegetation, surface debris and soil. The final cap was constructed over top of these areas.

After clearing and grubbing was completed, the survey crew installed wooden stakes throughout the area indicating the amount of fill required to meet the design specifications for the cover (Photograph 4-4). Control points were set around the job site perimeter so that the construction crew could easily replace stakes run over by equipment using a standard survey level and rod (Photograph 4-5).

Photograph 4-4.
Wood stakes noting final grade.

Photograph 4-5.
Control Point.

4.2.2 Soil Cover Construction

Construction of the cover began on April 27. Soil was excavated from the borrow area, transported and placed on the landfill by a self propelled elevating scraper (Photograph 4-6). A bulldozer was used to loosen up the borrow material for easy retrieval by the scraper. Once the soil was placed, a sheeps foot vibratory compactor was passed several times over the material to compact the soil (Photograph 4-7). Water was added for compaction and dust control.

Photograph 4-6.
Scraper loading borrow material.

Photograph 4-7.
Sheeps foot vibratory compactor.

Providing a sufficient supply of water was one of the biggest challenges of the project. Initially three supply wells had been considered. They were RC-3, RG and NW-30, in order of preference and proximity to the job site (Figure 4-1). RC-3 was rejected because there was apparently no water well permit with the State for withdrawal of water. A pump was placed in RG, but it produced very little water. Since the first two options were eliminated, and the distance to NW-30 was about 23 miles, a fourth well was considered. This well (Tula gate well)

is also about 23 miles from the site, but it proved to be inadequate to meet the project's needs alone. The two wells (NW-30 and Tula gate) were used for a couple of days before another tenant on the range informed the construction contractor that the water from NW-30 was needed for a mission critical function. They offered another supply which proved substantial enough to meet the project needs. The location of this supply was at the NASA Space Harbor.

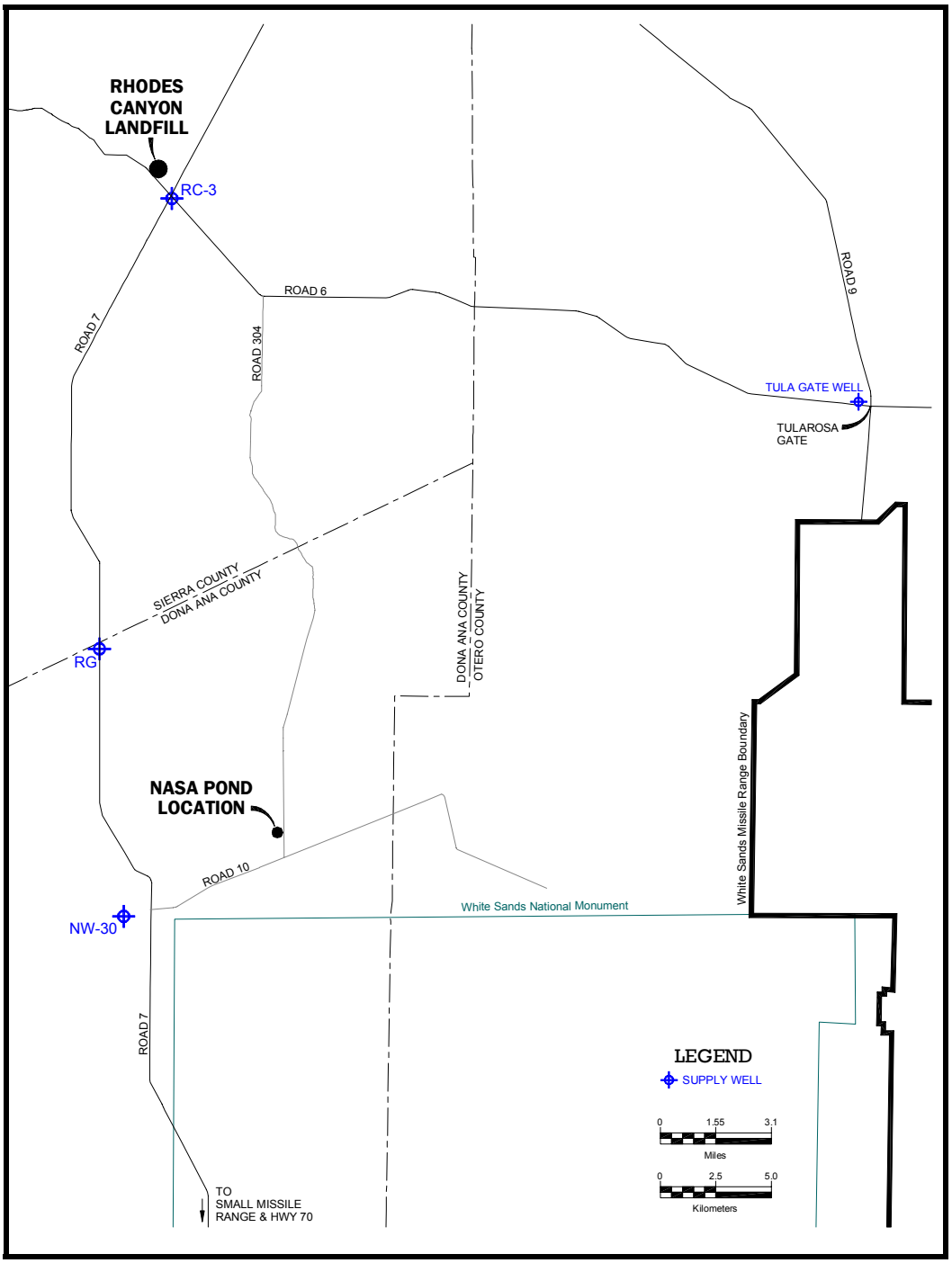

Figure 4-1. Location of Water Supplies.

Within two weeks of the water trucks hauling from the NASA Space Harbor, Range Road 7 began to deteriorate from the added traffic and heavy loads. The damage occurred at previously filled potholes and at points in the road where the culverts were over an estimated 5 mile stretch of highway. WSMR, in response to the worsening road conditions, dropped the speed limit from 55 mph to 35 mph and began extensive road repairs (Photographs 4-8, 4-9 and 4-10).

Photograph 4-8. Road Repairs to Range Road 7.

Photograph 4-9. Traffic Control Measures.

Photograph 4-10. Range Road 7 damage.

The traffic control measures and road repairs improved driving conditions for the water trucks hauling water from the NASA site. Though it did lengthen the travel time and decreased the productivity of the construction crew. The soil was so dry that it could be placed without enough moisture for compaction. The productivity of the crew proved to be directly related to the amount water that could be applied (Photograph 4-11).

Photograph 4-11.
Water truck applying water to soil in borrow pit.

Construction of the soil cover was nearing completion on June 21, when bundles of the new fencing began arriving at the job site (Photograph 4-12). The geotextile liner for the swale arrived June 22 (Photograph 4-13).

Photograph 4-12.
New 8-ft chain link fence.

Photograph 4-13.
Geotextile liner arrives.

Construction of the swale was accomplished by filling and compacting the cover to grade, then cutting out the inverse trapezoidal shape using the scraper (Photograph 4-14). The sides and bottom were cut and smoothed using an articulating grader (Photograph 4-15). The soil at the bottom was compacted again for good measure.

Photograph 4-14.
Scraper cutting swale to grade.

Photograph 4-15.
Grader shaping sides of swale.

Work was suspended for several days at the end of June, when heavy rainfall soaked the site. Conditions were such that working in the saturated soils would be counterproductive. Once the site dried enough for equipment to operate on top of the newly placed soil cover without damaging it, work resumed.

The 60-mil High Density Polyethylene (HDPE) liner had arrived by July 15, 2004 (Photograph 4-16) and installation occurred on July 17 and 18. Prior to laying the liner in the ditch, a narrow channel was cut 12 inches deep along both sides using a ditch witch (Photograph 4-17) to hold it in place (Figure 1-1).

Photograph 4-16. Roll of HDPE Liner.

Photograph 4-17. Ditch witch.

The 60-mil HDPE liner was laid cross-wise in the ditch. Damage to the HDPE liner during installation was immediately repaired by factory trained personnel. The seems were overlapped by 12 inches and sealed using a heat gun (Photograph 4-18). The geotextile liner was placed on top of the HDPE liner to protect it from damage while the medium stone was placed on top (Photograph 4-19).

Photograph 4-18.
Sealing seems of HDPE liner.

Photograph 4-19.
Placing geotextile liner.

The stone was placed using a front end loader (Photograph 4-20). It took several days to fill the swale nearly completely with medium stone (Photograph 4-21).

Photograph 4-20.
Stone being placed by loader.

Photograph 4-21.
Swale filled with stone.

The perimeter fence installation gained speed beginning on July 20, 2004 as the swale installation was wrapping up (Photograph 4-22). Erosion control measures were employed to prevent loss of cover material (Photograph 4-23 and 4-24). Installation of the perimeter fence was finished July 29, 2004 (Photograph 4-25). Hydroseeding was conducted on August 17 and 18 (Photograph 4-26).

The completed soil cover was surveyed by a licensed land surveyor. The as-built drawings and a legal description of the fenced area are included in Appendix B.

On September 3rd, signs were posted at the entrance and along the perimeter fencing prohibiting unauthorized entry.

Photograph 4-22.
Perimeter fencing being erected.

Photograph 4-23.
Silt fencing installed on soil cover.

Photograph 4-24.
Silt fencing along soil cover perimeter.

Photograph 4-25.
Perimeter fencing completed.

Photograph 4-26. Hydroseeding.

4.3 Waste Management

Solid waste generated during the construction activities was limited to the following:

Empty Transformer – The empty transformer was tested and found to contain no PCBs. It was recycled as scrap metal.

Diesel Contaminated Soil – During refueling of vehicles and equipment diesel fuel occasionally dripped from the dispenser onto the ground. The spilt fuel and soil was shoveled into a drum for disposal. The volume of contaminated soil accumulated during the project was approximately 5 gallons. The soil was managed as non-hazardous waste and properly disposed of.

Ordinary trash – Food waste, product wrapping and shipping material and excess construction materials (having no value) were collected and properly disposed of.

4.4 Post-Closure Care

Post Closure Care will be implemented to provide long-term maintenance and monitoring of the soil cover.

The soil cover will be inspected quarterly by trained personnel. The personnel will be examining the cover to ensure that there are no signs of human or animal disturbance, that no solid waste has been uncovered and that water is not ponding over the landfill cells. The inspection will be documented in a bound logbook noting the personnel onsite and any observations.

Analytical data gathered during groundwater monitoring events will be evaluated for deviations from the established background levels.

At a minimum, the following tasks will be completed in the quarterly cap inspection:

1. Verify that the gate is closed and locked.
2. Walk the fence and check for breaches or deterioration in construction
3. Ensure that signage remains in tact and legible.
4. Confirm that the monitoring wells are locked and well covers are tight.
5. Inspect the landfill cap for traffic, vegetation, erosion, animal activity, settlement and waste protrusion.

Restoration of the soil cover will be performed if landfilled material becomes exposed or water begins ponding over the cells.

The Post Closure Care of the soil cover will continue until groundwater monitoring is deemed no longer necessary through the use of five-year reviews (not to exceed 25-years). Upon receiving no further action (NFA) approval from NMED, groundwater monitoring and Post Closure Care will cease and the White Sands Missile Range will prepare a Corrective Measures Completion Report.

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APPENDIX A

Archaeological Report

White Sands Missile Range Environmental Document
Archaeology Report No. 482

FINAL

AN ARCHAEOLOGICAL MONITOR OF SITE LA 121,626 AT THE RHODES CANYON LANDFILL, RHODES CANYON RANGE CENTER, WHITE SANDS MISSILE RANGE, SIERRA COUNTY, NEW MEXICO

September 2004

BAE SYSTEMS

White Sands Missile Range
Environment and Safety Directorate
White Sands Missile Range, New Mexico 88002

This document contains information related to the location and character of historic resources and is EXEMPT FROM MANDATORY DISCLOSURE OR PUBLIC RELEASE UNDER FOIA (5 U.S.C. Para. 552(b)(3) (1970) by authority of the National Historic Preservation Act of 1966, as amended (PL 89-665 §304) and the Archaeological Resources Protection Act (PL 96-95 §9). This information shall only be used in compliance with applicable state and federal laws and regulations, including the New Mexico Cultural Properties Act of 1978 [NMSA 1978, §§18-6-1 to 18-6-17 (Repl. Pamp. 1987 and Cum. Supp. 1990)], Federal Regulation 36-CFR-800, and the Archeological Resources Protection Act of 1979 (16 U.S.C. §470aa et. seq.).

The views, opinions, and findings contained in this report are those of the authors and should not be construed as an official department of defense position, policy, or decision, unless so designated by other documentation.

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1. AGENCY USE ONLY (LEAVE BLANK)	**2. REPORT DATE** September 2004		**3. REPORT TYPE AND DATES COVERED** Final
4. TITLE AND SUBTITLE An Archaeological Monitor of Site LA 121,626 at the Rhodes Canyon Landfill, Rhodes Canyon Range Center, White Sands Missile Range, Sierra County, New Mexico			**5. FUNDING NUMBERS**
6. AUTHOR(S) David T. Kirkpatrick			
7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(ES) Human Systems Research, Inc. P.O. Drawer 728 Las Cruces, NM 88004			**8. PERFORMING ORGANIZATION REPORT NUMBER** HSR 2003-46-B
9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES) Department of the Army U.S. Army White Sands Missile Range 100 Headquarters Avenue ATTN: CSTE-DTC-WS-ES-ES White Sands Missile Range, NM 88002			**10. SPONSORING/MONITORING AGENCY REPORT NUMBER** WSMR Project Number *482*
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION AVAILABILITY STATEMENT			**12b. DISTRIBUTION CODE**
13. ABSTRACT (MAXIMUM 200 WORDS) In April 2004, Site LA 121,626 was monitored during remediation activities at the Rhodes Canyon landfill. A road grader removed vegetation and leveled the area around Locus E and Locus G. These areas had been previously excavated during a data-recovery program. The archaeological monitor was checking for subsurface features and charcoal deposits that would be exposed during grading work. No subsurface features or charcoal were found. The western area of Site LA 121,626 were not disturbed during construction activities.			
14. SUBJECT TERMS Archaeological monitor, Jornada Mogollon, Landfill remediation, Sierra County, New Mexico, White Sands Missile Range **MARKS Number 200-4**			**15. NUMBER OF PAGES** *20* **16. PRICE CODE**
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FINAL

AN ARCHAEOLOGICAL MONITOR OF SITE LA 121,626 AT THE RHODES CANYON LANDFILL, RHODES CANYON RANGE CENTER, WHITE SANDS MISSILE RANGE, SIERRA COUNTY, NEW MEXICO

by
David T. Kirkpatrick

Prepared for
BAE SYSTEMS
White Sands Missile Range, New Mexico

Under
Contract No. DAAD07-95-C-0125
Work Assignment Order No. 10-YY
Task Order No. 04-06

Submitted by
Human Systems Research, Inc.
Tularosa, New Mexico

NMCRIS Project/Activity No. 89871
HSR Report No. 2003-46B
White Sands Missile Range Project No. 482

September 2004

September 15, 2004

Mr. Leonard Habel
North Wind
PO Box
Building 126E
White Sands Missile Range

Subject: Archaeological Monitor at Rhodes Canyon Landfill
WSMR Project No. 482
NMCRIS Project No. 89871
Human Systems Research Report 2003-46B

Dear Mr. Habel:

This is a letter report on the monitoring activities conducted at the Rhodes Canyon Landfill by archaeologists from Human Systems Research, Inc. (HSR). The Rhodes Canyon landfill is located west of the Rhodes Canyon Range Center in the midrange area of White Sands Missile Range (Figure 1). The White Sands Missile Range was required under the New Mexico Hazardous Waste Act and its corresponding regulations (20 NMAC 4.1) to take corrective measures at the site in order to minimize potential releases to the environment or risks to human health. The corrective measures employed were the construction of a natural soil cover (or cap) and erection of a security fence. The shape of the landfill and the design of the cap were such that it appeared to encroach on a culturally sensitive area. The area identified as LA 121,626 was later confirmed to be inside the western boundary of the proposed Rhodes Canyon Landfill cap.

Site LA 121,626 had been previously excavated by archaeologists from HSR in January and February 1999 as part of the remediation effort (Laumbach and Russell 1999). It was recommended that a monitor be present when earth-disturbing activities occurred in those areas of the site that would be covered by the soil cap. The monitor was recommended because the site has the potential for subsurface hearth features. These features could have charcoal present. The charcoal could be used to

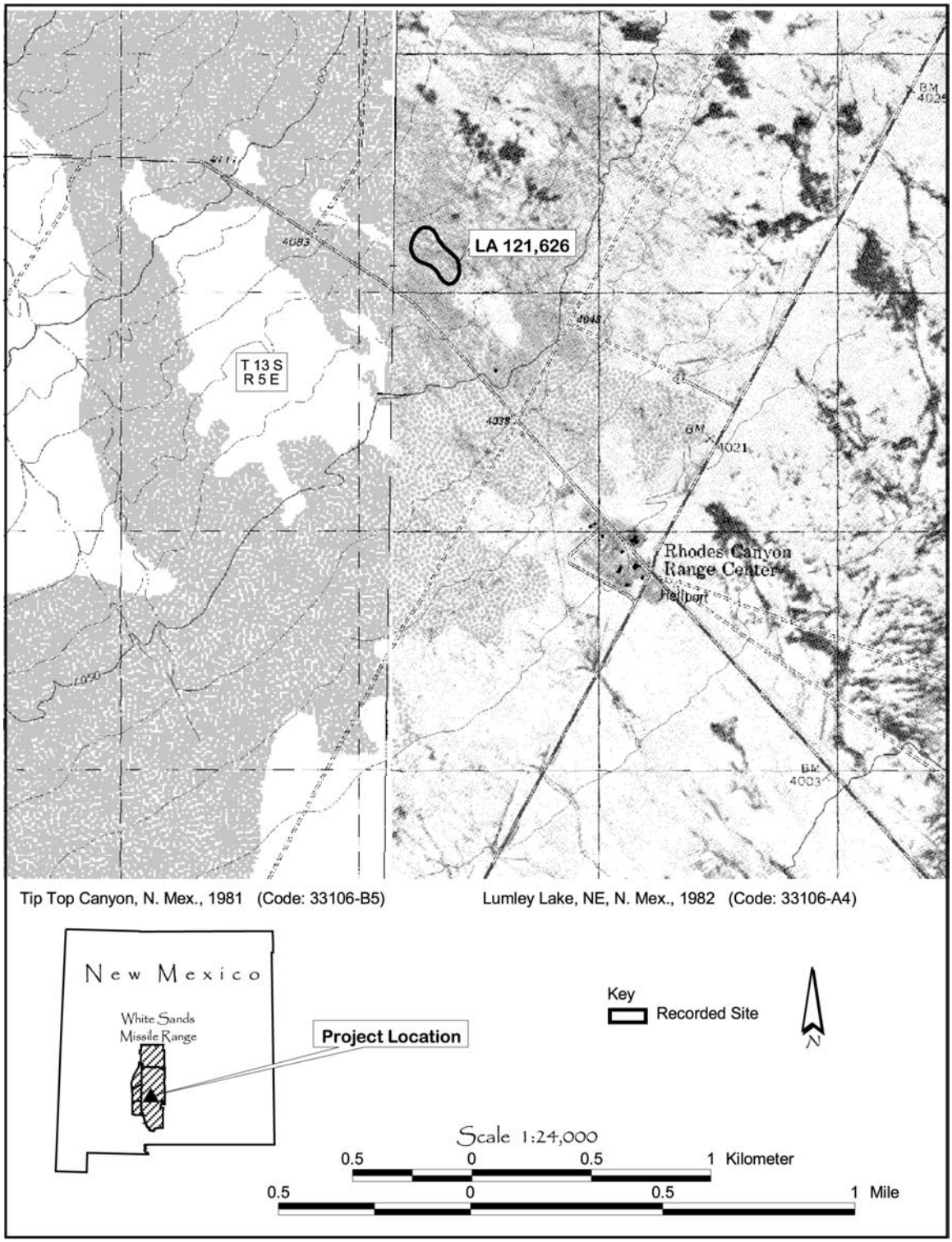

Figure 1. Location of Site LA 121,626 near Rhodes Canyon Range Center.

obtain a radiocarbon date that would then indicate when the site was occupied. In addition, the charcoal could provide information on native vegetation and plants used by the inhabitants of the site. If hearths and charcoal deposits were exposed during construction activities, the archaeological monitor could collect the samples for these studies.

The landfill remediation work involved grubbing out existing vegetation, blading the area level, placing a soil cap over the landfill, and installing a protective fence.

On February 2, 2004, William Russell, archaeologist with HSR, inspected the site and identified the eastern boundary. Based on this information, Len Habel, Senior Environmental Engineer, North Wind, Inc., determined that the landfill work would extend west of the eastern boundary of the site. Prior to the earth-disturbing activities, an orange plastic fence was erected east of the site boundary by Benny Flores of North Wind. This protected the site while earth-disturbing activities occurred in the non-site areas of the landfill.

While the eastern part of the site is outside the actual landfill, the western edge of the soil cap or mound would extend into the site area. Consequently, this area had to be cleared of vegetation and leveled prior to the placing of fill for the cap. No subsurface excavations were going to be conducted in the site area, just the placing of the soil cap over the cleared area.

On April 26, 2004, David T. Kirkpatrick arrived at the site to begin the monitoring activities. He walked over the site to familiarize himself with the site, locations of excavation units, features, and the landform of the area. He met with the operator of the road grader from Morrow Enterprises, Inc. who was grubbing out the vegetation and leveling the area. A protocol was agreed upon whereby the monitor would walk approximately 10 m behind the grader. If the monitor found anything, he would flag it and let the operator know to avoid it on the return path.

The western boundary of the landfill was marked by stakes and plastic flagging tape. A map of the project area (Figure 2) was provided by Len Habel, who also photographed the monitoring activities (Figures 3-10). The area north of the monitor area had been previously cleared and leveled. The grader operator began by clearing a path from the north, going south along the flagged line, which turned to the southeast. Once the grader operator ended the path at the cleared area to the southeast of the site, he turned the grade around and went back up the line adjacent to the path that had just been cleared. This procedure continued until all the vegetation had been removed and the area leveled.

Special attention was given to the areas around Locus C, Locus E, and Locus G where lithic debitage had been recovered from the excavation units (Laumbach and Russell). No subsurface artifacts or features were exposed in these loci during the earth-disturbing activities.

On the north side of Locus E was a surface scatter of cobbles. The low area had been subject to erosion by water. One of the cobbles had the general shape of a one-hand mano, but it was heavily covered with calcium carbonate. Although there were two flat

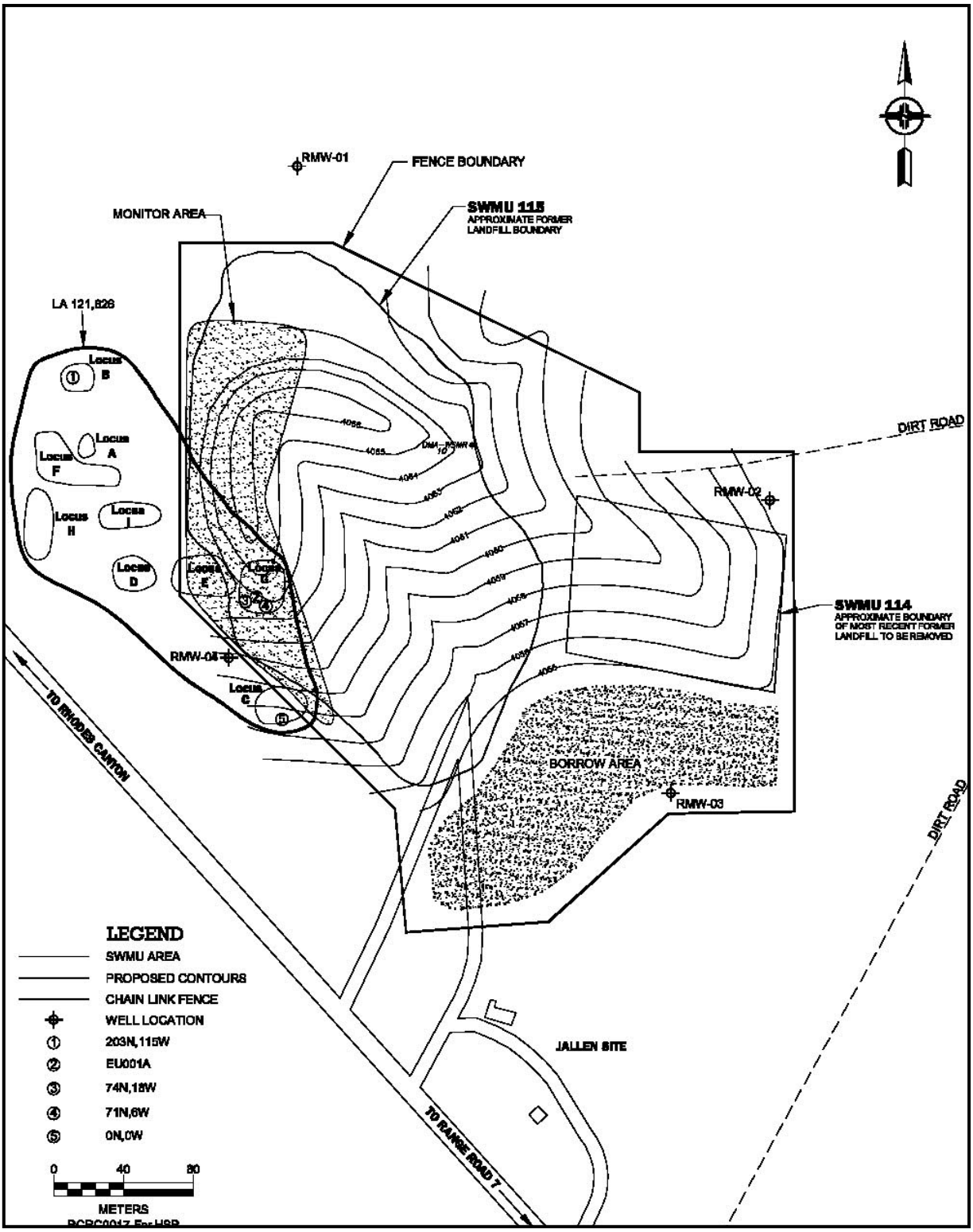

Figure 2. Location of Site LA 121,626 and Rhodes Canyon landfill.

areas that looked like grinding surfaces, the carbonate build-up prevented making identification. The cobble was collected and a UTM coordinate was obtained on the location with a Trimble GPS receiver. Unfortunately, none of the UTM coordinates taken by North Wind personnel that day had saved.

The cobble was washed with 10 percent muriatic acid, dissolving the calcium carbonate that covered the cobble. With the calcium carbonate gone, it was possible to see the single grinding surface on the cobble, a one-hand mano (Figure 11). The mano is a fine-grained sandstone that has been burned. As a result of the burning, areas of the mano have a reddish color. The convex grinding surface measures 6 cm by 7 cm. The mano measures 10 cm by 7.5 cm by 6.5 cm. Some erosion and cracking of the mano has occurred due to the burning.

During the fencing phase of the project, the contractor needed an additional 10 ft (3 m) west of the monitored area. The additional area was needed as a work zone to erect the perimeter fence. On July 9, 2004, William Russell monitored the grubbing and leveling of a 10-ft wide area. No artifacts, features, or charcoal were observed in this area.

In summary, the landfill remediation activities focused on all of Locus E and Locus G and portions of Locus C of Site LA 121,626. These areas were monitored for the potential discovery of subsurface hearths and charcoal deposits. None were found during the grading and leveling activities. The western portion of Site LA 121,626 was not impacted during the construction activities. An updated site form is attached. The construction crew acted in a very professional manner to stay within the designated areas of activity.

If you have any questions or comments, please contact me at 524-9456.

References Cited

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Sincerely,

David T. Kirkpatrick, Ph.D., RPA
Associate Director

Figure 3. West boundary of the monitor area with landfill at left, looking southeast.

Figure 4. Area north of Locus E and G, looking northwest.

Figure 5. Southern portion of Locus G, looking south.

Figure 6. Overview of Locus G, looking south

Figure 7. Road grader at south half of Locus G, looking east.

Figure 8. Area north of Locus E and G, looking east.

Figure 9. Graded area north of RMW-04 monitor well, looking south.

Figure 10. Graded area at Locus E, with western boundary at left, looking north.

Figure 11. Mano from Locus E, Site LA 121,626.

1. IDENTIFICATION & OWNERSHIP

LA Number: 121626 (contact ARMS for site registration) ☒ **Site Update**? (complete at least Sections 1-4)

Site Name(s): _____

Other Site Number(s): **Agency Assigning Number:**

_____ _____

_____ _____

_____ _____

Current Site Owner(s): Department of Army, White Sands Missile Range

Site Type: _____ **Occupation Type:** _____

2. RECORDING INFORMATION

NMCRIS Activity No.: 89871 **Field Site Number:** _____

Site Marker? ☐ (specify ID#): _____

Recorder(s): David T. Kirkpatrick

Agency: Human Systems Research **Recording Date (dd-MMM-yyyy):** 26 April 2004

Site Accessibility (choose one): ☒ accessible ☐ buried (sterile overburden) ☐ flooded ☐ urbanized ☐ not accessible

Surface Visibility (% visible; choose one): ☐ 0% ☐ 1-25% ☐ 26-50% ☐ 51-75% ☐ 76-99% ☐ 100%

Remarks: _____

Recording Activities:
- ☐ sketch mapping
- ☐ instrument mapping (e.g., total station mapping)
- ☐ surface collection (controlled or uncontrolled)
- ☐ in-field artifact analysis
- ☐ other activities (specify): _____
- ☒ photography
- ☐ shovel or trowel tests; probes
- ☐ test excavation
- ☐ excavation (data recovery)

Description of Analysis or Excavation Activities: _____

Photographic Documentation: White Sands Missile Range Catalog 26 April 2004 Digital by Len Habel

Surface Collections (choose one):
- ☐ no surface collection
- ☐ uncontrolled surface collection
- ☒ collections of specific items only
- ☐ controlled (sample: <100%)
- ☐ controlled (complete: 100%)
- ☐ other method (describe): _____

Records Inventory:
- ☒ site location map
- ☐ sketch map(s)
- ☐ instrument map(s)
- ☐ excavation, collection, analysis records
- ☐ photos, slides, and associated records
- ☒ other records: **map showing site location and area monitored**
- ☒ field journals, notes
- ☐ NM Historic Building Inventory form

Repository for Original Records: Human Systems Research

Repository for Collected Artifacts: White Sands Missile Range

3. CONDITION

Archaeological Status: ☒ surface collection ☐ test excavation ☐ partial excavation ☐ complete excavation

Disturbance Sources: ☐ wind erosion ☐ water erosion ☐ bioturbation ☐ vandalism ☐ construction/land development

☒ other source (specify): after a data recovery program, the east and southeastern area of the site were bladed level for capping the Rhodes Canyon Landfill with soil and erecting a protective fence around the capped landfill.

Vandalism: ☐ defaced glyphs ☐ damaged/defaced building ☐ surface disturbance ☐ manual excavation ☐ mechanical excavation ☐ other vandalism (specify): _____

Percentage of Site Intact (choose one): ☐ 0% ☐ 1-25% ☐ 26-50% ☒ 51-75% ☐ 76-99% ☐ 100%

Observations on Site Condition: The remaining portions of the site are in good shape but it has been excavated as part of the data recover program. It is possible that subsurface deposits such as small hearth features with charcoal may still be present.

4. RECOMMENDATIONS (for Performer/Recorder use only)

National Register Eligibility (choose one): ☐ eligible ☐ not eligible ☒ not sure

Applicable Criteria: ☐ (a) ☐ (c) ☐ (b) ☒ (d)

Basis for Recommendation: A "Not Determined" recommendation was made by Elizabeth Oster on 1 March 2000.

Assessment of Project Impact: The current project does not impact the western portion of the site (see site map).

Treatment Recommendations: Avoid and consult on any future projects in the site area.

5. SHPO CONSULTATIONS (for SHPO and Sponsor use only)

Sponsor NR Determination: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

Sponsor Staff: _____ **Date (dd-MMM-yyyy):** ___ (day) ___ (month) ___ (year)

Sponsor Remarks: _____

SHPO NR Concurrence: ☐ eligible ☐ not eligible ☐ not determined **Applicable Criteria:** ☐ (a) ☐ (b) ☐ (c) ☐ (d)

HPD Staff: _____ **Date (dd-MMM-yyyy):** ___ (day) ___ (month) ___ (year) **HPD Log No:** _____

Register Status: ☐ listed on National Register ☐ listed on State Register ☐ formal determination of eligibility

State Register No.: _____

SHPO Remarks: _____

6. LOCATION

Source Graphics:

☒ USGS 7.5' (1:24,000) topo maps ☐ rectified aerial photos [Scale: _____]

☐ other topo maps [Scale: _____] ☐ unrectified aerial photos [Scale: _____]

☐ GPS unit GPS accuracy (choose one): ☐ < 1.0 m ☐ 1-10 m ☐ 10-100 m ☐ >100 m

☐ other source (describe): _____

UTM Coordinates (@ center of site; at least one set of coordinates required):

Map-based Coordinates Datum: NAD27 **Zone:** **E:** _____ **N:** _____

GPS-based Coordinates Datum: NAD27 **Zone:** **E:** _____ **N:** _____

Directions to Site: _____ **In highway R-O-W?** ☐

Town (if in city limits): _____ **State:** NM **County:** _____

USGS Quadrangle Name	Date	USGS Code
_____	____	_____
_____	____	_____

PLSS Meridian	Unplatted	Township	Range	Section	¼ Sections			Protracted?
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐
New Mexico	☐	T _____	R _____	__	_____	_____	_____	☐

7. PHYSICAL DESCRIPTION

Site Dimensions: _____ **x** _____ meters **Basis for Dimensions** (choose one)**:** ☐ estimated ☐ measured

Site Area: _____ sq m **Basis for Area** (choose one)**:** ☐ estimated ☐ measured **Elevation:** _____ feet

Site Boundaries Complete? (choose one)**:** ☐ Yes ☐ No (explain): _____

Basis for Site Boundaries: ☐ distribution of archeological features & artifacts ☐ modern features or ground disturbance
☐ property lines ☐ topographic features ☐ other (specify): _____

Depositional/Erosional Environment: ☐ alluvial ☐ aeolian ☐ colluvial ☐ residual ☐ no deposition (on bedrock)
☐ other process (describe): _____

Stratigraphy & Depth of Archeological Deposits (choose one)**:** ☐ unknown/not determined
☐ no subsurface deposits present ☐ subsurface deposits present ☐ stratified subsurface deposits present

Estimated Depth of Deposits: _____

Basis for Depth Determinations: ☐ estimated ☐ shovel/trowel tests ☐ core/auger tests ☐ excavations
☐ road or arroyo cuts ☐ rodent burrows ☐ other observations (describe): _____

Observations on Subsurface Archeological Deposits: _____

Local Vegetation (list species in decreasing order of dominance)**:**
Overstory: _____
Understory: _____

Vegetation Community (choose one or two): ☐ forest ☐ woodland ☐ grassland ☐ scrubland ☐ desert scrubland ☐ marshland
☐ other community (specify): _____

Topographic Location:

	☐ bench	☐ dune	☐ low rise	☐ ridge
☐ alluvial fan	☐ blowout	☐ flood plain/valley	☐ mesa/butte	☐ rockshelter
☐ arroyo/wash	☐ canyon rim	☐ foothill/mountain front	☐ mountain	☐ saddle
☐ badlands	☐ cave	☐ hill slope	☐ open canyon floor	☐ talus slope
☐ base of cliff	☐ cliff/scarp/bluff	☐ hill top	☐ plain/flat	☐ terrace
☐ base of talus slope	☐ constricted canyon	☐ lava flow (malpais)	☐ playa	

☐ other location (describe): _____

Observations on Site Setting: _____

8. ASSEMBLAGE DATA

Assemblage Content (all components)**:**

Lithics:

- ☐ lithic debitage
- ☐ chipped-stone tools
- ☐ diagnostic projectile points
- ☐ non-local lithic material
- ☐ stone-tool manufacturing items (cores, hammerstones, etc.)
- ☐ ground-stone tools
- ☐ other stone tools

Prehistoric Ceramics

- ☐ whole ceramic vessels
- ☐ diagnostic ceramics
- ☐ other prehistoric ceramics

Historic Artifacts:

- ☐ diagnostic glass artifacts
- ☐ other glass artifacts
- ☐ diagnostic metal artifacts
- ☐ other metal artifacts
- ☐ whole ceramic vessel
- ☐ diagnostic ceramics
- ☐ other historic ceramics

Other Artifacts and Materials:

- ☐ bone tools
- ☐ faunal remains
- ☐ macrobotanical remains
- ☐ perishable artifacts
- ☐ ornaments
- ☐ figurines
- ☐ mineral specimens
- ☐ architectural stone
- ☐ burned adobe
- ☐ fire-cracked rock/burned caliche

☐ Other items (specify): _____

Assemblage Size (all components)**:** ~~ESTIMATED FRE~~QUENCY _____

artifact class	0	1s	10s	100s	1000s	>10,000	*Counts (if <100)
lithic artifacts (choose one): (include debitage)	☐	☐	☐	☐	☐	☐	_____
prehistoric ceramics (choose one):	☐	☐	☐	☐	☐	☐	_____
historic artifacts (choose one):	☐	☐	☐	☐	☐	☐	_____
total assemblage size (choose one):	☐	☐	☐	☐	☐	☐	_____

Dating Potential: ☐ radiocarbon ☐ dendrochronology ☐ archeomagnetism ☐ obsidian hydration
☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Assemblage Remarks: _____

9. CULTURAL/TEMPORAL AFFILIATIONS

TOTAL NUMBER OF COMPONENTS DEFINED: 1

COMPONENT #1 (EARLIEST)

Cultural Affiliation: _____ _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records
☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	_____		
Latest Period (if any)**:**	_____	_____	_____

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration
☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

COMPONENT #2

Cultural Affiliation: _____ _____

Basis for Temporal Affiliations (choose one)**:** ☐ not applicable ☐ based on associated chronometric data or historic records

☐ associated diagnostic artifact or feature types ☐ based on analytically derived assemblage data or archeological experience

***Period of Occupation:** (*see NMCRIS Guidelines for valid periods, default occupation dates, and phase/complex names)

	Period Name	Begin Date	End Date
Earliest Period:	_____		
Latest Period (if any)**:**	_____	_____	_____

Dating Status: ☐ radiocarbon ☐ dendrochronology ☐ archaeomagnetism ☐ obsidian hydration

☐ relative techniques (e.g. seriation, diagnostics, etc.) ☐ other methods (specify): _____

Basis for Cultural/Temporal Affiliation: _____

Component Type: _____ _____

Remarks: _____

***Associated Phase/Complex Name(s):** _____

10. FEATURE DATA

(see NMCRIS User's guide for a list of valid feature types)

FEATURE TYPE	Reliable ID ?	# Observed	Assoc. Comp. #s	Feature ID, Notes

Feature Remarks: _____

11. REFERENCES

Written Sources of Information: _____

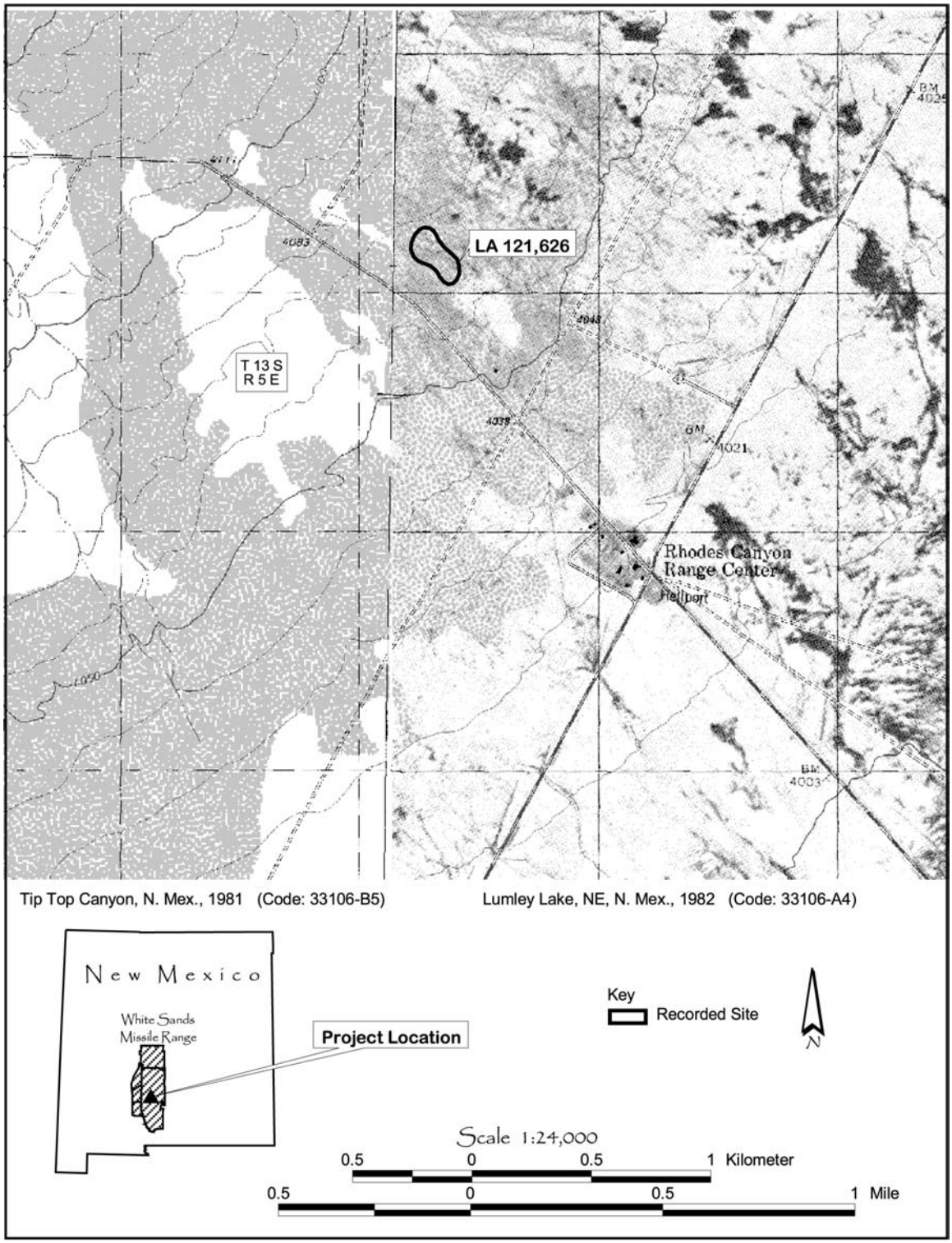
Additional Sources of Information: _____

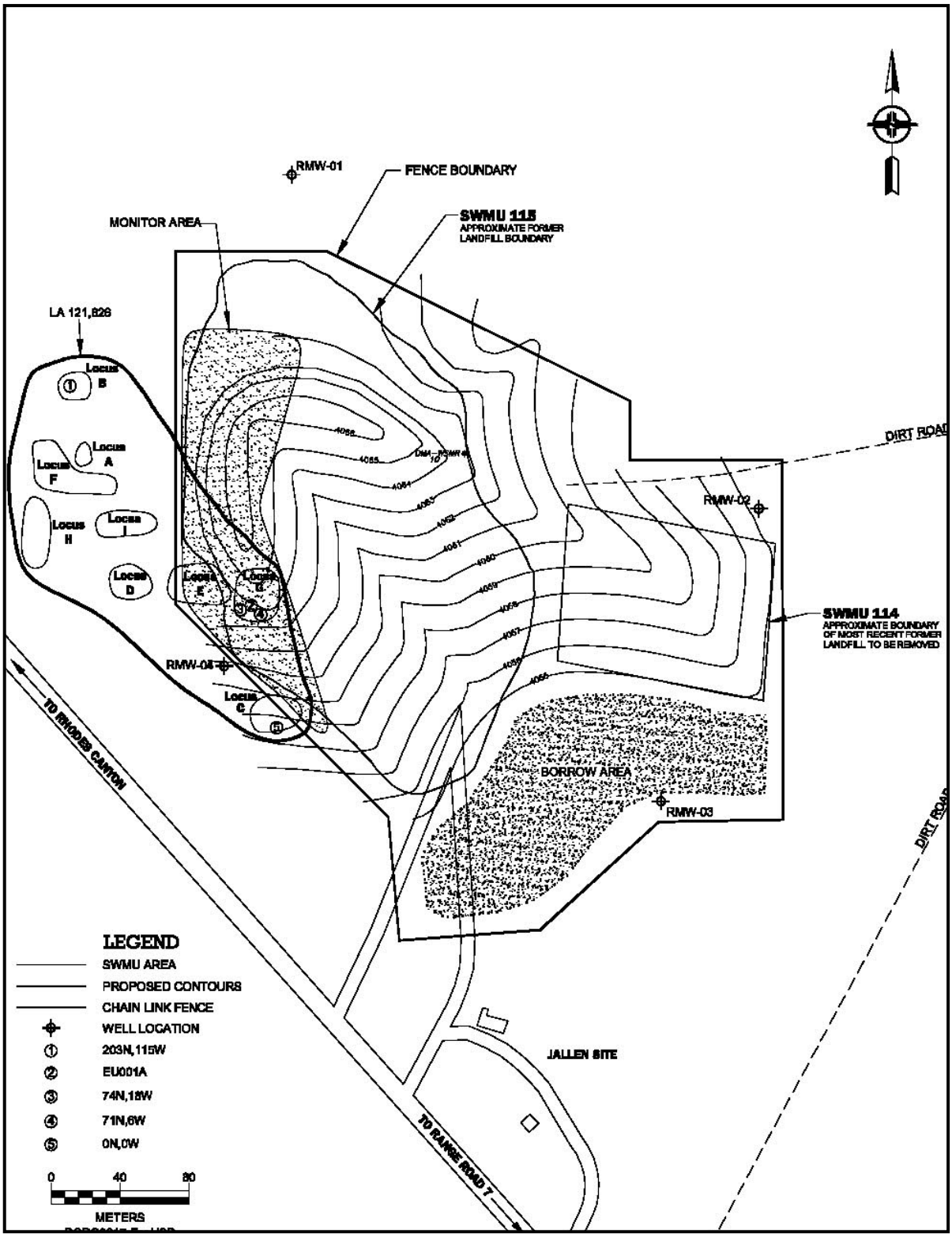
12. NARRATIVE DESCRIPTION

At Site LA 121,626, an archaeological monitor was present during earth-disturbing activities associated with the remediation of the Rhodes Canyon Landfill. The east southeastern areas of the site, including part of Locus C and all of Locus E and Locus G, were graded level for a soil cap and protective fence around the landfill. This earth-disturbing activity was monitored for the presence of subsurface features, concentrations of fire-cracked rock, and charcoal from hearth features. A single one-hand mano was collected from the north part of Locus E. The mano had a single grinding surface with no evidence of pecking or stria on the grinding surface The mano had fire-reddend areas on it. No other artifacts, features or charcoal deposits were found during the grading activity.

13. SITE RECORD ATTACHMENTS

☒ site location map (USGS 7.5' topo; required) ☒ sketch map or site plan (required) ☐ continuation forms?
☐ other materials (itemize): _____

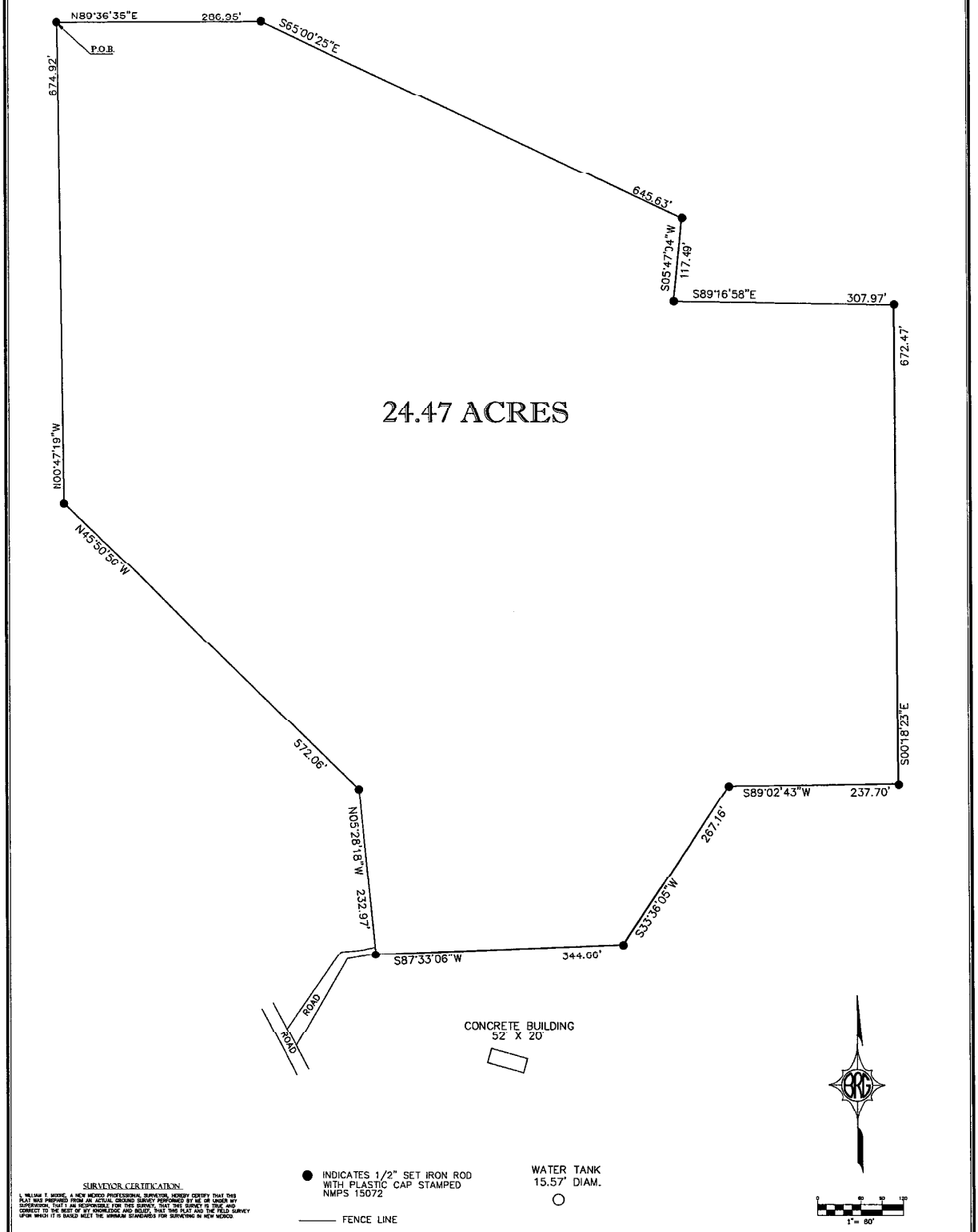

LA 121,626
T 13 S
R 5 E
Rhodes Canyon
Range Center
Heliport
Tip Top Canyon, N. Mex., 1981 (Code: 33106-B5)
Lumley Lake, NE, N. Mex., 1982 (Code: 33106-A4)
New Mexico
White Sands
Missile Range
Project Location
Key
Recorded Site
N
Scale 1:24,000
0.5 0 0.5 1 Kilometer
0.5 0 0.5 1 Mile


RMW-01
FENCE BOUNDARY
MONITOR AREA
SWMU 115
APPROXIMATE FORMER LANDFILL BOUNDARY
LA 121,626
Locus B
Locus A
Locus F
Locus H
Locus I
Locus D
Locus E
Locus G
Locus C
RMW-04
DIRT ROAD
RMW-02
SWMU 114
APPROXIMATE BOUNDARY OF MOST RECENT FORMER LANDFILL TO BE REMOVED
BORROW AREA
RMW-03
TO RHODES CANYON
JALLEN SITE
TO RANGE ROAD 7
LEGEND
SWMU AREA
PROPOSED CONTOURS
CHAIN LINK FENCE
WELL LOCATION
① 203N,115W
② EU001A
③ 74N,18W
④ 71N,6W
⑤ 0N,0W
0 40 80
METERS

APPENDIX B

Asbestos Documents

BOUNDARY SURVEY
RHODES CANYON LANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004



SURVEYOR CERTIFICATION

I, WILLIAM T. MOORE, A NEW MEXICO PROFESSIONAL SURVEYOR, HEREBY CERTIFY THAT THIS PLAT WAS PREPARED FROM AN ACTUAL GROUND SURVEY PERFORMED BY ME OR UNDER MY SUPERVISION, THAT I AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, THAT THIS PLAT AND THE FIELD SURVEY UPON WHICH IT IS BASED MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

WILLIAM T. MOORE, NMPS #15072 DATE

SHEET NO. 1 OF 6

SHEET TITLE: BOUNDARY MAP

PROJECT TITLE: BOUNDARY SURVEY
RHODES CANYON LANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004

BRG BLACKHAM, ROMAN, GUNAJI AND ASSOCIATES, INC.
ENGINEERING - PLANNING - SURVEYING
1203 MESPARK DR. - LAS CRUCES, NM 88005 - (505)525-2278 - (505)523-9518 (FAX)

JOB NO. 04-27
DRAWN BY: T. MOORE
FIELD WORK BY: J. PROVENCIO, T. MOORE

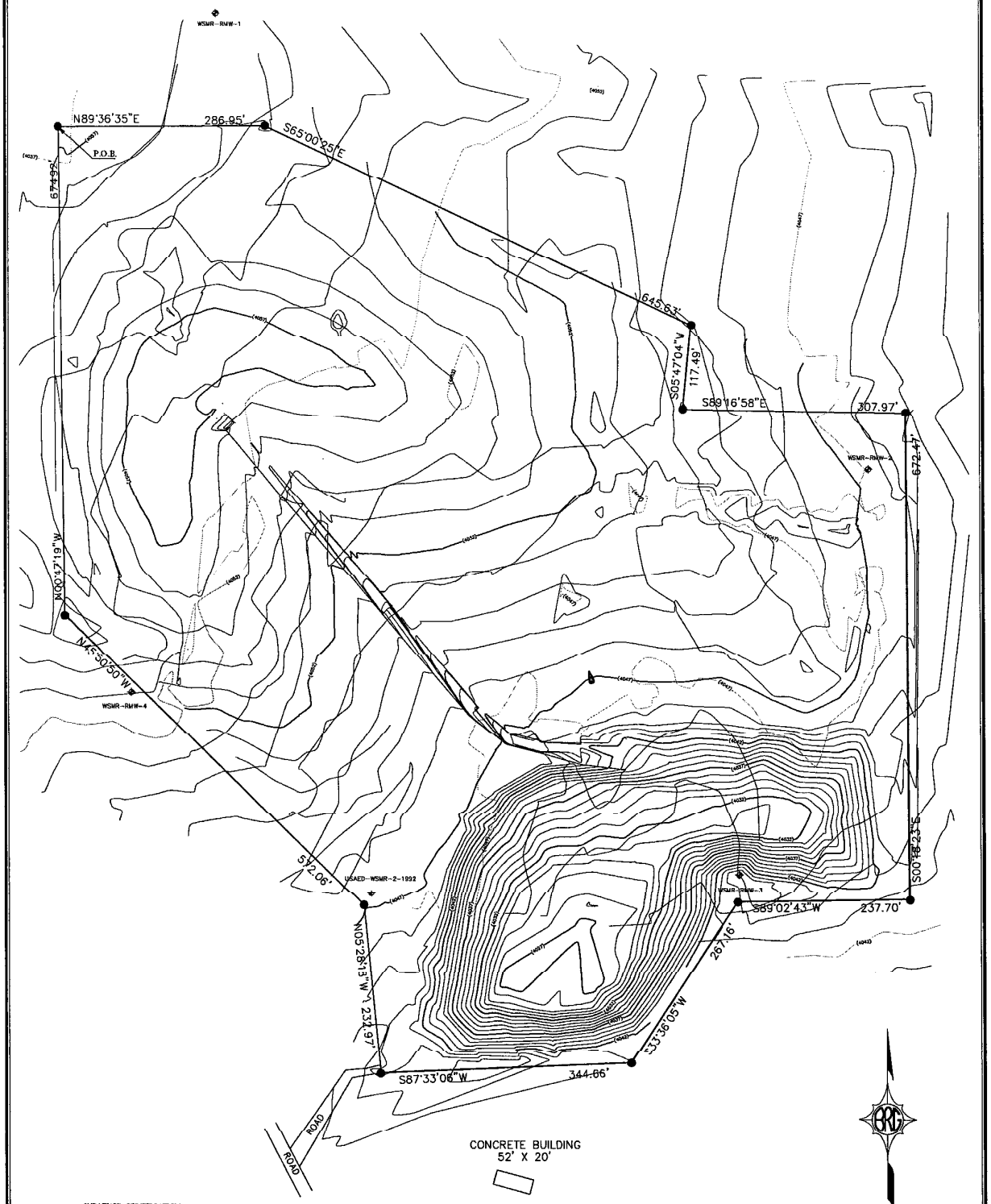
DEVELOPER:

SURVEYOR'S STAMP

REVISIONS

DATE	REVISIONS	BY

TOPOGRAPHIC SURVEY
RHODES CANYONLANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004



SURVEYOR CERTIFICATION

I, WILLIAM T. MOORE, A NEW MEXICO PROFESSIONAL SURVEYOR, HEREBY CERTIFY THAT THIS PLAT WAS PREPARED FROM AN ACTUAL GROUND SURVEY PERFORMED BY ME OR UNDER MY SUPERVISION, THAT I AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, THAT THIS PLAT AND THE FIELD SURVEY UPON WHICH IT IS BASED MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

WILLIAM T. MOORE, NMPS #15072 DATE

PRE CONSTRUCTION CONTOURS
POST CONSTRUCTION CONTOURS
SWALE

0 30 60 90 120
1" = 60'

SHEET NO. 2 OF 6

SHEET TITLE: BOUNDARY MAP

PROJECT TITLE
TOPOGRAPHIC SURVEY
RHODES CANYONLANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004

BRG BLACKHAM, ROMAN, GUINAJI AND ASSOCIATES, INC.
ENGINEERING - PLANNING - SURVEYING
1203 MEDPARK DR. - LAS CRUCES, NM 88005 - (505)525-2278 - (505)523-9538 (FAX)

JOB NO. 04-27
DRAWN BY: T. MOORE
FIELD WORK BY: J. PROVENCIO, T. MOORE

DEVELOPER:

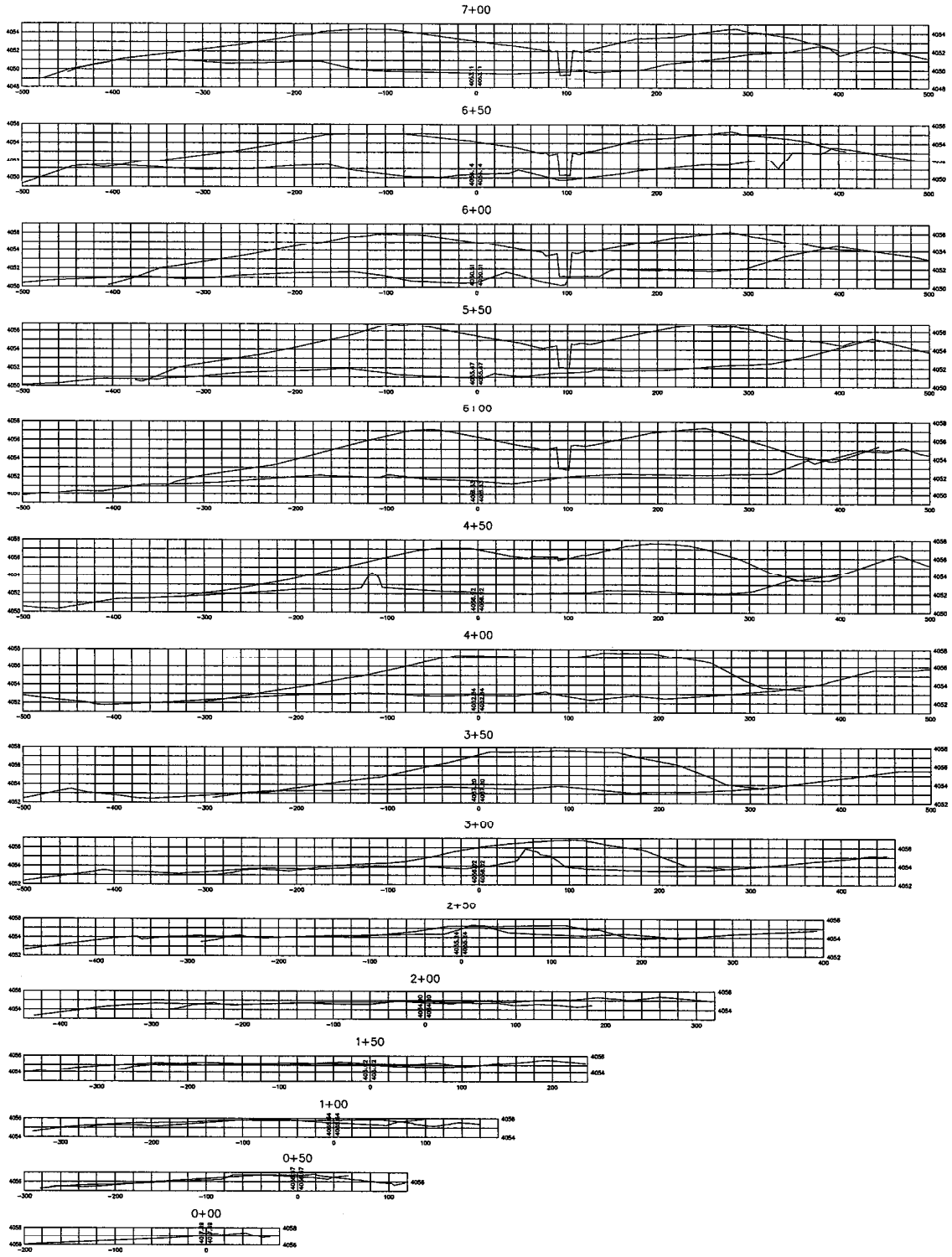
SURVEYOR'S STAMP

REFERENCES-BENCHMARKS

DATE	REVISIONS	BY

CROSS-SECTIONS

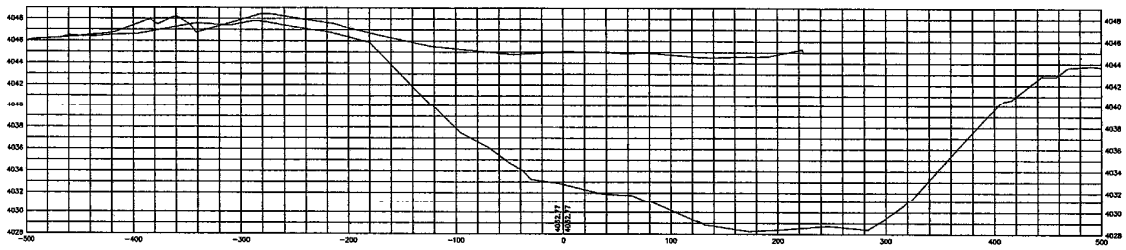
RHODES CANYON LANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004



SHEET NO.	SHEET TITLE	PROJECT TITLE		SURVEYOR'S STAMP	NGS CONTROL BENCH MARKS
3 OF 6	BOUNDARY MAP	DATA SHEET RHODES CANYON LANDFILL WHITE SANDS MISSILE RANGE AUGUST 31, 2004	BRG BLACKHAM, R.ROMAN, GUNAJI AND ASSOCIATES, INC. ENGINEERING · PLANNING · SURVEYING 1203 MEDPARK DR. · LAS CRUCES, NM 88005 · (505)525-2278 · (505)523-9518 (FAX) JOB NO. 04-37 DRAWN BY: T. MOORE FIELD WORK BY: J. PROVENCIO, T. MOORE DEVELOPER:		DATE / REVISIONS / BY

CROSS-SECTIONS
RHODES CANYON LANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004

12+50



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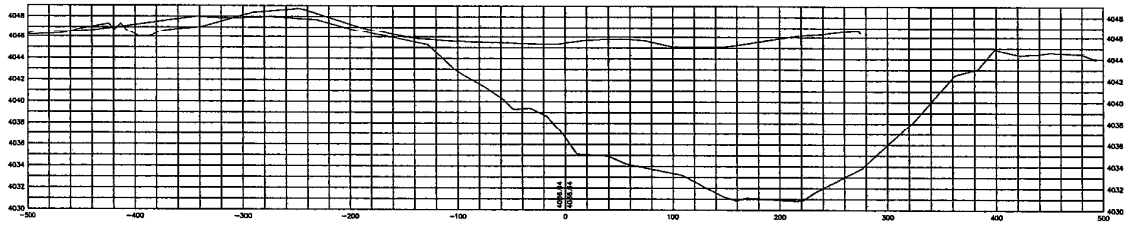

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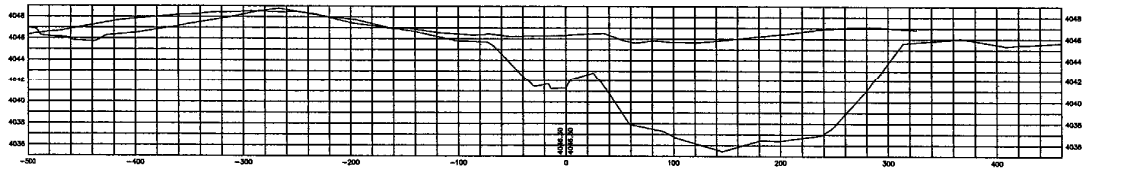

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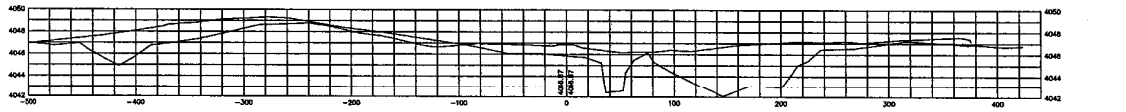

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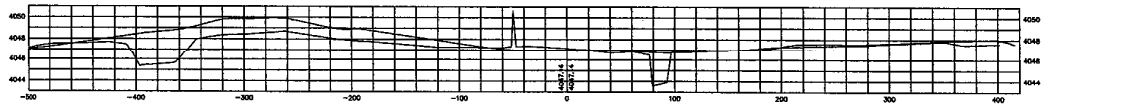

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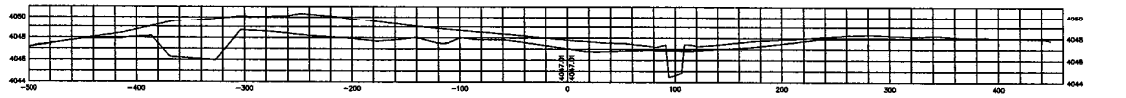

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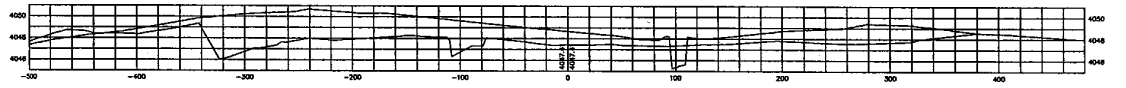

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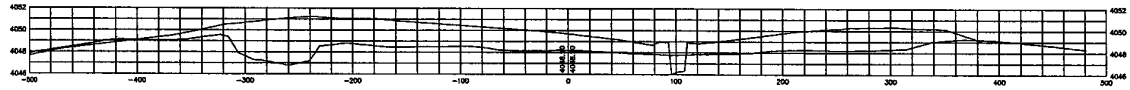

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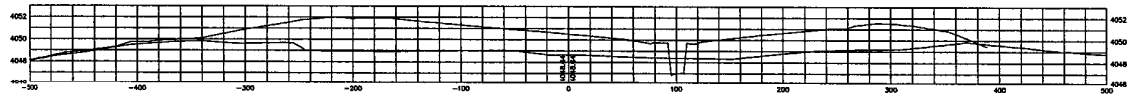

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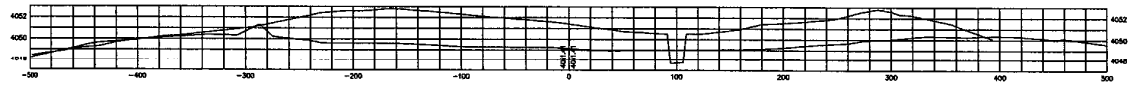

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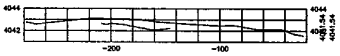
SHEET NO. 4 OF 6	SHEET TITLE: BOUNDARY MAP	PROJECT TITLE: DATA SHEET RHODES CANYON LANDFILL WHITE SANDS MISSILE RANGE AUGUST 31, 2004	BRG BLACKHAM, ROMAN, GUINAJI AND ASSOCIATES, INC. ENGINEERING - PLANNING - SURVEYING 1203 MEDIPARK DR. - LAS CRUCES, NM 88005 - (505)525-2278 - (505)523-9518 (FAX) JOB NO. 04-22 DRAWN BY: T. MOORE FIELD WORK BY: J. PROVENCIO, T. MOORE DEVELOPER:	SURVEYOR'S STAMP	REFERENCES-BENCHMARK DATE / REVISIONS / BY

CROSS-SECTIONS
RHODES CANYON LANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004

15+50



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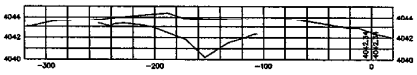

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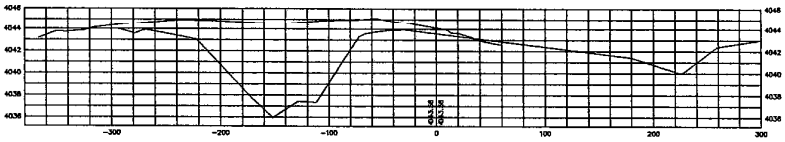

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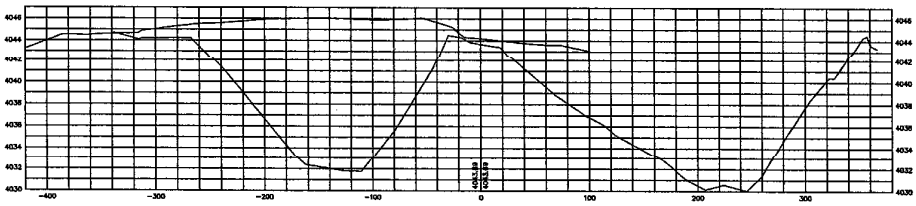

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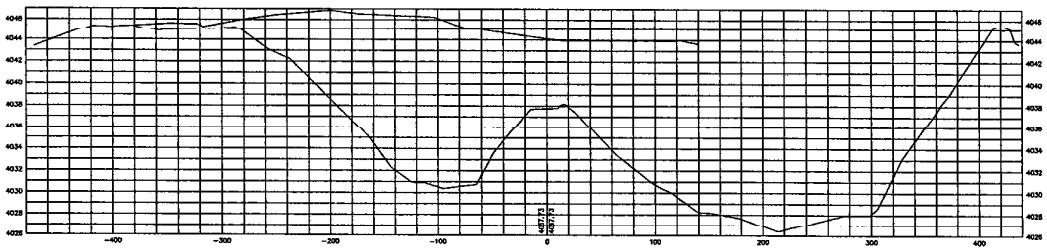

SHEET NO. 5 OF 6	SHEET TITLE: BOUNDARY MAP	PROJECT TITLE: DATA SHEET RHODES CANYON LANDFILL WHITE SANDS MISSILE RANGE AUGUST 31, 2004	BRG BLACKHAM, ROMAN, GUINAJI AND ASSOCIATES, INC. ENGINEERING - PLANNING - SURVEYING 1203 MEDPARK DR. - LAS CRUCES, NM 88005 - (505)525-2278 - (505)523-9518 (FAX) JOB NO. 04-37 DRAWN BY: T. MOORE FIELD WORK BY: J. PROVENCIO, T. MOORE DEVELOPER:	SURVEYOR'S STAMP	REFERENCES-BENCHMARKS DATE / REVISIONS / BY

DATA SHEET
RHODES CANYON LANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004

LEGAL DESCRIPTION OF A 24.47 ACRE PARCEL

A 24.47 ACRE TRACT OF LAND SITUATE WITHIN THE WHITE SANDS MISSLE RANGE MILITARY RESERVATION, SIERRA COUNTY, NEW MEXICO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF THE TRACT HERIEN DESCRIBED, HAVING THE NEW MEXICO CENTRAL STATE PLANE ZONE 2003 COORDINATES: NORTH 790093.11 FEET AND EAST 1564549.49 FEET, MARKED BY A ½"SET IRON ROD;
THENCE N89°36'35"E 286.95 FEET TO AN ANLGE POINT OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE S65°00'25"E 645.63 FEET TO AN ANGLE POINT OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE S05°47'04"W 117.49 FEET TO AN ANGLE POINT OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE S89°16'58"E 307.97 FEET TO THE NORTHEAST CORNER OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE S00°18'23"E 672.47 FEET TO THE SOUTHEAST CORNER OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE S89°02'43"W 237.70 FEET TO AN ANGLE POINT OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE S33°36'05"W 267.16 FEET TO AN ANGLE POINT OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE S87°33'06"W 344.66 FEET TO THE SOUTHWEST CORNER OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE N05°28'18"W 232.97 FEET TO AN ANGLE POINT OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE N45°50'50"W 572.06 FEET TO AN ANGLE POINT OF THE TRACT HERIEN DESCRIBED MARKED BY A ½"SET IRON ROD;
THENCE N00°47'19"W 674.92 FEET TO THE PLACE AND POINT OF BEGINNING, CONTAINING 24.47 ACRES OF LAND, MORE OR LESS.

NGS OPUS SOLUTION REPORT

USER: wtmoore@brgengineering.com DATE: August 30, 2004
RINEX FILE: log0097v.04o TIME: 16:32:25 UTC

SOFTWARE: page5 0407.16 master16.pl START: 2004/04/06 21:28:00
EPHEMERIS: igs12652.eph [precise] STOP: 2004/04/07 01:20:00
NAV FILE: brdc0970.04n OBS USED: 9392 / 9571 : 98%
ANT NAME: TRM4800 # FIXED AMB: 53 / 54 : 98%
ARP HEIGHT: 1.66 OVERALL RMS: 0.018(m)

REF FRAME: NAD83(CORS96)(EPOCH:2002.0000) ITRF00 (EPOCH:2004.2650)

X: -1517616.414(m) 0.010(m) -1517617.070(m) 0.010(m)
Y: -5125323.261(m) 0.009(m) -5125321.885(m) 0.009(m)
Z: 3470278.710(m) 0.006(m) 3470278.603(m) 0.007(m)

LAT: 33 10 6.60177 0.005(m) 33 10 6.60698 0.005(m)
E LON: 253 30 21.21905 0.010(m) 253 30 21.17970 0.009(m)
W LON: 106 29 38.78095 0.010(m) 106 29 38.82030 0.009(m)
EL HGT: 1210.896(m) 0.009(m) 1209.889(m) 0.009(m)
ORTHO HGT: 1233.774(m) 0.027(m) [Geoid03 NAVD88]

PLANE COORDINATES North(Y) East(X) Convergence (deg) Point Scale
UTM(Zone 13): 3670960.788(m) 360686.375(m) -0.81756158 0.99983930
SPC(3002 NM C): 240463.607(m) 477233.236(m) -0.13355162 0.99990639

US NATIONAL GRID DESIGNATOR: 13SCS6068670961(NAD 83)

BASE STATIONS USED

PID DESIGNATION LATITUDE LONGITUDE DISTANCE(m)
DE8222 ABQ1 ALBUQUERQUE USCG1 CORS ARP N345726.546 W1062940.038 198466.9
AF9528 WSMN WHITE SANDS CORS ARP N322425.674 W1062059.350 85526.6
DF5389 TXEL EL PASO RRP2 CORS ARP N314129.438 W1061617.603 165147.1

NEAREST NGS PUBLISHED CONTROL POINT
DS0438 N 238 N330954. W1062910. 840.6

BASE STATION INFORMATION

STATION NAME: abq1 a 2 (Albuquerque USCG1; Albuquerque, New Mexico USA)
ANTENNA: ASH700829.3 SNOW
S/N=1999120103
XYZ -1486206.7360 -5019130.3122 3634977.9326 MON @ 1997.0000 (M)
XYZ -0.0156 -0.0010 -0.0069 VEL (M/YR)
NEU 0.0000 0.0000 0.0000 MON TO ARP (M)
NEU -0.0000 0.0000 0.0877 ARP TO L1 PHASE CENTER (M)
NEU -0.0000 0.0000 0.0598 ARP TO L2 PHASE CENTER (M)
XYZ -0.1133 -0.0073 -0.0501 VEL TIMES 7.2636 YRS
XYZ 0.0000 0.0000 0.0000 MON TO ARP
XYZ -0.0204 -0.0689 0.0502 ARP TO L1 PHASE CENTER
XYZ -1486206.8726 -5019130.3884 3634977.9329 L1 PHS CEN @ 2004.2650
XYZ -0.0003 0.0002 0.0001 + XYZ ADJUSTMENTS
XYZ -1486206.8729 -5019130.3882 3634977.9331 NEW L1 PHS CEN @ 2004.2650
XYZ -1486206.8525 -5019130.3193 3634977.8828 NEW ARP @ 2004.2650
XYZ -1486206.8525 -5019130.3193 3634977.8828 NEW MON @ 2004.2650
LLH 34 57 26.56470 253 30 19.92164 1719.6247 NEW L1 PHS CEN @ 2004.2650
LLH 34 57 26.56470 253 30 19.92164 1719.5370 NEW ARP @ 2004.2650
LLH 34 57 26.56470 253 30 19.92164 1719.5370 NEW MON @ 2004.2650

STATION NAME: wsmn a 6 (White Sands; White Sands, New Mexico USA)
ANTENNA: TRM23903.00
S/N=0220011898
XYZ -1517577.7395 -5173006.2581 3399278.7216 MON @ 1997.0000 (M)
XYZ -0.0141 -0.0015 -0.0064 VEL (M/YR)
NEU 0.0000 0.0000 0.0000 MON TO ARP (M)
NEU -0.0000 0.0000 0.0770 ARP TO L1 PHASE CENTER (M)
NEU -0.0000 0.0000 0.0756 ARP TO L2 PHASE CENTER (M)
XYZ -0.1024 -0.0109 -0.0465 VEL TIMES 7.2636 YRS
XYZ 0.0000 0.0000 0.0000 MON TO ARP
XYZ -0.0183 -0.0624 0.0413 ARP TO L1 PHASE CENTER
XYZ -1517577.8602 -5173006.3314 3399278.7164 L1 PHS CEN @ 2004.2650
XYZ 0.0001 -0.0001 -0.0001 + XYZ ADJUSTMENTS
XYZ -1517577.8601 -5173006.3315 3399278.7163 NEW L1 PHS CEN @ 2004.2650
XYZ -1517577.8418 -5173006.2691 3399278.6750 NEW ARP @ 2004.2650
XYZ -1517577.8418 -5173006.2691 3399278.6750 NEW MON @ 2004.2650
LLH 32 24 25.69108 253 39 0.61019 1204.1570 NEW L1 PHS CEN @ 2004.2650
LLH 32 24 25.69108 253 39 0.61019 1204.0800 NEW ARP @ 2004.2650
LLH 32 24 25.69108 253 39 0.61019 1204.0800 NEW MON @ 2004.2650

STATION NAME: txel a 2 (El Paso RRP2; El Paso, Texas USA)
ANTENNA: TRM41249.00
S/N=UNKNOWN
XYZ -1522291.3745 -5215436.9860 3331963.8928 MON @ 1997.0000 (M)
XYZ -0.0144 0.0006 -0.0047 VEL (M/YR)
NEU 0.0000 0.0000 0.0000 MON TO ARP (M)
NEU -0.0000 0.0000 0.0714 ARP TO L1 PHASE CENTER (M)
NEU -0.0000 0.0000 0.0682 ARP TO L2 PHASE CENTER (M)
XYZ -0.1046 0.0044 -0.0341 VEL TIMES 7.2636 YRS
XYZ 0.0000 0.0000 0.0000 MON TO ARP
XYZ -0.0170 -0.0583 0.0375 ARP TO L1 PHASE CENTER
XYZ -1522291.4961 -5215437.0400 3331963.8962 L1 PHS CEN @ 2004.2650
XYZ 0.0002 -0.0003 -0.0002 + XYZ ADJUSTMENTS
XYZ -1522291.4959 -5215437.0402 3331963.8959 NEW L1 PHS CEN @ 2004.2650
XYZ -1522291.4788 -5215436.9819 3331963.8584 NEW ARP @ 2004.2650
XYZ -1522291.4788 -5215436.9819 3331963.8584 NEW MON @ 2004.2650
LLH 31 41 29.45500 253 43 42.35737 1122.1153 NEW L1 PHS CEN @ 2004.2650
LLH 31 41 29.45500 253 43 42.35737 1122.0439 NEW ARP @ 2004.2650
LLH 31 41 29.45500 253 43 42.35737 1122.0439 NEW MON @ 2004.2650

REMOTE STATION INFORMATION

STATION NAME: log0 1
ANTENNA: TRM4800
S/N=UNKNOWN
XYZ -1517617.6110 -5125322.8910 3470279.6680 MON @ 2004.2647 (M)
XYZ 0.0000 0.0000 0.0000 VEL (M/YR)
NEU -0.0000 0.0000 1.6601 MON TO ARP (M)
NEU 0.0000 0.0000 0.1759 ARP TO L1 PHASE CENTER (M)
NEU 0.0000 0.0000 0.1789 ARP TO L2 PHASE CENTER (M)
XYZ 0.0000 0.0000 0.0000 VEL TIMES 0.0002 YRS
XYZ -0.3945 -1.3324 0.9082 MON TO ARP
XYZ -0.0418 -0.1412 0.0962 ARP TO L1 PHASE CENTER
XYZ -1517618.0473 -5125324.3640 3470280.0725 L1 PHS CEN @ 2004.2650

BASELINE NAME: abq1 log0
XYZ 0.5457 1.0032 -1.0615 + XYZ ADJUSTMENTS
XYZ -1517617.5016 -5125323.3614 3470279.6110 NEW L1 PHS CEN @ 2004.2650
XYZ -1517617.4598 -5125323.2203 3470279.5148 NEW ARP @ 2004.2650
XYZ -1517617.0653 -5125321.8878 3470278.6065 NEW MON @ 2004.2650
LLH 33 10 6.60905 253 30 21.17991 1211.7279 NEW L1 PHS CEN @ 2004.2650
LLH 33 10 6.60905 253 30 21.17991 1211.5520 NEW ARP @ 2004.2650
LLH 33 10 6.60905 253 30 21.17991 1209.8919 NEW MON @ 2004.2650

BASELINE NAME: wsmn log0
XYZ 0.5360 1.0031 -1.0655 + XYZ ADJUSTMENTS
XYZ -1517617.5113 -5125323.3615 3470279.6070 NEW L1 PHS CEN @ 2004.2650
XYZ -1517617.4695 -5125323.2203 3470279.5108 NEW ARP @ 2004.2650
XYZ -1517617.0750 -5125321.8879 3470278.6025 NEW MON @ 2004.2650
LLH 33 10 6.60889 253 30 21.17955 1211.7280 NEW L1 PHS CEN @ 2004.2650
LLH 33 10 6.60889 253 30 21.17955 1211.5521 NEW ARP @ 2004.2650
LLH 33 10 6.60889 253 30 21.17955 1209.8920 NEW MON @ 2004.2650

BASELINE NAME: txel log0
XYZ 0.5404 1.0119 -1.0680 + XYZ ADJUSTMENTS
XYZ -1517617.5069 -5125323.3527 3470279.6045 NEW L1 PHS CEN @ 2004.2650
XYZ -1517617.4651 -5125323.2115 3470279.5083 NEW ARP @ 2004.2650
XYZ -1517617.0706 -5125321.8791 3470278.6000 NEW MON @ 2004.2650
LLH 33 10 6.60900 253 30 21.17962 1211.7186 NEW L1 PHS CEN @ 2004.2650
LLH 33 10 6.60900 253 30 21.17962 1211.5427 NEW ARP @ 2004.2650
LLH 33 10 6.60900 253 30 21.17962 1209.8826 NEW MON @ 2004.2650

G-FILES

Axx2004 4 6 4 4 7
B2004 4 62128 4 4 7 119 1 page5 v0407.16IGS 222 1 2 27NGS
2004 830IFD0FX
Iant_info.003 NGS 20040630
C00090001 314102128 8 1061915685 26 1646992763 18
X0974ALOG0X0974AABQ1
D 1 2 8830523 1 3 -7288160 2 3 -7914684

Axx2004 4 6 4 4 7
B2004 4 62128 4 4 7 119 1 page5 v0407.16IGS 222 1 2 27NGS
2004 830IFD0FX
Iant_info.003 NGS 20040630
C00090002 392332 9 -476843812 31 -709999275 20
X0974ALOG0X0974AWSMN
D 1 2 8691941 1 3 -7993622 2 3 -8038411

Axx2004 4 6 4 4 7
B2004 4 62128 4 4 7 119 1 page5 v0407.16IGS 222 1 2 27NGS
2004 830IFD0FX
Iant_info.003 NGS 20040630
C00090003 -46744082 11 -901151028 37-1383147416 25
X0974ALOG0X0974ATXEL
D 1 2 8679930 1 3 -7811571 2 3 -8049807

POST-FIT RMS BY SATELLITE VS. BASELINE
POST-FIT RMS BY SATELLITE VS. BASELINE
OVERALL 03 06 09 11 14 15 18 19
abq1-log0| 0.015 0.018 0.019 0.015 ... 0.015 ... 0.011 0.017
21 22 25 26 29 31
abq1-log0| 0.013 0.015 0.019 0.016 0.013 0.012

POST-FIT RMS BY SATELLITE VS. BASELINE
OVERALL 03 06 09 11 14 15 18 19
wsmn-log0| 0.016 0.018 0.020 0.017 ... 0.012 ... 0.012 0.020
21 22 25 26 29 31
wsmn-log0| 0.014 0.012 0.015 0.016 0.023 0.035

POST-FIT RMS BY SATELLITE VS. BASELINE
OVERALL 03 06 09 11 14 15 18 19
txel-log0| 0.022 0.027 0.027 0.022 ... 0.017 0.018 0.018 0.028
21 22 25 26 29 31
txel-log0| 0.018 ... 0.024 0.023 0.024 0.027

OBS BY SATELLITE VS. BASELINE
OBS BY SATELLITE VS. BASELINE
OVERALL 03 06 09 11 14 15 18 19
abq1-log0| 3206 368 107 318 ... 371 ... 462 264
21 22 25 26 29 31
abq1-log0| 391 462 101 130 66 166

OBS BY SATELLITE VS. BASELINE
OVERALL 03 06 09 11 14 15 18 19
wsmn-log0| 3048 333 116 316 ... 370 ... 448 242
21 22 25 26 29 31
wsmn-log0| 390 449 97 119 63 105

OBS BY SATELLITE VS. BASELINE
OVERALL 03 06 09 11 14 15 18 19
txel-log0| 3138 357 114 293 ... 378 462 458 254
21 22 25 26 29 31
txel-log0| 398 ... 110 125 47 142

Covariance Matrix for the xyz OPUS Position (meters^2).
0.0000005911 0.0000001732 -0.0000001030
0.0000001732 0.0000066800 -0.0000003585
-0.0000001030 -0.0000003585 0.0000029978

Covariance Matrix for the enu OPUS Position (meters^2).
0.0000009876 -0.0000008210 0.0000012701
-0.0000008210 0.0000036313 -0.0000013488
0.0000012701 -0.0000013488 0.0000056500

Horizontal network accuracy = 0.00397 meters.
Vertical network accuracy = 0.00466 meters.

Derivation of NAD 83 Position

ITRF vectors from unknown station monument to reference station monument in Reference Frame ITRF00 epoch 2004.2650 from pages

	Xr-X= DX(m)	Yr-Y= DY(m)	Zr-Z= DZ(m)
ABQ1	31410.21280	106191.56850	164699.27630
WSMN	39.23320	-47684.38120	-70999.92750
TXEL	-4674.40820	-90115.10280	-138314.74160

Vectors from unknown station monument to reference station monument rotated and scaled into NAD83 at epoch 2004.2650

	DX(m)	DY(m)	DZ(m)
ABQ1	31410.21542	106191.58780	164699.26319
WSMN	39.23196	-47684.39026	-70999.92135
TXEL	-4674.41047	-90115.12019	-138314.73006

Position of reference station ARP in NAD83 from NCSIDB at specified epoch.

	Xr(m)	Yr(m)	Zr(m)	
ABQ1	-1486206.19279	-5019131.67616	3634977.97626	2002.00
WSMN	-1517577.18800	-5173007.65293	3399278.78611	2002.00
TXEL	-1522290.82490	-5215438.37857	3331963.97124	2002.00

Position of reference station monument in NAD83 at specified epoch.

	Xr(m)	Yr(m)	Zr(m)	
ABQ1	-1486206.19279	-5019131.67616	3634977.97626	2002.00
WSMN	-1517577.18800	-5173007.65293	3399278.78611	2002.00
TXEL	-1522290.82490	-5215438.37857	3331963.97124	2002.00

Velocity of reference station monument in NAD83.

	Vx (m/yr)	Vy (m/yr)	Vz (m/yr)
ABQ1	0.00000	0.00000	0.00000
WSMN	0.00060	-0.00050	0.00070
TXEL	0.00010	0.00150	0.00240

Position of reference station monument in NAD83 at epoch 2004.2650

	Xr(m)	Yr(m)	Zr(m)
ABQ1	-1486206.19279	-5019131.67616	3634977.97626
WSMN	-1517577.18664	-5173007.65407	3399278.78770
TXEL	-1522290.82467	-5215438.37518	3331963.97667

Computed positions of unknown station monument in NAD83 at epoch 2004.2650

	X (m)	Y (m)	Z (m)
ABQ1	-1517616.40822	-5125323.26396	3470278.71306
WSMN	-1517616.41860	-5125323.26381	3470278.70904
TXEL	-1517616.41420	-5125323.25499	3470278.70673
Mean	-1517616.41367	-5125323.26092	3470278.70961

Final position of unknown station monument in NAD83 at epoch 2002.0000 from HTDP

	X (m)	Y (m)	Z (m)
Mean	-1517616.41400	-5125323.26100	3470278.71000

This position was computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

NEW MEXICO CENTRAL STATE PLANE COORDINATES
HORIZONTAL: NAD83 ZONE 2003 VERTICAL: NAVD88

NAME	NORTHING	EASTING	ELEVATION
WSMR-RMW-1	790248.82	1564768.85	4055.69
WSMR-RMW-2	789623.58	1565666.07	4046.81
WSMR-RMW-3	789064.23	1565485.99	4044.95
WSMR-RMW-4	789312.85	1564650.11	4052.91
WSMR-USAED-2	789036.06	1564979.50	4047.81

NOTE ON VOLUME CALCULATIONS

WHEN YOU CALCULATE THE VOLUMES USING THE COMPOSITE METHOD, INSTEAD OF USING A GRID, THE COMPOSITE METHOD RE-TRIANGULATES A NEW SURFACE BASED ON POINTS FROM BOTH SURFACES. IT USES THE POINTS FROM BOTH SURFACES, AS WELL AS ANY LOCATION WHERE THE TRIANGLE EDGES BETWEEN THE TWO SURFACES CROSS. THE COMMAND THEN CALCULATES THE NEW COMPOSITE SURFACE ELEVATIONS BASED ON THE DIFFERENCE BETWEEN THE ELEVATIONS OF THE TWO SURFACES. THIS METHOD IS THE MOST ACCURATE, GIVING THE EXACT VOLUMES BETWEEN THE TWO SURFACE DEFINITIONS.

Site Volume Table: Unadjusted

Site	Stratum	Surf1	Surf2	Cut yards	Fill yards	Net yards	Method
04-27 SITE							
	new stratum	existing	design	270	62065	61795 (F)	Composite
	2nd stratum	lowered eist surface	design	4	91461	91457 (F)	Composite
	total post con	existing		48801	49444	643 (F)	Composite

PROJECT TITLE
DATA SHEET
RHODES CANYON LANDFILL
WHITE SANDS MISSILE RANGE
AUGUST 31, 2004

SHEET TITLE: BOUNDARY MAP
SHEET NO. 6 OF 6

BRG BLACKHAM, ROMAN, GUNAJI AND ASSOCIATES, INC.
ENGINEERING - PLANNING - SURVEYING
1203 MEDPARK DR. - LAS CRUCES, NM 88005 - (505)525-2278 - (505)523-9518 (FAX)
JOB NO. 04-27
DRAWN BY: T. MOORE
FIELD WORK BY: J. PROVENCIO, T. MOORE
DEVELOPER:
SURVEYOR'S STAMP
REFERENCES-BENCHMARKS

DATE	REVISIONS	BY