Closeout Report for IHSS Group 000-5 (Present Landfill [IHSS 114])

September 2005

Final Closeout Report for IHSS Group 000-5 Present Landfill (IHSS-114)

KAISER·HILL COMPANY

Volume I

Environmental Restoration
Rocky Flats Environmental Technology Site

September 2005

Closeout Report
for IHSS Group 000-5
(Present Landfill [IHSS 114])

Approval received from the U.S. Environmental Protection Agency

(________________).

Approval letter contained in the Administrative Record.

September 2005

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ACRONYMS

ACM	asbestos containing material
AR	Administrative Record
CAD/ROD	Corrective Action Decision/Record of Decision
CCR	Accelerated Action for the Present Landfill RFETS Construction Certification Report
CKD	cement kiln dust
CRA	Comprehensive Risk Assessment
cy	cubic yards
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FML	flexible membrane liner
FY	Fiscal Year
GCL	Geosynthetic Clay Liner
GDN	Geocomposite Drainage Net
HRR	Historical Release Report
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
K-H	Kaiser-Hill Company, L.L.C.
NFAA	No Further Accelerated Action
NLR	no longer representative
PAC	Potential Area of Concern
PLF	Present Landfill
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFETS or Site	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study

EXECUTIVE SUMMARY

This Closeout Report summarizes accelerated action activities conducted at Individual Hazardous Substance Site (IHSS) Group 000-5 at the Rocky Flats Environmental Technology Site (RFETS or Site) in Golden, Colorado. IHSS Group 000-5 consists of the Present Landfill (PLF).

Closure of IHSS Group 000-5 was conducted in accordance with the Final Interim Measure/Interim Remedial Action for IHSS 114 and Resource Conservation and Recovery Act (RCRA) Closure of the RFETS Present Landfill document (DOE 2004). Closure activities primarily included removing pond sediments and placing them under the RCRA cover, constructing the RCRA Subtitle C-compliant cover and associated work, and installing new groundwater monitoring wells.

Attachment A of this Closeout Report includes the Construction Certification Report (CCR) for the Accelerated Action the PLF. This Closeout Report and associated documentation will be retained as part of the Rocky Flats Administrative Record (AR) file.

1.0 INTRODUCTION

This Closeout Report summarizes accelerated action activities conducted at Individual Hazardous Substance Site (IHSS) Group 000-5 at the Rocky Flats Environmental Technology Site (RFETS or Site) in Golden, Colorado. IHSS Group 000-5 consists of the Present Landfill (PLF), IHSS 114.

Figure 1 shows the location of IHSS Group 000-5 and Figure 2 gives a more detailed look at the Present Landfill.

Accelerated action activities executed as documented in the Accelerated Action for the Present Landfill Rocky Flats Environmental Technology Site Construction Certification Report (CCR) Volumes I through IV (Attachment A). Accelerated action activities primarily included the removal of pond sediments and placing them in an area under the RCRA cover, constructing the RCRA Subtitle C-compliant cover and associated work, and installing new groundwater monitoring wells.

Planned activities were documented in the Final Interim Measure/Interim Remedial Action (IM/IRA) for IHSS [NW-] 114 and Resource Conservation Recovery Act (RCRA) Closure of the RFETS Present Landfill, and gained regulatory approval in August 2004 (DOE 2004) (EPA, CDPHE 2004). Ecological effects will be evaluated in the ecological risk assessment portion of the Sitewide Comprehensive Risk Assessment (CRA).

Approval of this Closeout Report constitutes regulatory agency concurrence that IHSS Group 000-5, Present Landfill (IHSS 114) is a No Further Accelerated Action (NFAA) Site and a regulatory closed RCRA-regulated unit. This information and NFAA determination will be documented in the Fiscal Year (FY) 2005 (05) Annual Update for the Historical Release Report (HRR).

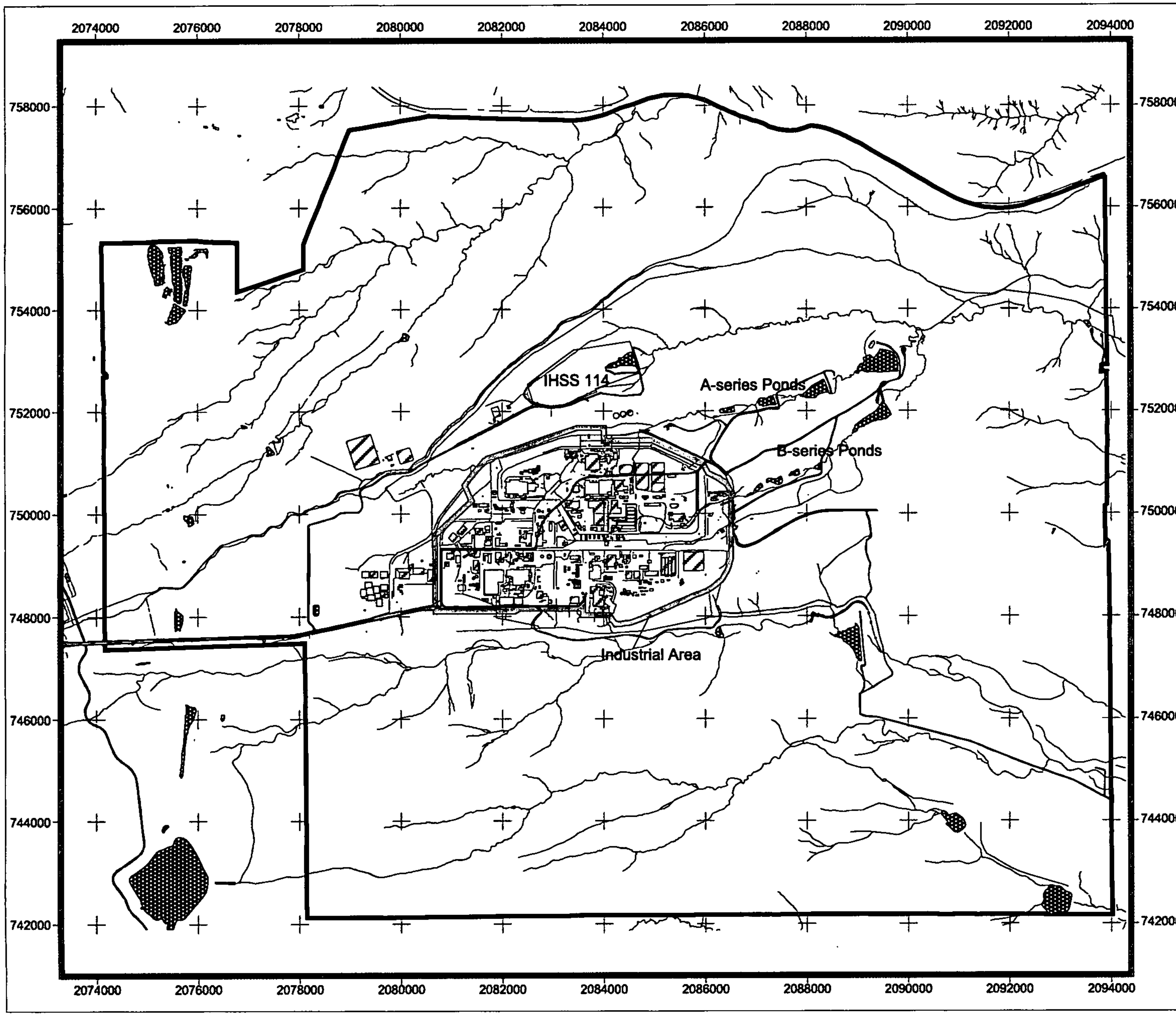

Figure 1
IHSS Group 000-5
Present Landfill (IHSS 114)
Location Map

IHSS
Road
Stream
Lake
IA Boundary
Site Boundary
Structure
Demolished
Standing

750 0 750 1500 2250 Feet

Scale = 1:29,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RADMS

Prepared for:
KAISER•HILL
COMPANY

Date: 05/25/2005
File: W:\Projects\Fy2004\000-5\plf_cor_figs.apr

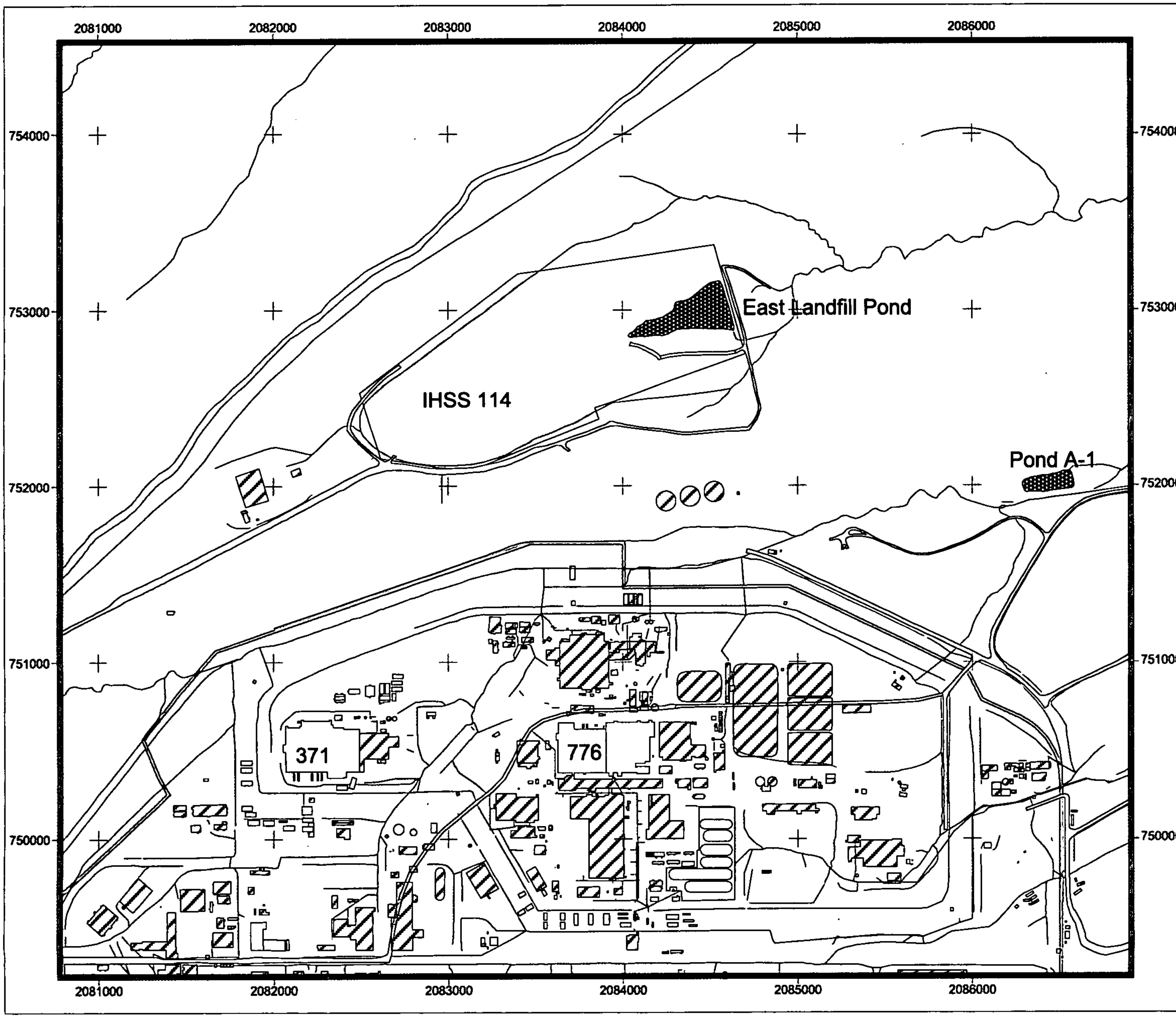

Figure 2
IHSS Group 000-5
Present Landfill (IHSS 114)
Detailed Location

IHSS
Road
Stream
Lake
IA Boundary
Site Boundary
Structure
Demolished
Standing

N W E S

750 0 750 1500 2250 Feet

Scale = 1:8,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: RADMS

Prepared for: KAISER•HILL COMPANY

Date: 05/25/2005
File: W:\Projects\Fy2004\000-5\plf_cor_figs.apr

1.1 Historical Information

The PLF was placed into service in August 1968 for the disposal of solid waste, including office trash, paper, rags, personal protective equipment (PPE), construction and demolition debris, scrap metal, empty waste containers, used filters, and electrical components. Waste containing hazardous constituents that was disposed in the landfill included containers partially filled with paint, solvents, degreasing agents, and foam polymers; wipes and rags contaminated with these materials; paint and oil filters; and metal cuttings and shavings coated with hydraulic oil and carbon tetrachloride. A total of 241 nonhazardous solid waste streams and 97 potentially hazardous solid waste streams were disposed in the PLF. Procedures were implemented to stop the disposal of hazardous waste into the PLF in the fall of 1986 (DOE 2004).

From 1968 to 1978, the landfill received approximately 20 cubic yards (cy) of waste per day. Beginning in 1985, asbestos-containing material (ACM) was disposed in designated 10-foot-deep pits located east of the Present Landfill. The ACM was wrapped in heavy plastic bags, placed in the pit, and covered with soil. Site records indicate that disposal of ACM continued until April 1990. Additional descriptions of various wastes disposed at the PLF are presented in the Final IM/IRA for IHSS 114 (DOE 2004).

The PLF remained in operation until March 1998, at which time it was placed in a contingent closure status and seeded to stabilize interim cover soil and control erosion. The PLF, including the East Face, occupies an area of approximately 22 acres (Figure 2). A seep exists at the east end of the landfill (known as the Present Landfill seep), as a result of infiltration of precipitation and the migration of groundwater through the landfill.

Various interim response actions were performed at the PLF beginning in 1973 and continuing until 2003. These included, among other actions, installation of a groundwater intercept system around the PLF, construction of two 900-foot long soil-bentonite slurry walls at the east end of the PLF, installation of a passive seep treatment system, installation of various groundwater monitoring wells and installation of four gas venting wells at the PLF during various years. Complete descriptions of the interim response actions are included in the PLF IM/IRA (DOE 2004).

2.0 ACCELERATED ACTION

The PLF remedial action objectives (RAOs) were developed to:

- Prevent direct human and ecological exposure to contaminated soil or fill material at the Present Landfill;
- Provide containment of the Present Landfill with a RCRA Subtitle C interim status equivalent cover; and
- Protect surface water quality.

To achieve these objectives, a RCRA Subtitle C-compliant cover system was designed for the PLF to prevent direct contact with fill material, provide a layer between surface water runoff and the fill material, and reduce the infiltration of precipitation (DOE 2004).

Environmental Restoration (ER) accelerated action activities were conducted between August 2004 and May 2005. Starting and ending dates of significant activities are listed in the Final Detailed Schedule shown on Figure 4 of the CCR (Attachment A). Photographs of site activities are presented in Appendix C of the CCR (Attachment A).

2.1 Summary of Present Landfill Accelerated Action

Section 4.0 of the CCR presents the summary of the Present Landfill accelerated action, including a general description of the various construction items. The following text presents a general chronological order for the construction activities that took place at the PLF (K-H 2005a):

- Mobilization and preliminary activities (Section 4.1)
    - Mobilization and preparatory work,
    - Closure of Previous gas venting wells;
- Clearing and grubbing at the PLF (Section 4.2);
- Initial grading and proof rolling (Section 4.3);
- Repair of soft spots and waste removals (Section 4.4);
- Placement of Compacted Grading Fill (Section 4.6);
- Removal of pond sediments and placement at PLF (Section 4.5)
- Placement of lower 6-inch cushion soil (Section 4.7);
- Geosynthetic installations (Section 4.8)
    - Geosynthetic Clay Liner (GCL),
    - Geomembrane, flexible membrane liner (FML),
    - Geocomposite Drainage Net (GDN);
- Upper 10-inch cushion soil placement (Section 4.9);
- Rock layer placement (Section 4.10);
- Cover soil placement (Section 4.11);
- East Face Earthwork and Seep System Construction (Section 4.12)
- Passive seep treatment system installation (Section 4.13);
- Venting system installation (Section 4.14);
- Perimeter diversion channel construction (Section 4.15)
- Seeding (Section 4.16);
- Erosion control matting (Section 4.17); and
- New down gradient groundwater monitoring well installation (Section 4.18).

3.0 RCRA UNIT CLOSURE

IHSS Group 000-5, Present Landfill (IHSS 114) is a RCRA unit. The Final IM/IRA for IHSS 114 and RCRA Closure of the RFETS Present Landfill addresses this unit closure (DOE 2004). Approval of this Closeout Report with CCR constitutes closure of this RCRA-regulated unit in accordance with CHWA 1007-2, part 265.

4.0 DEVIATIONS

Summaries of the design changes, clarifications and revisions during construction as well as the field changes are found in Section 5.0 of the CCR (Attachment A).

5.0 POST-ACCELERATED ACTION CONDITIONS

Construction was completed in accordance with the design set forth in the Present Landfill Accelerated Action Final Design, Construction Quality Assurance/Quality Control Plan (Appendix A of the CCR) and the subsequent addenda created during construction (Attachment A). Appendix C of the CCR contains project photographs.

East Landfill Pond sediments were removed and placed under the final cover. Confirmation sampling was performed to verify that the removal of contaminated pond sediments was complete. Appendix K contains the confirmation sampling report (Attachment A). Following the pond sediment removal, the area was regraded to approximate the original grades (Attachment A). Section 4.13 describes how the passive seep treatment system was modified to include the original seep plus the drainage from the strip drain system placed on the original embankment and the inflow from the north and south Groundwater Interception System (Attachment A). The Final IM/IRA for IHSS 114 requires quarterly monitoring of the effluent and the system itself (DOE 2004).

6.0 SITE RECLAMATION

The PLF, including the pond area, was seeded, mulched and had erosion mat placed to re-vegetate the construction area and the PLF cover. Native seed mix was used on the cover and wetland and upland seeds were planted at the Landfill Pond. Sections 4.16 through 4.19 of the CCR contain more detailed site reclamation information (Attachment A).

7.0 STEWARDSHIP ANALYSIS

The Present Landfill stewardship evaluation was conducted through ongoing consultation with the regulatory agencies. Frequent informal project updates, e-mails, and telephone and personal contacts occurred throughout the project. Appendix I of the CCR provides copies of applicable Regulatory Contact Records (Attachment A).

7.1 Current Site Conditions

As discussed in Section 2.1, accelerated actions at the Present Landfill consisted of the removal of East Landfill Pond sediments and the construction of a RCRA Subtitle C-compliant cover.

7.2 Post-Accelerated Action Monitoring and Long-Term Stewardship Considerations

Post-accelerated action monitoring and long-term stewardship considerations are addressed in Appendix A of the Final IM/IRA for IHSS 114 and RCRA Closure of the RFETS PLF. The Final IM/IRA for IHSS 114 describes the following requirements for maintaining the final cover (DOE 2004):

- Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;
- Maintain and monitor the groundwater monitoring system and comply with all other appropriate requirements; and
- Prevent runon and runoff from eroding or otherwise damaging the final cover.

Potential surface water impacts and water quality monitoring requirements are addressed in Table 1 of Appendix A of the Final IM/IRA for IHSS 114. The table describes the requirements for monitoring landfill seep, groundwater, and the groundwater interception system flow (DOE 2004).

IHSS Group 000-5, the PLF (IHSS 114), will be evaluated as part of the Sitewide CRA. The CRA is part of the Remedial Investigation/Feasibility Study (RI/FS) that will be conducted for the Site. The need for and extent of any more general, long-term stewardship activities will also be analyzed in the RI/FS and proposed as part of the preferred alternative in the Proposed Plan for the Site. Institutional controls and other long-term stewardship requirements for the Site will ultimately be contained in the Corrective Action Decision/Record of Decision (CAD/ROD) and any post-RFCA agreement. This Closeout Report and associated documentation will be retained as part of the RFETS AR file.

8.0 CONCLUSIONS

Results of the accelerated action justify NFAA for IHSS Group 000-5 the Present Landfill (IHSS 114). Justification is based on the successful completion of the construction of the RCRA Subtitle C compliant cover such that the approved RAOs were satisfied.

9.0 REFERENCES

EPA, CDPHE 2004, Correspondence to J. Legare, DOE RFO; from M. Aguilar, EPA Region 8, and S. Gunderson, CDPHE; Re: IM/IRA and RCRA Closure of the Present Landfill (August 2004), August 23, 2004.

DOE, 2004, Final Interim Measure/Interim Remedial Action for IHSS 114 and RCRA Closure of the RFETS Present Landfill, Rocky Flats Environmental Technology Site, Golden, Colorado, August.

Attachment A

Accelerated Action for the Present Landfill Rocky Flats Environmental Technology Site
Construction Certification Report

Volumes I, II, III, IV, and V

IHSS GROUP 000-5
PRESENT LANDFILL (IHSS-114)

ACCELERATED ACTION FOR THE PRESENT LANDFILL
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
CONSTRUCTION CERTIFICATION REPORT

ATTACHMENT A OF THE
FINAL CLOSEOUT REPORT

VOLUME I

Prepared for:

KAISER-HILL COMPANY, LLC
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
12101 Airport Way, Unit B
Broomfield, CO 80021-2583

Prepared by:

TETRA TECH, INC.
1900 South Sunset Street, Suite 1-F
Longmont, Colorado 80501

Tetra Tech Job No. 19-4886.001.00

September 2005

TETRA TECH, INC.

Construction Certification Report
Accelerated Action for the Present Landfill
Rocky Flats Environmental Technology Site

September 2005

ROCKY FLATS PRESENT LANDFILL ACCELERATED ACTION

CONSTRUCTION CERTIFICATION REPORT

OWNER APPROVAL:

U.S. DEPARTMENT OF ENERGY DATE

CERTIFICATION

Construction Quality Assurance Engineer (CQAE)

The undersigned Construction Quality Assurance Engineer hereby certifies that the Present Landfill (PLF) Accelerated Action at the Rocky Flats Environmental Technology Site was performed in substantive compliance with the Final Design Plans and Specifications and approved design and field changes during construction. Further, the undersigned certifies that the construction quality assurance was performed in accordance with the requirements of the PLF Final Design Construction Quality Assurance/Quality Control (QA/QC) Plan and subsequent addenda during construction. This certification is based on construction QA observations and tests and information supplied by the QC inspections, testing and surveying. This certification does not include any component of the design of the PLF Accelerated Action and does not include short or long-term performance of the PLF closure. No other representation, expressed or implied, and no warranty or guarantee is included or intended.

COLORADO REGISTERED
JOHN H. RAHE
14707
9/14/05
PROFESSIONAL ENGINEER

John H. Rahe, P.E.
Construction Quality Assurance Engineer
Colorado Professional Engineer No. 14707
Tetra Tech, Inc.

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LIST OF AS-BUILT DRAWINGS

AS-BUILT SURVEYS
(In Map Pockets)

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ACRONYMS AND ABREVIATIONS

ACI	American Concrete Institute
ACM	asbestos-containing material
ADS	Advanced Drainage Systems
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society of Testing and Materials
ATT	Advanced Terra Testing, Inc.
BMP	best management practice
BZ	Buffer Zone
CAD/ROD	Corrective Action Decision/Record of Decision
Cat	Caterpillar
CCR	Construction Certification Report
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CHWA	Colorado Hazardous Waste Act
CKD	cement kiln dust
CM	Construction Manager
cm/sec	centimeters per second
COC	contaminant of concern
COE	U.S. Army Corps of Engineers
CQA	Construction Quality Assurance
CQAE	Construction Quality Assurance Engineer
CQC	Construction Quality Control
CTR	Contractor's Technical Representative
CWA	Clean Water Act
cy	cubic yard
DFW	definable feature of work
DOE	U.S. Department of Energy
Dwg	Drawing
EPA	U. S. Environmental Protection Agency
FML	flexible membrane liner (a.k.a. Geomembrane)
FML-T	textured flexible membrane liner
ft/ft	feet per foot
GCL	geosynthetic clay liner
GDN	geocomposite drainage net
gpm	gallons per minute
GRI	Geosynthetic Research Institute
GSA	Grain Size Analysis
GWIS	groundwater interception system
HASP	Health and Safety Plan
HDPE	high-density polyethylene
IA	Industrial Area

ACRONYMS AND ABREVIATIONS – CONT.

IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
K-H	Kaiser-Hill Company, L.L.C.
lbs/in	pounds per inch
lf	linear feet
LGP	Low Ground Pressure
LLDPE	linear low density polyethylene
LLDPE-T	textured linear low-density polyethylene
MDD	maximum dry density
mph	miles per hour
MQC	manufacturer's quality control
NAG	North American Green
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
oz/sy	ounces per square yard
PE	Professional Engineer
PLF	Present Landfill
PLF Cover	Geosynthetic Composite Cover
PLS	Professional Land Surveyor
PPE	personal protective equipment
psi	pounds per square inch
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QCSM	Quality Control Site Manager
RAO	remedial action objective
RI/FS	Remedial Investigation/Feasibility Study
RFA	Rocky Flats Alluvium
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFI	Request for Information/Clarification
Sch	Schedule
SDR	Standard Dimension Ratio
SAP	Sampling and Analysis Plan
sf	square feet
sy	square yard
SQAM	Site Quality Assurance Manager
Stoller	S.M. Stoller Corporation
SWMU	solid waste management unit
T	ton

ACRONYMS AND ABREVIATIONS – CONT.

TRM	turf reinforcement mat
Tt	Tetra Tech, Inc.

1.0 INTRODUCTION

This section presents the project location and background information for the Present Landfill (PLF) Accelerated Action Closure at the Rocky Flats Environmental Technology Site (RFETS). The purpose and scope of this Construction Certification Report (CCR) is discussed and an overview of the PLF Accelerated Action is presented.

1.1 Project Location and Background

RFETS is a government-owned, contractor-operated facility formerly used for the fabrication of miscellaneous weapons components for national defense. The 6,550-acre site is located in Jefferson County, Colorado, and approximately 16 miles northwest of Denver. The site occupies approximately 10 square miles (Figure 1).

Centrally located within the RFETS boundary is a 400-acre area referred to as the Industrial Area (IA). The IA contained approximately 400 buildings along with other structures, roads, and utilities, and is where the majority of RFETS mission activities took place between 1951 and 1989. The remaining 6,150 acres consist of undeveloped land used as a Buffer Zone (BZ) to further limit access to the operations area. The Present Landfill (IHSS 114) and the East Landfill Pond (also known as Operable Unit [OU] 7) are located north of the IA within the BZ, at the western end of the No Name Gulch drainage.

The Present Landfill was placed into service in August 1968 for the disposal of solid waste, including office trash, paper, rags, personal protective equipment (PPE), construction and demolition debris, scrap metal, empty waste containers, used filters, and electrical components. From 1968 to 1978, the landfill received approximately 20 cubic yards (cy) of waste per day compacted within the PLF.

Beginning in 1985, asbestos-containing material (ACM) was disposed in designated 10-foot-deep pits located east of the Present Landfill. The ACM was wrapped in heavy plastic bags, placed in the pit, and covered with soil. Site records indicate that disposal of ACM continued until April 1990. Additional descriptions of various wastes disposed at the PLF are presented in the Final Interim Measure/Interim Remedial Action (IM/IRA) for IHSS 114 and RCRA Closure of the RFETS Present Landfill (August 2004).

Various interim response actions were performed at the PLF beginning in 1973 and continuing until 2003. These included, among other actions, installation of an uncontaminated groundwater interception system around the PLF, construction of two 900-foot long soil-bentonite slurry walls at the east end of the PLF, installation of a passive seep treatment system, installation of various groundwater monitoring wells and installation of three gas venting wells at the PLF during various years. Complete descriptions of the interim response actions are included in the IM/IRA.

The Present Landfill remained in operation until March 1998, at which time it was placed in a contingent closure status and seeded to stabilize interim cover soil and control erosion. The Present Landfill, including the East Face, occupies an area of approximately 22.5 acres (Figure

2). A seep exists at the east end of the landfill (known as the Present Landfill seep), as a result of infiltration of precipitation and the migration of groundwater.

The PLF remedial action objectives (RAOs) were developed to prevent human and ecological exposures to fill material, achieve Resource Conservation and Recovery Act (RCRA) interim status closure, and protect surface water quality. To achieve these objectives, a RCRA Subtitle C-compliant cover system was designed for the PLF to prevent direct contact with fill material, provide a layer between surface water runoff and the fill material, and reduce the infiltration of precipitation.

1.2 Purpose and Scope of Report

The accelerated action closure addresses the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation and the RCRA closure of the Present Landfill and the East Landfill Pond at the RFETS. This CCR provides documentation of the accelerated action closure of the PLF including treatment of the PLF seep and remediation of the East Landfill Pond.

Certification is provided that the remediation and closure activities have been performed in accordance with the final Accelerated Action Design for the PLF, approved design and field changes during construction and the final Construction QA/QC Plan (Kaiser-Hill, 2004). This is in conformance with the State of Colorado's requirements for certification of closure under the Colorado Hazardous Waste Regulations (Part 265).

Included in this CCR are descriptions of the general construction sequence, construction equipment and personnel, summary of the PLF Accelerated Action, design and field changes during construction, a summary of quality assurance and quality control during construction, a summary of environmental monitoring during construction, construction reporting records, a summary of the pre-final and final inspections and the as-built drawings. Appendices to the CCR include the construction drawings and specifications, the QA/QC Plan, a project photographic log, the applicable contractor's construction submittals and requests for information, the QA/QC documentation, hold point/release documentation, contact records, pond confirmation sampling, seep monitoring during construction, the final as-built record survey drawings, groundwater monitoring well logs, east face post-construction stability analyses and East Face storm-water channel design.

Post-closure care requirements are not included in this document but are in a separate monitoring and maintenance plan.

1.3 Overview of Present Landfill Accelerated Action

A RCRA Subtitle C-compliant cover has been placed over the PLF including the East Face of the PLF. This cover system includes proof rolling, stabilization of various soft spots in the top of the PLF, proof-rolling, regrading with compacted Rocky Flats Alluvium (RF alluvium or RFA) and placement of a cushion soil layer beneath the liner system. The liner system consists of a geosynthetic clay liner (GCL) underlying a 60-mil linear low density polyethylene (LLDPE) geomembrane flexible membrane liner (FML) and a geocomposite drainage net (GDN) over the FML. The soil cover over the liner system includes another cushion soil layer adjacent to the GDN, a rock layer and a RF alluvium soil cover layer. The total thickness of the soil cover over the liner system is approximately four feet. Vegetated soil was stripped from the PLF prior to cap construction and, along with other soil having vegetation from other sources, was replaced within the top of the RF alluvium soil cover prior to seeding. The top slope of the PLF closure varies from approximately 2 to 5 percent. The perimeter ditch was improved around the PLF with discharge downstream of the East Landfill Pond.

The East Face of the PLF was flattened to a slope of 4(horizontal):1(vertical) with compacted RFA following removal of soft materials below the toe of the east slope. The East Face closure includes the liner/cover system described above as well as a strip drain system along the original east face slope along with modifications of the PLF seep collection system.

The seep water emanating from the east side of the PLF will continue to be treated through a modified passive seep interception and treatment system. The East Landfill Pond remains and no major changes have been made to the pond's physical configuration; however, the East Landfill Pond sediments have been removed and placed under the RCRA Subtitle C-compliant cover. Regrading of the East Pond was performed following removal of the sediments.

1.4 Project Organization

This section consists of the project organization for the accelerated action closure of the PLF. Lines of communication and responsibility are discussed in this section as well.

1.4.1 Owner and Prime Contractor

The owner/operator of the RFETS is the Department of Energy (DOE) which is responsible for all accelerated actions and closure activities at the site. The prime contractor for the DOE at the RFETS is the Kaiser-Hill Company, LLC (K-H). K-H has overall responsibility for implementation of the design and construction of the PLF Accelerated Action.

1.4.2 Regulatory Oversight Agencies

The regulatory agencies having oversight responsibility at the PLF closure are the U.S. Environmental Protection Agency (EPA), Region VIII and the Colorado Department of Public Health and Environment (CDPHE).

1.4.3 Program Construction Team

The Construction Manager (CM) for the PLF closure construction was S.M. Stoller Corporation (Stoller). The earthwork sub-contractor was Neilsons-Skanska and the geosynthetic lining sub-contractor was Colorado Linings International.

The seeding/mulching operations at the PLF were performed by Rocky Flats Closure Site Services, LLC (RFCSS) as subcontractor to K-H.

Envirocon performed the final construction of the East Face storm-water management channels in August 2005.

1.4.4 Design Team

The design team for the PLF Accelerated Action consisted of K-H along with Earth Tech, Inc. (Earth Tech) as the design sub-contractor. Earth Tech developed the design drawings and specifications and the Construction QA/QC Plan with review by K-H and approval by the regulatory agencies.

1.4.5 Construction Quality Control Team

The construction quality control team consisted of personnel from Stoller and from Golder Associates Inc. (Golder; sub-contractor to Stoller). Golder performed all CQC field and laboratory testing for earthwork and geosynthetics for the PLF closure. The quality control site manager (QCSM) from Stoller provided all QC management and review. Paragon Land Consultants, Inc. performed the site record surveying for the Stoller construction team.

Construction QC for the down gradient groundwater monitoring wells and steel support beam installations for the seep treatment structure grating was performed in June 2005 by personnel from K-H. Final East Face storm-water management channel construction QC was performed in August 2005 by personnel from Earth Tech.

1.4.6 Construction Quality Assurance Team

The construction quality assurance team consisted of Tetra Tech (Tt) as the construction quality assurance (CQA) sub-contractor to K-H. Advanced Terra Testing, Inc. (ATT) performed the QA laboratory testing and the field QA testing was performed by both Tt and ATT.

1.4.7 Construction Quality Assurance/Quality Control Plan

The construction QA/QC procedures and requirements were defined in the Final Design Submittal Construction Quality Assurance/Quality Control Plan, included as Appendix B of this

CCR. This document defines the various roles and responsibilities of the construction QA/QC personnel, specifies requirements of the various QC and QA conformance tests and procedures and defines the various QA/QC meetings, communications and documentation required for the project.

2.0 GENERAL CONSTRUCTION SEQUENCE OF PRESENT LANDFILL ACCELERATED ACTION

This section presents the general construction sequence of the Present Landfill Accelerated Action from initiation of work in the summer of 2004 through the completion and closeout of the project in the spring of 2005. A detailed schedule for Stoller's construction activities through mid-May, 2005 is presented on Figure 4.

Construction of the PLF closure was performed in a design-construct sequence as the construction started based on preliminary "95 percent" complete drawings and specifications. The design was completed and finalized during construction, first for the western, upper portion of the PLF followed by the eastern portion of the PLF.

The PLF closure cover construction generally proceeded from west to east for all layers of the closure system. When one layer such as the regraded surface was completed for a certain distance, the 6-inch cushion was started in that area, and when that layer was completed and approved by the field construction team in that section, the geosynthetic layers were started over that section. Thus, various components of the construction were being constructed at the same time under a hold point/release process (Appendix H), which facilitated the construction progress.

All construction activities discussed below were in compliance with the construction Drawings, Specifications, QA/QC Plan and approved design and field changes during construction.

2.1 Mobilization and Preparatory Work

The construction subcontractor (Stoller/Neilsons-Skanska) mobilized to the site in early August 2004. Mobilization and preparatory work, as discussed below in Section 4.1 was completed by early September.

2.2 Western Portion Construction

The western portion of the PLF closure was completed first, up to the "5980" contour line as shown on Figure 3 (near grid line 20500 to 20700 E). This portion of the accelerated action design was approved by the EPA/CDPHE first prior to approval of the East Face design and therefore this portion was started and completed first. Some overlap of construction in the western and eastern portions of the PLF occurred, but the western portion was completed prior to the eastern portion.

2.2.1 Earthwork at the Western Portion

Stripping (Clear & Grub) of the interim cover vegetation and top few inches of cover soil at the PLF was started on September 1, 2004. The proof roll procedures at the PLF started on September 14 along with the stabilization of soft areas. The RF alluvial subgrade placement and compaction was also initiated in mid-September. The 6-inch thick cushion material placement and compaction procedures started on October 19 and were completed on the top of the PLF (to 20700 grid line, Figure 3) by February 11, 2005.

Placement and compaction of the 10-inch thick cushion layer over the top of the geosynthetic components began in the western portion of the PLF on November 16, 2004 and was essentially completed by April 18, 2005 on the top of the PLF. The 12-inch thick rock layer was started on the west side of the PLF in early January and was essentially completed by April 20, 2005 on the top of the PLF. Placement of the 22-inch RF alluvial final cover layer was initiated in mid-January and was completed by April on the western portion. The top 2 to 3 inches of the material initially stripped from the PLF, and obtained from other site sources, was placed over the 22-inch layer from January to April in the western portion. The entire surface was ripped and disked prior to seeding in April with completion of seeding on the East Face slope (see Section 2.3 below) on June 2, 2005.

2.2.2 Geosynthetic Installations - Western Portion

The geosynthetics for the top liner system began on October 28, 2004 with the placement of GCL on the western portion of the PLF followed by FML and then GDN. The liner system was completed up to 5980 line (approximately 1,250 from the west end; Figure 3) by January 11, 2005. The liner crews then demobilized until mid-February when the next portion of the top liner system was completed up to the 20700 grid line just west of the anchor trench between the PLF top and East Face as discussed below in Section 2.4.

The landfill vent system below the liner was started in October, 2004 and a small liner crew installed the vertical vent risers and placed tape over the top of the vents in mid-January, 2005. The top covers were then installed on these gas vents in May, 2005.

2.3 Eastern Portion Construction

Exploratory borings on the East Face of the PLF were drilled and logged for final design from access fills at the crest and at the toe in September, 2004. Soil samples were collected from the borings for classification and geotechnical testing. The boring logs and results of the testing are included in the final design documents.

Work on the eastern portion includes an area west of the East Face berm east of the "5980" line, and the East Face including all seep system work and the northeast and southeast asbestos areas.

Clearing and grubbing of the East Face embankment areas were performed in January and February. Excavation of soft materials below the toe of the east embankment and replacement with compacted RF alluvium were performed in early to mid February. Installation of the strip drains along the East Face embankment was performed in mid to late February and placement of the compacted RF alluvial buttress was performed in late February to March, 2005. Placement and stabilization of the east pond sediments at the eastern portion of the PLF top occurred in mid-to-late January, 2005 including proof rolling of the stabilized materials. Placement of grading fill and the 6-inch cushion soils were then placed in this area in February to early March.

The final top PLF liner systems were installed over the northeast and southeast asbestos areas and the eastern portion of the PLF top in mid-to-late March with completion of the liner system in the eastern portion, including the East Face slope, by April 4, 2005.

Earthwork over the top of the eastern area (eastern PLF top and East Face slope) liner system, including the 10-inch cushion, rock layer and RF alluvial cover soil layers, were completed by early May, 2005.

2.4 East Pond Work

Vegetation was removed from the East Pond area in October, 2004 and pond sediments were removed from mid-December to early January, 2005. The wet sediments were mixed with cement kiln dust within the pond area in early January. Regrading of the East Pond was performed in late January and minor stabilization work at the southwest corner of the pond was completed in mid May, 2005.

2.5 Perimeter Channels and East Face Storm-Water Channels

Work on the perimeter channels was started in the fall of 2004 and substantially completed by early May, 2005. The culverts at the north perimeter channel and the southeast outfall from the south channel were completed on May 13, 2005.

Following final east face post-construction stability analyses and design of the east face storm-water management channels, the east face storm-water channels were installed at the toe of the east face in early August, 2005.

2.6 Completion and Closeout

Substantial completion of the PLF closure was reached on May 13, 2005. Following the pre-final inspection on May 9, final completion was achieved on May 19 and the construction contractor demobilized by May 20, 2005.

Seeding and mulching of the western portion of the PLF was performed in early spring and erosion control blankets were installed at the western portion of the PLF from early April through early May. Seeding, mulching and placement of erosion control matting was completed at the PLF on June 2, the steel supports for the seep treatment structure grating were installed the week of June 13 and the three new down-gradient groundwater monitoring wells were completed during week of June 20, 2005 and the east face storm-water channels were completed on August 9, 2005.

3.0 CONSTRUCTION EQUIPMENT AND PERSONNEL

This section presents the construction equipment and personnel utilized at the PLF to perform the closure activities by the construction team.

3.1 Construction Equipment

The construction contractor's equipment varied from 7 to 9 pieces of equipment during the early phases of the project to 26 to 27 pieces of equipment during the middle to latter phases of construction. These included haul dump trucks, motor graders, wheel tractor-scrapers, bulldozers, large pad-foot (sheepsfoot) compactor, smooth drum/vibratory roller, rubber-tired and tracked backhoe excavators, front-end loaders, tracked skid steer, forklifts, water truck, Bobcats and hand tampers. In addition to these, various 20 cy end-dump and belly-dump and flat-bed haul trucks were used by offsite material haulers to deliver earthwork and geosynthetics materials to the site. The type and number of each piece of equipment utilized on the site by the construction contractor is listed below:

The following equipment was utilized on the site during construction:

Motor Graders Caterpillar (Cat) 14G (3)
Front End Loader Cat 950B (1)
Front End Loader Cat 966F (1)
Track Loader Cat 963C (1)
Scrapers Cat 633D (3)
Bulldozers Cat D6R Low Ground Pressure (LGP) (2)
Bulldozer Cat D5R LGP (1)
Bulldozer with Rome Plow Cat D6 (1)
Smooth Drum Compactor with Vibratory Cat CS-583C (1)
Sheepsfoot (Pad-Foot) Compactor Cat 825G (1)
Sheepsfoot Wheel on Backhoe (1)
Water Truck (1)
Rubber Tired Backhoe Cat (1)
Bobcat T300 (1)
Tracked Skid Steer Loader Cat (1)
Forklift Cat (1)
Backhoes Cat 325L (2)
Dump Trucks Volvo A35C (2)
Dump Trucks Volvo A30C (3)
Hand Tampers (2)
Drill Seeder FLX-II (1)
Hydro-Mulch Truck (2)
Bulldozer with Disk (1)

3.2 Construction Personnel

The construction personnel included construction program management personnel from Stoller, earthwork construction personnel from Nielsons-Skanska, geosynthetics installation crews from Colorado Linings, and construction quality control personnel from Golder and survey personnel from Paragon. The PLF closure included over 85,000 man-hours of construction work during 2004 and 2005.

3.2.1 Earthwork Personnel

Earthwork crews varied in size of up to 35 personnel depending upon the extent of earthwork being performed. These included supervisors, equipment operators, spotters/flaggers, mechanics/oilers, and laborers.

3.2.2 Geosynthetics Installation Personnel

Geosynthetics personnel consisted of up to 17 personnel including supervisors, welders, sewers and laborers depending upon the extent of geosynthetics installations being performed.

3.2.3 Construction Quality Control Personnel

Construction quality control personnel typically included two to five field earthwork and geosynthetics sampling and testing personnel and various testing personnel in Golder's testing laboratory.

4.0 SUMMARY OF PRESENT LANDFILL ACCELERATED ACTION

This section presents the summary of the Present Landfill Accelerated Action including a general description of the various construction items. These summary descriptions are presented in a general chronological order from mobilization and preliminary activities through seeding of the PLF. A summary of installed quantities is also provided in this section.

4.1 Mobilization and Preliminary Activities

The construction contractor's mobilization and preliminary work consisted of mobilizing equipment to the site, performing preparatory site work and abandoning the existing vent system at the PLF.

4.1.1 Mobilization and Preparatory Work

Several construction trailers were delivered to the site and installed west of the PLF for the construction group, Kaiser-Hill, construction quality control personnel and construction quality assurance personnel. All such trailers were anchored down to remain stable during high winds and were equipped with power from a portable generator.

Preparatory work included improvement of various haul roads from the main paved access road and from Centennial Pit including addition of gravel to soft areas and placement of signage. A one-way access route was established for a portion of this site access road (Figure 2). Site fueling areas and material storage areas north and south of the PLF were prepared and dewatering of the pond east of the PLF began during the preparatory work stage. Water removed from the pond was stored in Baker Tanks and then transferred to the A-series ponds in accordance with RFETS Water Management Plans. Temporary concrete barriers were placed around the existing gas vents.

A truck weigh scale was placed near the gate to the Centennial Pit and an equipment wash pad and fuel tank with surrounding berm were installed at the site during the preparatory work. Erosion controls were placed at the site primarily within the perimeter ditch. The surveyors placed grading stakes on the PLF to guide the cut and fill operations during the subsequent grading operations.

4.1.2 Closure of Existing Gas Vents

Various gas vents were located at the PLF prior to initiation of work for the PLF closure. These three vents were closed by cutting the risers of below grade and filling the open wells with bentonite.

4.2 Stripping at the PLF

The stripping, or clear and grub, operations at the PLF were performed using graders to cut and place the existing vegetation in windrows. Scrapers were then used to remove the vegetation including the top 2 to 3 inches of soil. This material was stockpiled northwest of the PLF for later use on the PLF final cover. During the stripping operations, various areas of waste were encountered near the surface. All such waste was sampled and evaluated as discussed in Section 7.2 below and various waste materials were removed from the PLF as discussed below in Section 4.4. Various shallow test bores were performed at the PLF to estimate the extent of near-surface waste materials and the approximate thickness of existing cover soils. Because waste was found closer to the surface of the PLF than originally anticipated, a design change to raise the grade of the landfill closure was performed as discussed in Section 5.2.

4.3 Initial Grading and Proof Rolling

The initial PLF grading was performed and the areas were then proof rolled using two full passes with a scraper fully loaded with soil. Representatives from the design team, CTR representatives, QC team and QA team walked behind the scrapers to observe the deflection during the proof roll. All soft areas, having deflections of 1 to 3-inches or more, were marked with paint and flagged. Several small and a few larger soft areas were marked during the proof rolling. Shallow borings were performed at a few of the larger soft spots to estimate the extent and depth of the soft areas.

The referenced borings were used to both determine the cause of the soft spot and to delineate the extent of the soft spot. To determine the cause, boreholes were drilled and pushed in the areas of the soft spot exhibiting the most deflection. The type of soft spot was identified by analyzing the core samples. Three soft spot types were identified as discussed in the September 21, 2004 technical memorandum (see fifth design change, Section 5.2; RFI No. 3, Appendix E.2).

During drilling, the core samples were logged in the field technician's field notebook and the cores were placed back in the hole. No samples were submitted for geotechnical analysis and borehole depths were not included in the CCR as the intent was to determine the reason for the soft spot, not to fully characterize the lithology. As required by the September 21, 2004 technical memorandum, the areas were proof-rolled after the soft spots were repaired to determine if the remedy was sufficient.

4.4 Repair of Soft Spots and Waste Removals

Various soft spots at the PLF were treated in accordance with Design Change No. 4 (see Section 5.2). Soft areas were classified as small areas, larger areas with clayey soils and soft, wet areas. Soft clayey soils and soft soils in small areas were removed and the areas covered with non-woven geotextile and biaxial high density polyethylene (HDPE; Tensar BS1200) geogrid for stabilization prior to placement of compacted Rocky Flats Alluvium fill over the areas. The RF

Alluvium was placed in 12-inch lifts and compacted with at least 4 passes of a large sheepsfoot (also specifically known as a "pad foot") roller (Cat 825G, as discussed below). Several soft spots contained very soft, wet materials which were partially removed and replaced with rock materials prior to placement of stabilization materials and compacted RF Alluvial soils. The wet soft spots generally required geogrid/geotextile plus rock fill while the dry soft spots generally required geogrid/geotextile prior to placement of compacted grading fill. All repaired areas were then proof rolled with a loaded scraper again to verify that less than 1-inch deflection resulted to verify proper compaction and stability.

Much of the waste materials encountered remained within the PLF and were relocated to fill areas along the south-central portion of the top. These materials were spread out and buried beneath compacted RF Alluvium and the areas were then proof rolled to achieve the stability required. Some waste materials such as graphite materials removed from the northwest corner of the PLF and various bags of asbestos materials encountered in the northeast and southeast areas were removed from the site and properly disposed of through the Site's waste disposal program.

4.5 Removal of Pond Sediments and Placement at PLF

Removal of sediments from the East Pond were accomplished through: 1) the excavation of relatively dry sediments and transport directly to the top of the PLF and 2) mixing of relatively wet sediments with cement kiln dust (CKD) at the pond with subsequent transport to the top of the PLF.

4.5.1 Removal of Dry Sediments

Pond sediments which were visually field determined to be relatively dry were excavated and transported via large dump trucks to the top of the PLF. These sediments were removed primarily from the edges of the pond, hauled to the top of the PLF on the east side and spread prior to blending with CKD.

4.5.2 Removal of Wet Sediments

Pond sediments which were visually field determined to be relatively wet were blended with CKD at the pond and at a location adjacent to the pond prior to transport to the top of the PLF (see Contact Record, Appendix I). These sediments were removed primarily from the central portion of the pond following dewatering of the pond. All blending with CKD was performed using backhoe equipment until the blended material was sufficiently dry to transport to the top of the PLF. Some materials were transported to the top of the PLF, which were too wet to compact. Such materials were blended with CKD at the top of the PLF as necessary to achieve compaction.

4.5.3 Blending with CKD and Compaction

All pond sediments transported to the top of the PLF on the east side were spread and initially mixed with CKD using a backhoe followed by bulldozer mixing. In order to provide sufficient mixing of the materials, a large disc was then pulled behind a bulldozer which provided sufficient mixing of the sediments and CKD. The materials were then graded and compacted with the large sheepsfoot compactor in approximately 8-inch lifts to achieve required compaction as demonstrated by proof-rolling (see Section 5.1).

Completed sections of the CKD-treated sediments were then proof-rolled using a loaded scraper similar to the procedure utilized for the other portions of the PLF. Soft areas were then marked and allowed to dry prior to re-compaction. All portions of the properly compacted sediments were then graded and certified as acceptable prior to placement of compacted RF alluvial materials.

4.5.4 Confirmation Sampling and Regrading Pond Area

Confirmation sampling was performed in the East Pond following removal of pond sediments to verify that removal of contaminated sediments was completed. The confirmation sampling report is included in Appendix J.

Following removal of pond sediments as verified by confirmation sampling the pond area was regraded to smooth slopes approximating original grades using a backhoe. Following a very wet period in the spring of 2005, the southeast portion of the pond experienced some sloughing/movement. This area was subsequently regraded and compacted RF alluvium was placed and compacted to further stabilize the area.

4.6 Placement of Compacted Grading Fill

The compacted grading fill is RF alluvium which consists of rocky materials with approximately 14 to 25 percent fines and approximately 2 to 10 percent rock in the 6-to-12 inch size range (Submittals No. 39 and 39A, Appendix D.2). Because of the size range of the material, it is not conducive to moisture and density testing by established ASTM techniques except for large scale water or sand replacement techniques, which can be cumbersome and potentially inaccurate. Therefore, the technique for determining the placement procedure for the RF alluvium was based on a procedure specification from a field demonstration as discussed in Design Change No. 5 (Section 5.2). This consisted of placing a 1-foot lift of the RF alluvium followed by compaction of the material with varying passes of a large pad-foot (sheepsfoot) roller (Cat 825G). Following compaction, the materials were then proof rolled using a loaded scraper (Cat 633D). Following four complete passes of the sheepsfoot compactor on the RF alluvium at proper moisture content as visually determined, the compacted materials achieved less than 1-inch deflection as visually determined under the proof roll and the placement/compaction procedure was determined to be acceptable. This procedure was then utilized throughout the remainder of the RF alluvium placed and compacted for regrading at the PLF top surface and East Face buttress construction.

Very cold weather impacted placement of subgrade materials a few times during the late fall and winter period. Several areas of RF alluvium were removed due to frost followed by wet conditions in early December, 2004 and again in January, 2005 and were replaced as necessary prior to compaction to the project requirements.

The RF alluvial regraded surface was then surveyed to achieve tolerances of plus or minus 0.1 foot of design grades prior to placement of the 6-inch cushion soil.

4.7 Placement of Lower 6-Inch Cushion Soil

The lower 6-inch thick cushion soil, also known as foundation soil, was placed over the top of the compacted RF alluvial materials and placed in a loose lift of approximately 7 to 8 inches prior to compaction. Portions of the cushion soil were scarified to provide air drying to achieve proper moisture content necessary for compaction. Rocks and cobbles larger than 0.5 inch were manually removed from the cushion soil and large soil clods were broken down prior to compaction as visually determined. The cushion soil was compacted with a vibrating smooth drum compactor (Cat CS-583C) to achieve the specified minimum compaction of 95 percent of the maximum dry density as determined by the Standard Proctor Test (ASTM D 698).

The minimum thicknesses of the cushion soils were verified and the grade of the soil layer was verified by survey prior to placement of the geosynthetic liner system. A tolerance of minus 0 and plus 0.2 foot of the design grades was achieved for all cushion soil placements in accordance with design specifications.

4.8 Geosynthetic Installations

This section describes installation of the geosynthetic liner systems for both the western and eastern portions of the PLF closure. Geosynthetics installed for the PLF closure include, from bottom of the composite liner system to top: geosynthetic clay liner (GCL), geomembrane flexible membrane liner (FML) and geocomposite drainage net (GDN). Two different types of GCL and FML were utilized for the PLF cap system, one for the top area and one for the East Face closure. All geosynthetics were delivered to the site, stored on gravel pads north and south of the PLF and covered with tarpaulins. All geosynthetics were installed by Colorado Lining International.

The quality assurance and quality control procedures and tests for the geosynthetic installations at the PLF are discussed in Section 6 and the QA/QC data and test results are presented in Appendices F (Quality Control) and G (Quality Assurance). Detailed panel installations for the GCL, FML and GDN materials are presented in the final as-built Record Drawings (Appendix M).

4.8.1 Geosynthetic Clay Liner

The GCL materials consist of an inner core of granular sodium bentonite between two geotextile materials. These are "Bentomat" materials manufactured by CETCO Lining Technologies in Lovell, Wyoming. The GCL was delivered to the site in rolls 150-feet long by 14.5 to 15-feet wide. Typically the rolls of GCL were lifted and transported to the landfill using forklifts, then placed in accordance with the manufacturer's recommendations (Submittal No. 005A, Appendix D.2) and the specifications.

4.8.1.1 GCL on Landfill Top

Placement of GCL began from the west side of the PLF following completion and certification of the 6-inch cushion soil layer. The GCL installed on the top of the PLF is a Bentomat ST which has a woven slit-film geotextile on one side (top) and a non-woven geotextile on the other side with needle-punched fibers through the GCL. This GCL is typically utilized on cover slopes less than 10(h):1(v).

Adjacent panels of GCL were overlapped at least 6 inches and end-of-panel (butt) seams were overlapped a minimum of 24 inches. The edge seams between panels contained the manufacturer's "Supergroove" material, which provides bentonite contact between the panels through a slot in the geotextile. Therefore, most of these edge seams did not require the use of additional granular bentonite. The end butt seams, however, all received additional granular bentonite added between panel sections. These were applied through an application device calibrated to add at least one-quarter pound of granular bentonite per foot. Granular bentonite was also added to penetrations in the GCL cut to provide vertical pipe penetrations.

Various portions of the GCL placed on the west side of the PLF required removal due to hydration following runoff from precipitation events, both rain and snow. Such sections were removed and replaced with new GCL as detailed in Appendices F 2.2 and L. When the crest of the PLF was reached, this problem diminished because the drainage was away from the leading edge of the GCL. One area of the GCL which was hydrated to approximately 3 feet from the edge was not removed; rather the adjacent GCL panel was overlapped over this hydrated section. This is an acceptable method of repair for edges of GCL which have become hydrated. The ends of the GCL were placed in an anchor trench extending around the edges of the PLF cover (Figure 3 and Appendix L, Record Surveys).

All sections of GCL were inspected for defects prior to placement of FML over that particular section. Defects were repaired using either: 1) a geotextile patch over the top of the damaged GCL heat welded to the top geotextile, 2) a GCL cap section, 3) an extension of the GCL or 4) a large overlap of adjacent GCL. Appendix F 2.2 includes the locations and methods for each GCL repair, which were performed in accordance with project requirements.

4.8.1.2 GCL on East Face Slope

The GCL installed on the East Face of the PLF is a Bentomat DN which consists of non-woven geotextile on both sides with needle-punching of the GCL matrix. This material has relatively high internal shear strength as well as high interface friction angles with adjacent geosynthetics, and is designed for use on slopes up to 3:1.

This material was placed over the 6-inch cushion soil layer with primarily vertical seams on the 4:1 side slopes of the East Face. Installation of the GCL began from the central-east portion of the East Face and proceeded towards the south to the southeast corner. Following completion of this south area the material was then placed from the central-east face slope towards the north to the northeast corner. Following placement and approval of each section of the GCL, the material was covered with textured FML before the end of each day. The materials were rolled from the anchor trench just beyond the top of the slope down to the toe anchor trench. Vertical panels of GCL were overlapped 10 inches, minimum and end-of-panel seam areas were overlapped a minimum of 24 inches with granular bentonite placed between panels. These horizontal end-of-panel seam areas were shingled on the 4:1 slope.

This GCL on the East Face slope was inspected and repaired in the same manner discussed above for the GCL on the landfill top area.

4.8.2 Geomembrane (Flexible Membrane Liner)

The FML for the landfill closure consists of a 60-mil linear low density polyethylene (LLDPE) geomembrane manufactured by GSE Lining Technology, Inc. The FML was delivered to the site in rolls each 520 to 560-feet long by 22.5-feet wide. FML rolls were placed on the PLF closure using forklifts and liner installation crews as necessary. All seams between adjacent panels of FML were double-seam fusion welded with an electric hot wedge welding machine. Extrusion welds were made using hand-held extruders with integrated pre-heat air supply.

4.8.2.1 Smooth FML on Landfill Top

The FML on the top of the PLF closure is a smooth, black 60-mil LLDPE (GSE "Ultraflex") material. The FML panels were placed and overlapped 6 inches with adjacent panels prior to wedge welding. In general, the panels of FML were placed in accordance with the panel liner layout diagrams prepared by the installer with approval by the CTR and CQAE. In some areas, notably the southeast portion of the top PLF area and East Face, it was decided to vary the placement slightly from the layout diagrams based on actual field conditions and requirements. These are field changes summarized in Section 5.4.

The seam areas were cleaned as necessary and the wedge welders were operated at speeds varying from approximately 7 to 10 feet per minute (fpm) at temperatures of 750 to 800 degrees Fahrenheit. Slower machine speeds were typically used with lower ambient air temperatures. Both the wedge welded and extrusion machines were checked once or twice daily (beginning of each shift which encompassed varying ambient temperatures) using trial seams tested for shear and peel.

Although procedures were in place to seam the FML at ambient temperatures below 32 degrees F down to 5 degrees F, these procedures were not necessary due to the relatively mild winter. This is documented in RFI No. 30 (Appendix E). The major portion of the FML fusion seaming was performed during ambient temperatures between 35 and 60 degrees F. Only minor portions of patching with extrusion welders was performed at ambient temperatures slightly below freezing, which did not impair the performance of the patch seams.

Following placement of each FML panel or section of panels, the surface was observed for any defects by the SQAM and the QCSM. This included any damage from equipment, surface defects, welding problems or large wrinkles. The specifications required that FML wrinkles have a maximum height-to-width ratio of 0.5 with a maximum wrinkle height of 6 inches. Any defects or damages to the FML were then marked and the defects repaired by either repair patches, extruded FML patch material or grind and re-weld for inadequate welds. Various QC tests were performed including testing of destructive seam samples for peel and shear, pressure testing the wedge-welded seams and use of a vacuum box for patches and repaired areas. Most field tests initially passed the minimum requirements, and those initial tests not passing required additional repairs until subsequent tests achieved the minimum requirements. Therefore, all final QC tests met the minimum project requirements. Such test procedures are discussed in Section 6.

The ends of the FML panels were placed into the same anchor trench as the GCL extending around the periphery of the landfill top area. Ends of the FML (and GCL) were trimmed as necessary to avoid excessive overlap on materials in the anchor trench. Cushion soil was then compacted in the anchor trench using a hand tamper to the required specifications of at least 95 percent of the maximum dry density as determined by the Standard Proctor Density Test (ASTM D 698).

4.8.2.2 Textured FML on East Slope

A co-extruded textured 60-mil LLDPE geomembrane FML was installed on the East Face slope to achieve the required veneer stability of the liner system on the 4:1 slope. Following interface friction angle testing of the various geosynthetic materials, it was determined that the 60-mil LLDPE-T overlying the Bentomat DN with the project GDN on top would be stable on the 4:1 slope.

Following placement and approval of sections of the GCL on the East Face slope, panels of the textured FML were placed by rolling the sections from the anchor trench just beyond the top of the crest down the slope to the toe anchor trench. The side of the FML having the higher asperity was placed on the upper side of the FML to achieve an adequate friction angle with the overlying GDN on the slope, which was determined to be the critical interface friction angle based on laboratory testing (Submittals No. 045 and 082, Appendix D.2). Vertical FML seams were overlapped 6 inches and fusion heat welded with the double seam welder. The welding machine ran upslope from the toe anchor trench to the upper anchor trench at speeds varying from 8 to 8.5 fpm. Trial seam tests were performed for textured FML similar to that described above for smooth FML. A few 45 degree field seams between FML panels were required on the 4:1 side slopes and no horizontal seams were installed on the slope.

The textured FML on the East Slope was then inspected by the QCSM and the SQAM and marked for any defects and all defective areas were repaired as discussed in Section 4.8.2.1 above. Field tests were performed on the East Face FML-T installation as discussed above and all field tests passed the minimum requirements.

4.8.3 Geocomposite Drainage Net

The geocomposite drainage net (GDN) used for the PLF closure on both the top area and East Face was a TexDrain 200 DS8 manufactured by CETCO Lining Technologies. This consists of high-flow polyethylene drainage net with non-woven geotextile on both sides of the drainage net. This material was delivered to the site in rolls 200-feet long by 13.5 feet wide and stored north and south of the PLF.

GDN rolls were placed at the site over construction team approved sections of FML. The adjacent sections of GDN were tied at approximately 5-foot centers with plastic zip-ties between geonet sections and the adjacent sections of the geotextile were continuously sewn with a hand-operated machine. Minor portions of the GDN geotextile were heat seamed, however, the majority were sewn.

End or butt seams between GDN panels were zip-tied at one foot intervals with geotextile sections heat bonded over these areas. These butt seam connections were also utilized on the East Face 4:1 slope as discussed below. The ends of the GDN were extended over the top of the GCL/FML anchor trench, down the 4:1 side slopes of the perimeter drainage channel and terminated at the base of the rock layer.

The GDN was inspected visually for defects and seaming prior to release for the overlying soil layer. Small portions of the GDN extending over the 4:1 side slopes along the perimeter channel sustained damage from snow removal equipment in early December. Such areas were repaired using a geotextile under the hole to replace the damaged lower geotextile, zip-tying the torn drainage net together and welding a small new 3-layer GDN section over the damaged area. This provided adequate repair of the damaged areas while providing necessary drainage. Portions of the GDN were also damaged by extremely high winds in mid-December and resulted in an area of the zip-ties being pulled apart, while the sewn geotextile held together. This required the removal of the sewn geotextile and replacement of all torn zip-ties followed by re-sewing the geotextile to the original specifications.

The GDN on the East Face slope was placed from the upper anchor trench down the 4:1 slope to approximately 19 to 20 feet beyond the lower anchor trench. This lower end extended to the rock layer to provide drainage outlet from the GDN. The panels were placed with edge seams overlapped 6 inches with plastic zip-ties placed between the geonet sections every 5 feet, maximum. The geotextiles were then continuously sewn on the vertical slope seams. The end (butt) seams were overlapped a minimum of 24 inches and shingled down slope prior to tying every 1 foot with zip-ties. These end overlaps were then covered with heat-seamed geotextile sections.

4.9 Placement of Upper 10-inch Cushion Soil

Placement of the 10-inch cushion soil began from the west end of the PLF following completion and approval of the GDN in a particular area. Front end loaders were used to place and rough grade the 10-inch cushion layer without driving directly on the GDN. Small wrinkles within specification limits were typically covered and large wrinkles in excess of specification limits were "stepped-out" to small wrinkles and covered. The material was then graded and compacted to achieve the proper thickness and compaction specifications as discussed above for the 6-inch cushion layer (Section 4.6).

Portions of the 10-inch cushion material were too wet to place and compact and were spread out to air dry until the moisture content was closer to optimum required for compaction. Other portions of the cushion soil were spread out in long "fingers" over the GDN prior to expected weather events with potential high winds. This served to protect the GDN from such events, and the cushion soil was subsequently spread, graded and compacted to achieve specifications of at least 95 percent of the maximum dry density as determined by the Standard Proctor Density Test (ASTM D 698).

4.10 Placement of Rock Layer

Following placement and compaction of the 10-inch cushion soil in an area at the proper moisture content, the rock layer was delivered and spread using low-ground-pressure (LGP) bulldozers (Cat D6) to the required thickness of 12-inches.

Final project specifications required the development of a test section on the rock layer using equipment proposed for placement to minimize impacts to the underlying cushion soils. To verify that significant impacts did not occur to the underlying cushion soil following use of the LGP bulldozer equipment, test pits were excavated through the materials. These indicated that very little rock materials had penetrated the upper two inches of the underlying cushion soil. Therefore, use of the LGP (D6) bulldozer was approved by the designers and the EPA/CDPHE (Appendix E) and the use of other equipment on the rock layer was minimized.

Portions of the rock material exhibited some segregation of rock and finer-grained materials during delivery and placement. Such areas were modified by placement of small amounts of cushion soils to the surface of segregated rock materials.

4.11 Placement of Cover Soil

Following placement and approval of the rock layer in an area, the cover soil layer was placed from west to east at the PLF. This placement was performed in a two stage process with an initial lift of approximately 22 inches of RF Alluvium followed by an approximately 2 to 3 inch lift of more organic RF alluvial soil. This upper layer of soil was obtained from material stripped from the temporary cover on the PLF, from materials previously stripped from the "New Landfill" west of the PLF, which was not constructed, and other sources approved by the construction team. A third source of surface RF alluvial soil with relatively high organics was acquired from the Centennial Pit surface soils to complete the soil cover at the PLF.

The initial 22-inch lift was placed with the LGP (D6) bulldozer with no compaction. Necessary material delivery haul roads across the surface of the material were minimized to reduce compaction of the materials. This initial lift was surveyed to verify grades and to provide for a plus 0.2 foot and minus 0 tolerances as per design specifications. The final 2 to 3-inch lift was then delivered and placed using scrapers and low ground pressure equipment. The lift was then graded and surveyed to verify the total thickness of 24-inches, minimum and to verify the final grades were in accordance with design. The top of the cover soils were then ripped using ripper teeth attached to a D6 bulldozer or motor grader at approximately 1-foot spacing with a ripping depth of approximately 12 inches. This ripping of the surface was required to prepare a loosened soil strata for seed bed preparation.

To achieve a loose, blended condition for seeding, the upper few inches of the surface was then disked using a D6H XL bulldozer with an agricultural disk.

4.12 East Face Earthwork and Seep System Construction

Construction at the East Face of the PLF included preparation of the East Face and toe area including seep water collection and temporary modification of the seep system followed by construction of the buttress, installation of the liner system (as discussed above in Section 4.8) and placement of the cover soil layers.

All work performed east of the "5980" line was conducted under approved Work Plans, including the following:

1. East Landfill Pond Sediment Removal Work Plan, dated November 23, 2004, approved by the EPA on December 2, 2004;
2. Section 1 East Face Work Plan, dated January 21, 2005, approved by the EPA on 1/21/05;
3. Section 3 East Face Work Plan, dated January 21, 2005, approved by the EPA on 1/24/05;
4. Section 2 East Face Work Plan, dated February 3, 2005, approved by the EPA 2/23/05;
5. Liner Installation Work Plan (Between the "5980" line and the crest of the existing slope), dated February 3, 2005, approved by the EPA on 2/11/05;
6. PLF Strip Drain Installation Notes, dated February 11, 2005, approved by the EPA on 02/11/05;
7. 6-Inch Cushion Soil Installation Work Plan, dated March 10, 2005, approved by the EPA on 3/11/05.

4.12.1 East Face Clearing and Grubbing

Construction at the East Face of the PLF began with clearing and grubbing of the north, south and central portions of the existing East Face. Trees and root balls were removed as was a layer of vegetated soil. The seep areas on the north groin of the east slope were uncovered during excavation in this area. The cover soils removed from the East Face were stockpiled for later use on the final cover.

During clearing and grubbing of the area, several bags of asbestos materials were uncovered and removed from the site as well as some areas of miscellaneous trash. Additional asbestos-containing materials (ACMs) were discovered on the southeast and northeast portions of the PLF which were outside the limits of the cover system. Rather than extend the cover design, it was decided to remove the asbestos from the site (Figure 5). All ACMs were properly disposed using the Site's waste disposal program (see Contact Records, Appendix I).

4.12.2 East Face Embankment Construction

Soft silty materials near the toe of the East Face Embankment were excavated and removed to sound foundation materials as visually determined. A geotechnical engineer observed the removal and determined that the excavation reached sound materials with concurrence of QA personnel. The thickness of the soft soils had been previously estimated to be a few feet through the drilling program. The toe area excavation was approximately 5 to 10-feet deep by approximately 80-feet long by approximately 10 feet wide at the base. This area was backfilled with RF alluvium and spread and compacted in lifts using at least four passes of the large sheepsfoot compactor (Cat 825).

Prior to placement of the East Face Buttress, a series of strip drains were placed along the pre-construction embankment to collect the north seep and any additional seeps which may occur along the embankment (As-Built Dwg. No. 013B). These strip drains are an "Akwadrain" material as manufactured by American Wick Drain Corporation consisting of 1-foot wide geosynthetic drains as discussed further in Section 5.2. The strip drains were stapled into the embankment material and covered with sand for protection during construction. The strip drains discharge into a polyethylene sump and a gravel drain system near the old seep collection area with piped conveyance to the seep treatment system. The sump at the end of the strip drains was installed initially and backfilled. This was later excavated to correct a drainage problem as discussed in Section 5.1. Rocky Flats alluvial backfill was then placed back in this excavation and compacted with a sheepsfoot attached to a backhoe to achieve the 4:1 slope. The pipe installed from the sump to the seep treatment system was a 4-inch diameter polyvinyl chloride (PVC; Schedule 80) within gravel bedding. A portion of the flow in the pipe bedding was also intercepted at a bentonite wall downstream of the sump and collected in a pipe for discharge into the seep treatment system.

The original seep treatment system was removed and temporarily diverted downstream during construction of the East Face buttress. The original concrete seep collection vault was left in place and filled with gravel prior to placement of buttress fill material over the vault. The original seep collection area was modified with a small bentonite cutoff wall with a 3-inch diameter PVC (Sch. 80) pipe in a trench with gravel bedding conveying seepage flows to the new seep treatment area as discussed below.

The East Face buttress was constructed using RF alluvium with placement in approximately 12-inch lifts. The material was spread and compacted with four passes of the large sheepsfoot compactor. Water was added to the lifts as necessary to maintain moisture content required to achieve proper compaction. The previous drill pads (also RF alluvium) were regraded and included within the horizontal lifts of the buttress.

4.12.3 East Face Cover Construction

The 4:1 slopes on the East Face, including the north and south areas were graded prior to placement of the 6-inch cushion soil layer. This 6-inch layer was placed by a front end loader with equipment pushing the material down the slope. The material was then graded to the proper thickness using a motor grader prior to compaction with the smooth drum roller working up and down the slope as necessary. The roller was on the uphill side while performing this compaction procedure.

Similar to the top surface of the PLF, a composite liner system was placed on the 4:1 East Face slopes following placement of the 6-inch cushion soil layer as discussed above in Section 4.8. The composite liner system was placed a portion of the distance down the 4:1 slope to cover the identified waste areas with the anchor trench approximately 15 to 20 feet vertically above the downstream toe (As-Built Dwg. No. 008).

The upper 10-inch cushion soil was then placed over the liner system on top of the GDN on the East Face down to the lower anchor trench by placing from the southeast portion of the area towards the north. A front end loader placed the cushion soil with equipment pushing the material down the slope. A motor grader was then used on the slope followed by the smooth drum roller similar to the procedure utilized for the 6-inch cushion soil layer.

The rock layer was placed over the properly graded and compacted 10-inch cushion soil by tramming down the slope with a front end loader and then pushing up the slope with a D6 bulldozer to avoid segregation of rock materials. The rock and 10-inch cushion layers were placed with controlled maneuvering of equipment to avoid damage to the underlying geosynthetics.

The rock layer was installed on top of the bench below the portion of the 4:1 slope covered by the geosynthetic liner system with "day lighting" at the surface. This was performed to provide for a drainage pathway for the GDN on the slope below the geosynthetic liner system.

The lower portion of the 4:1 East Face slope below the liner anchor trench does not contain the upper cushion soil and rock layers, but rather consists of compacted RF alluvium buttress with the associated cover soils above the geosynthetic liner system (As-Built Dwg. No. 013A).

Cover soils on the East Face slope were placed by first placing a portion of the 22-inch layer near the toe then placing the materials from the north to the south in a diagonal fashion along the slope. This procedure was utilized to reduce the potential stresses on the underlying liner system that could result from placement of the entire lift from the crest down the slope. Compaction of this layer was minimized to the extent possible during placement. The 2-inch soil layer was then placed to final grade prior to loosening the surface by disking for drill seeding.

The final slope of the East Face constructed embankment and cover varies from 4:1 in the central portion to approximately 4.2:1 on the north portion, and the total embankment height from the crest to the seep structure is 55 approximately feet.

4.12.4 Top Anchor Trench above East Face Slope

The top anchor trench above the East Face slope is designed for geosynthetic anchorage as well as drainage from the western portion of the top landfill GDN (As-Built Dwg. 013A). The GCL, FML and GDN extending down the 4:1 slope were placed in the anchor trench first with geosynthetic materials overlapping the opposite side of the trench followed by placement of the GCL, FML and GDN from the top area extending across the base of the anchor trench. The GDN was cut as necessary to provide a seal within the trench. The anchor trench then included a perforated 4-inch diameter polyethylene drainage pipe in a gravel envelope which extended to the top of the anchor trench. This drainage pipe discharges to the perimeter channel on both the north and south sides of the PLF closure. Drainage from the perimeter channel discharges downstream of the East Pond, east of the PLF closure. A non-woven geotextile (8 oz/sy) was then placed over the top of the anchor trench prior to placement of upper 10-inch cushion soil.

4.12.5 East Face Storm-Water Management Channels

The east face storm-water management channels were constructed to replace the temporary swales installed previously at the toe of the east face and provide adequate storm-water drainage. They consist of two trapezoidal drainage channels on the north and south sides of the seep treatment structure each beginning above the treatment structure (below the east face liner system lower anchor trench and GDN termination) and extending below the treatment structure. The North Channel is approximately 115-feet long and the south channel is approximately 100-feet long and gradients vary from approximately 12 to 25 percent with a gradient of approximately 2 percent at the outfalls. The channels consist of a non-woven geotextile (8 oz/sy) on the excavated base with 4 inches of gravel bedding (CDOT Class A Drain Rock, 1 ½-inch minus). Riprap (D50=6", CDOT Type VL) lining was installed in a thickness of approximately 12 inches over the gravel bedding. The bottom width is approximately 4 feet, the side slopes are 2:1 and the depth of flow is approximately 1 foot. Design of the channels is presented in Appendix O.

These channels were constructed with a track hoe with front end loaders delivering materials. Laborers placed the geotextile with minimum 2 feet overlaps shingled downstream and spread the gravel to proper thicknesses to achieve tolerances in bedding thickness of minus 0.1 and plus 0.2 feet. The riprap was placed and spread with the track hoe bucket to achieve required tolerances. These storm-water channels should adequately protect the toe of the east face, including the seep treatment structure, from erosion during floods up to the 1000-year design event.

4.13 Passive Seep Treatment System Installation

The passive seep treatment system was modified to include the original seep plus the drainage from the strip drain system placed on the original embankment and the inflow from the north and south Groundwater Interception System (GWIS). The original concrete seep collection box was closed by filling with gravel, as discussed above, and the seep was diverted to the new toe of the 4:1 slope where the seep enters the treatment system along with the drainage from the strip drain system and GWIS.

A bentonite cutoff wall was installed across pipes from the original seep and from the strip drain system to provide pipe-flow capture of all water flowing in the pipe bedding systems. This cutoff wall is approximately 25-feet long by 7-feet high by 2-feet wide installed approximately 9 to 10 feet upstream of the collection manholes. Seep cutoff polyethylene flanges were used around the pipes within the cutoff wall and a section of perforated pipe is installed upstream of the wall to collect all seepage in the pipes. This is reflected in Design Change No. 14 (Section 5.2). The bentonite cutoff wall was constructed in 6-inch lifts, hydrated with 1 gallon of water per 10 pounds of bentonite and allowed to hydrate for 15 minutes prior to placement of the next lift. The perforated pipes immediately upstream of this cutoff wall were field adjusted to the bottom of the pipe trench with additional liner material placed to provide for complete collection of all seepage in the pipes upstream of the wall with subsequent diversion to the downstream seep treatment system.

Two 4-foot diameter precast concrete manholes are installed downstream of the cutoff wall and both manholes have bolt-down cast aluminum covers. Flow from the strip drains and north and south GWIS flow into the north 4-foot deep manhole and the original seep flows into the south 6-foot deep manhole. Discharge from these manholes both occur in the seep treatment structure. Following construction, small flows totaling less than 1 gpm (as manually determined) occurred from the original seep, the strip drain system and the north GWIS into the seep treatment structure.

The seep treatment structure was constructed over compacted alluvium with a geotextile placed on the alluvium and an approximately 10-inch thick layer of gravel. The structure was constructed in four concrete pours: the base slab, the majority of the walls, the internal steps and the remaining portion of the downstream wall. The downstream wall was poured last to provide better access for construction of the steps. The structure dimensions, placement of steel reinforcement and pipe penetrations and level checks were made prior to pouring concrete in the structure. Standard concrete field slump and air entrainment tests were performed along with cylinders cast for later compressive strength testing.

As discussed in Section 6, the concrete for the north, south and west walls was tested below the originally-specified compressive strength of 4,000 psi (see Appendix F 2.1). Therefore, the designers checked the strength of the 12-inch thick concrete walls and it was determined that a 3,000 psi concrete would be sufficient as discussed in Section 5.2 below.

4.14 Venting System Installation

The primary purpose of the PLF venting system is for barometric pressure equalization. The PLF passive venting system consists of a series of gravel filled trenches at the top of the landfill under the liner system leading to a series of vertical riser pipes extending through the cover. The trenches were excavated with a backhoe through the graded, compacted RF Alluvium. Gravel in the trenches is a clean drainage rock, ¾-inch minus crushed gravel material. This is placed in trenches approximately 1-foot deep by approximately 2-feet wide with a non-woven geotextile (8 ounces per square yard) over the top as an added protection to the overlying GCL. These passive vent trenches extend in three rows over a total of approximately 3,000 feet of the PLF top area.

Nine ventilators are installed vertically at various locations through the cap system along with three vertical header access risers at the east end of the ventilation system. The vertical vents consist of 4-inch diameter high density polyethylene (HDPE) pipe having a Standard Dimension Ratio (SDR) of 11 (0.4 inch pipe wall) which is equivalent to the Schedule 80 HDPE pipe specified. The vertical vent penetrations consist of an HDPE pipe boot welded to the FML and the pipe with a stainless steel band around the pipe (Field Change No. 8). The GCL penetration consists of a cut at the pipe location with granular bentonite placed around the penetration. The vertical pipes extend approximately 4 feet above final grade with roof-top type aluminum vent covers.

4.15 Perimeter Diversion Channel Construction

The perimeter channels extend approximately 4,300 feet around the north and south sides of the PLF including an outfall with twin culverts on the southeast side and discharge through twin culverts on the north side. The northeast perimeter channel outfalls through a swale (Figure 3 and As-Built Dwg. 009).

4.15.1 Perimeter Channels

The major reaches of the perimeter channels were constructed with a minimum bottom width of 10 feet and 4:1 side slopes to the lines and grades on the final drawings. The average grade of the perimeter channels is approximately 1.5 to 2 percent, exclusive of the outfalls.

Construction of the channels was performed using excavators and scrapers and some additional RF alluvium was obtained from excavation of the channels to provide compacted grading fill at the PLF. Portions of the channel required temporary culverts and access ramps during construction, all of which were subsequently removed to final grade.

The invert and side slopes of the perimeter channels constructed at gradients of 2 percent or less were covered with straw/coconut fiber biodegradable, extended-term erosion control mat (NAG SC150) and seeded. This erosion mat utilized metal staples and was placed from the channel invert to the top of the 4:1 slope adjacent to the landfill and to a minimum height of 2 feet above the invert on the opposite side of the channel. The ends were buried in a trench at the top of the slopes and backfilled.

The northwest portion of the north perimeter channel was extended towards the northwest approximately 50 to 100 feet during construction, and the PLF cover system was likewise extended, following discovery of a graphite waste material at that location as discussed in Section 5.2. A portion of the waste was removed from the site while a portion remained under the extended cover.

4.15.2 Outfalls and Riprap

The south perimeter channel discharges into a riprap-lined section southeast of the PLF prior to conveyance through two new culverts under the East Dam access road. This riprap-lined section is approximately 350-feet long at a gradient of approximately 6 to 15 percent. This section is 10-feet wide with varying side slopes (up to approximately 2:1) and contains riprap in a thickness of approximately 18 to 21 inches (D50=12") extending a minimum of 2 feet vertically on the side slopes. The length of this southeast riprap-lined channel is approximately 350 feet upstream of the culverts and approximately 200 feet downstream of the culverts.

A separation geotextile was used beneath riprap on the excavated invert with ¾-inch minus gravel over top just below the riprap. This is a non-woven geotextile material having a weight of at 8 ounces per square yard, which is anchored into the channel side slopes at the top of the gravel and riprap.

An old corrugated metal pipe culvert on the north perimeter channel was replaced by two 36-inch diameter HDPE culverts. These are externally corrugated, smooth interior HDPE pipes in accordance with ASTM M 294 (ADS N-12) with bell and spigot joints with HDPE bands. They were installed with 2 feet of cover and pea-gravel pipe bedding under the culverts with compacted cushion soil fill over the top and RFA road surfacing. The southeast outfall from the south perimeter channel also contains two 36-inch diameter HDPE pipe culverts of the same specification under the East Dam access road.

The north culverts were placed at a slope of 2 percent and the southeast culverts were placed at a slope of 4 percent along the channels. Each culvert was separated by 2 feet, placed on 4 inches of pea gravel bedding and embedded in compacted cushion soils to approximately 1 foot above the top of the pipe. The cushion soils were compacted to at least 90 percent of the MDD as determined by the Standard Proctor Density Test. An additional one foot of RF alluvium was then placed and compacted over the cushion soils to achieve a cover of 2 feet over each culvert pipe.

Riprap was placed at the outfall of the northeast channel for a distance of approximately 100 feet and in a width of approximately 10 feet. A culvert is not present at this location; however, riprap was placed to prevent erosion below the grade break outfall.

4.16 Seeding at the PLF

Seeding of the PLF was performed by drill seeding methods in accordance with design specifications by the Rocky Flats Closure Site Services. This included three seed mixes with application in one applicator. This included a small seed box mix, a cool seed box mix and a fluffy seed box mix. The applicator (Truax Model FLXII-818) was calibrated for the three seed mixes and all three seed mix rates were increased to accommodate the requirements of the applicator. The final total seed mix rate used in the seeding program included approximately 16.7 pounds of live seed per acre.

Seeding on 4:1 slopes on the East Face and around the perimeter channel was performed by drill seeding followed by hydromulching.

4.17 Erosion Control Matting

Erosion control matting used for the PLF closure consists of a biodegradable straw (70%)/coconut fiber (30%) mat (North American Green [NAG] SC150), a biodegradable coconut mat (NAG C125) and a permanent erosion control/turf reinforcement mat (TRM; NAG C350). The permanent TRM consists of a three dimensional plastic net with coconut fiber matrix that is designed to prevent erosion in channels having maximum hydraulic velocities of approximately 10 feet per second (fps) or on long side slopes.

The biodegradable coconut mat (C125) is used on the top surfaces of the PLF with steel anchor pins at approximately 3 feet on center. The biodegradable straw/coconut mat (SC150) is used in the perimeter channel invert and side slopes. These erosion control mats are manufactured to provide approximately 2 to 3 years of erosion protection.

The TRM is used on the East Face 4:1 closure slopes and in the top surface outfalls from the east berm to the perimeter channel on the north and south sides in widths of approximately 30 feet. Because the tensile strength of the permanent TRM was slightly low for one of the samples tested in the QA laboratory (see Section 6.2.3 below), the staple pattern was increased over that recommended for the 4:1 East Face slope to achieve 2 to 2.5 feet spacing on the slope.

4.18 Installation of New Groundwater Monitoring Wells

Three new groundwater monitoring wells were installed down gradient of the PLF below the East Face Slope. One well was located near the north seep system manhole at the toe of the East Face and two were located further down gradient, one southeast of the East Pond and one northeast of the pond. The monitoring wells were installed in hollow-stem auger boreholes with total depths varying from approximately 27.7 feet to 32 feet below ground surface. The wells are screened approximately in the lower 20 to 25 feet, within weathered claystone and siltstone materials. The weathered bedrock contact varies the ground surface to approximately 12 feet below ground surface and all wells were dry at the time of drilling.

The monitoring wells are constructed using 2-inch diameter PVC pipe (Sch. 40) with slots in the screened zones of 0.01 inch width, threaded end sump caps and 16/40 silica sand filter pack. Bentonite pellets (1/4-inch) were used in the bottom of each well below the filter pack and in the top seal which is in the upper 4 to 4.5 feet of the wells. The surface PVC casings extend approximately 2.3 to 2.7 feet above the ground surface and the locking, 5 by 5-inch square protective steel casings extend 3.1 to 3.3 feet above the ground surface. The protective steel casings are anchored in concrete approximately 1.6 to 1.9 feet below ground surface. Well pads consist of 3 by 3-feet square concrete pads. The boring logs and well completion details are found in Appendix M.

4.19 Summary of Material Quantities

The following table presents material quantities for earthwork, geosynthetics, erosion control matting, pipes, vents, concrete and miscellaneous materials installed or removed at the PLF:

SUMMARY OF MATERIAL QUANTITIES

General Material Identification	Material Placement/Removal	Material Type/Size	Material Quantity
Earthwork	Compacted RF Alluvium	Top of PLF	18,420 yd^3 cut
			54,440 yd^3 fill
			36,020 yd^3 net fill
		East Face Buttress	33,250 yd^3
	RF Alluvium	22-inch Cover Soil	71,900 yd^3
		2-inch Topsoil Cover	15,000 yd^3
	Cushion Soil	6-inch Thick Layer	22,700 yd^3
		10-inch Thick Layer	39,000 yd^3
		Total Cushion Soil	61,700 yd^3
	Rock Layer	12-inch Thick Layer	45,200 yd^3
	Drainage Rock and Bedding	Drainage Rock (1-inch minus)	1,200 T
		Bedding (½-inch minus)	370 T
		East Face Drainage Channels (1 ½-inch minus)	98 T
	Riprap	D_{50} = 6-inch	200 T
		D_{50} = 12-inch	1,380 T
	Bentonite in Cutoff Wall		20 yd^3
	Cement Kiln Dust for Sediments		142 T
	Excavation	PLF and Perimeter Channels	41,500 yd^3
		East Pond Sediments	6,300 yd^3
		Waste Removal	200 yd^3 ACM
Geosynthetics	Geosynthetic Clay Liner (GCL)	Bentomat ST	859,355 ft^2
		Bentomat DN	138,760 ft^2
		Total Bentomat	998,115 ft^2
	Geomembrane (FML)	Smooth 60-mil LLDPE	846,664 ft^2
		Textured 60-mil LLDPE-T	137,560 ft^2
		Total LLDPE	984,224 ft^2
	Geocomposite Drainage Net (GDN)		1,061,000 ft^2
	Geotextile	8 oz/yd^2	4,300 yd^2

SUMMARY OF MATERIAL QUANTITIES – CONT.

Erosion Control matting.	NAG SC 150	Biodegradable Straw/Coconut	55,680 yd^2
	NAG C 125	Biodegradable Coconut	92,160 yd^2
	NAG C 350	Permanent Turf Reinforcement Mat	22,560 yd^2
Pipes, Vents, Concrete and Miscellaneous Materials	Perforated HDPE Pipe	4-inch Diameter	3,840 lf
	SDR 11 Riser Pipe	4-inch Diameter	120 lf
	PVC Solid Wall Pipe	3-inch Diameter	100 lf
	PVC Solid Wall Pipe	4-inch Diameter	110 lf
	PVC Solid Wall Pipe	1-inch Diameter	10 lf
	PVC Bell and Spigot Solid Wall Pipe	8-inch Diameter	570 lf
	HDPE Culvert Pipe	36-inch Diameter	240 lf
	Strip Drains		1,600 lf
	Precast Concrete Manholes with Aluminum Covers		2
	Seep Treatment Structure Concrete		21 yd^3

Notes:
ACM = Asbestos Containing Material
T = tons
ft^2 = square feet
lf = linear feet
yd^2 = square yards
yd^3 = cubic yards
HDPE = high density polyethylene
NAG = North American Green
PVC = polyvinyl chloride
SDR = standard dimension ratio

5.0 DESIGN AND FIELD CHANGES DURING CONSTRUCTION

This section presents a summary of the design and field issues and resolutions during construction. Summaries of the design changes, clarifications and revisions during construction as well as the field changes are also included.

Design changes are those changes for which the plans and/or specifications were revised by the project design team with approval by the CTR and review by the CQAE. Design changes and clarifications are recorded either in the Requests for Information (RFIs; Appendix E), in the Contact Records (Appendix I), between the 95 percent and 100 percent drawings or in the project files. Because the project schedule did not permit a finalized, agency-approved design prior to beginning construction, all changes are recorded from the time of the post-bid period at the 95 percent design in July 2004. Design changes after the 100 percent, stamped design in March 2005 are also included.

Field changes are those changes which were initiated primarily by the construction contractor or jointly by the contractor and design team with approval by the design team, CQAE and the CTR. These field changes are documented in the RFIs (Appendix E) or in the daily construction records (Appendices F.1 and G.1). The RFIs are also summarized in this section.

5.1 Field Issues and Resolutions

Various field issues were encountered during construction of the PLF closure which required resolution between the various parties. These included the following:

Compaction verification of RF alluvium required a testing procedure outside the normal ASTM procedures because of the wide range of soil and rock sizes found in the naturally-occurring materials. Because the materials vary in size from clay to 12-inch rocks, neither a soil testing nor a rock testing procedure would strictly apply to the material compaction. This required the use of a field procedure test with placement of the RF alluvium in 12-inch lifts followed by compaction at the proper moisture content with a large sheepsfoot compactor as developed in the test fill program. To verify the number of passes of the compaction equipment required, the RF alluvium test pad was proof-rolled with a loaded scraper (Cat 633D) to achieve a deflection of 1 inch or less. Four passes of the compaction equipment (Cat 825G) were necessary to achieve this deflection limitation. Therefore, the original specifications were modified to allow this field procedure for placement of compacted RF alluvium for grading fill.

The gradation of the RF alluvium was originally determined by ASTM D 422, which is the grain size analysis (GSA) procedure for soils. Because the cobbles larger than 6 inches were not included in this GSA, regulatory personnel requested that additional methods be used to document the gradation of RF alluvium used in the top two feet of the PLF cover. This required the use of a field test using ASTM D 422 for rock and soils smaller than 3 inches with ASTM D 5519 for rock between 3 and 12 inches. This field test determined that the percentage of rock between the 6 and 12-inch size ranges varied from approximately 1 to 8.7 percent by weight with an average of approximately 6 percent (Appendix F 2.1). The material gradation curves between the ASTM D 422 and the field ASTM D 5519 plus D 422 combined tests were very similar with the combined field test indicating a slightly coarser gradation. All tests indicated a clayey gravel (GC) material with sand and cobbles consistent with the site RF alluvium.

The quantities of originally identified borrow materials required for the PLF closure were not sufficient to complete the construction. Therefore, various sources of RF alluvium, cushion soils, and rock layer materials were required during the construction. The original stockpile of RF alluvium was supplemented by materials from Centennial Pit and other locations on the Rocky Flats site. These materials were similar in characterization and all were classified as clayey gravel with sand and cobbles as discussed above. The original cushion soils obtained from Centennial Pit were supplemented by additional cushion soils obtained from the nearby LaFarge aggregate facility, both of which met the specifications. The rock layer material originally used a Rocky Flats granite material which was supplemented by another rock source obtained from the mountains near Idaho Springs. The second rock material was an angular dioritic material with a higher compressive strength than the sub-angular Rocky Flats alluvium rock materials. Both rock materials met specifications.

Concern was raised prior to construction of the rock layer that the rock may penetrate the underlying cushion soils through the use of heavy equipment. A test fill was performed to determine if the use of a low ground-pressure (LGP) bulldozer on the rock layer would create penetration of the rock into the cushion soils. This test section indicated that very little rock penetration occurred into the cushion soils with essentially no rock penetrating more than approximately 2 inches. Therefore use of an LGP D6 bulldozer was allowed for placement of the rock layer.

The use of equipment necessary to place and grade the cover soils on the PLF created some compaction of materials during construction. Over-compaction of this cover soil was a concern because of the need to provide a relatively loose material in which seeding could be successful. Test pits were excavated into these soils to determine the degree of compaction due to placement procedures. These test pits indicated that the upper zones were moderately dense in most areas and dense in areas which had heavy truck traffic. To solve these problems with over-compaction it was proposed to rip the upper foot of the soils in both directions and then disk the upper few inches prior to seeding.

In addition to the asbestos-containing materials (ACM) removed from the southeast and northeast PLF areas and the north and south portion of the East Face, ACM was discovered east of the PLF. These included both bags of asbestos and asbestos board and roofing materials. Rather than revise the design to extend the PLF cover over these areas, the decision was made to remove the asbestos materials from these areas east of the PLF closure. This material was removed and loaded into trans-modal containers for subsequent removal from the site. The volume of asbestos removed was estimated to be approximately two hundred cubic yards.

5.2 Design Changes, Clarifications and Revisions

All of the following design changes, clarifications and revisions were performed by the design team either based on field conditions encountered, on requests from the construction contractor or regulators, or on consultation between the various parties involved to provide a better design for the PLF closure. These are documented either in the RFIs (Appendix E) or in the Contact Records (Appendix I) and are recorded on the As-Built drawings, final specifications or final QA/QC Plan.

The first design change was made in July 2004 by the project designers at the request of K-H and DOE and included revision of the design from a 40-mil to a 60-mil LLDPE FML for the cover liner system. Although not required by the design criteria, this design change was performed in consultation with the regulatory agencies and is documented in RFIs No. 1 and 6 (Appendix E) and recorded on the 95 percent and 100 percent design drawings.

The second design change involved the change of the rock layer specification (Section 02222). This material was originally specified as a rock material with few fines. To meet the concerns of the regulatory agencies to provide some fines in the rock for deeper rooted vegetation while maintaining a burrowing animal intrusion requirement, the specification was changed to provide some materials finer than 3/8 inch (decision reached by RFCA parties in December 2003). This change is recorded in RFI No. 8 and documented in the final stamped specifications.

The third design change involved revision of the specification for allowed wrinkles in the FML during placement. This design change was required to prevent large wrinkles in the material that could fold over and create a permanent crease in the geomembrane following construction. The revised specification states that the maximum wrinkle height to width ratio for the installed geomembrane not exceed 0.5 (h:w ratio) with a maximum height of 6 inches (e.g. 6-inches high by 12-inches wide, max.). This design change is documented in RFI No. 10 and is recorded in the final specifications.

The fourth design change involved raising the grade of the top of the PLF closure, which is reflected in changes to the landfill grades between the August 2004 (95%) and January 2005 (100%) design drawings. Waste material was encountered closer to the top of the PLF than originally anticipated in several areas and a graphite material was encountered in the northwest corner of the PLF. This design change was made to provide minimum grades of 2 to 5 percent on the top of the landfill closure without excavating significant amounts of the existing landfill thereby minimizing waste excavation. The top surfaces of the PLF closure were raised approximately 2 feet on average with this design change. This design change also included revision of the north perimeter channel to avoid the asbestos area and graphite area and revision of the northeastern anchor trench location to avoid the asbestos area. Various PLF design grade changes were performed by project designers in September and October 2004 and are included in the project files, and documented in the final stamped (100%) drawings.

The fifth design revision/clarification included design of stabilization for the soft spots on the PLF surface following stripping of topsoil and the initial proof-rolling procedure. Various soft spots were classified as: 1) small soft spots, 2) clay soft spots and 3) wet soft spots. Typically, repairs for the soft spots included removal of soft material as necessary beyond the limits of the soft spot to a maximum depth of 4 feet or until waste was encountered followed by placement of biaxial geogrid (Tensar BX1200) along with non-woven geotextile. Rocky Flats alluvium was then placed over the area in 12-inch lifts, compacted with the large sheepsfoot compactor, followed by proof rolling. Wet soft spots included placement of rock layer material over the geogrid and geotextile followed by placement of compacted RF alluvium. All soft spot repair areas were required to achieve a deflection of less than 1 inch during proof rolling with a loaded scraper. This design revision memorandum (September 2004) including sketches is provided following RFI No. 3 and is recorded on the As-Built Drawings.

The sixth design change involved revision of the earthwork specification. Following the field demonstration for the RF alluvium, as described above in Section 5.1, the Earthwork-Regrading Specification Section 02221 was revised in September 2004. The original design specification was revised from a measured compaction criteria to a procedural-observation specification for this compacted material. The field test fill procedures are presented following RFI No. 14 and the revised specification is included in Appendix A.

The seventh design change included revision of the subsurface drainage location on the East Face. The drainage system was originally designed under the liner system on the surface of the regraded buttress. To provide drainage of existing seeps on the East Face down to the toe without drainage through the new compacted buttress fill the location of the strip drains was changed to the existing embankment face under the buttress fill. This included removal of the drain from the lower anchor trench on the East Face. Field changes were also made during the installation of these drains based on field conditions encountered during construction as discussed below in Section 5.4. This design change was performed in February 2005 and is included in the Contact Records (2/17/05 and 2/21/05; Appendix I) and recorded on the As-Built Drawings.

The eighth design change involved the earthwork specification and QA/QC Table 4.2 revision to specify field test methods ASTM D 5519 plus ASTM D 422 for the RF alluvial cover soils. This is documented in the Contact Records (2/24/05; Appendix I) and is presented in the final QA/QC Plan (Appendix B).

The ninth design change involved the use of a slope steeper than 4:1 on portions of the outside perimeter channel side slopes, which was required based upon PLF grading changes as discussed above in design change No. 4. Portions of the outside perimeter channel side slopes were graded to steeper than the original side slopes. Because of the relatively short slopes adjacent to the perimeter channel, this was determined by the designers not to present an erosion or stability concern. This change is recorded in RFI No.114 and reflected on the As-Built Drawings.

The tenth design change involved the layer tolerance change originally specified in Section 02221 to provide for a minus zero and plus 0.2 foot tolerance in layer thicknesses of cushion soils, rock layer and cover soils. The regraded surface tolerance under the lower cushion soil layer remained plus or minus 0.1 foot. This is documented in RFI No. 33 and is recorded in the stamped final specification set.

The eleventh design change involved the change in location of the geotextile beneath the riprap of the riprap-lined channel to the invert of the channel grade (rather than on top of the granular bedding as originally shown on the drawings), and the change of grouted riprap in the southeast channel outfall to ungrouted (D50= 12") riprap. Based on calculations by the designers, this change in riprap design is acceptable for the peak velocities encountered. Original calculations showed that grout was not necessary but was included as a conservative measure. This change is documented in RFI No. 182 and subsequent attachments and is reflected on the As-Built Drawings.

The twelfth design change involved change of the original 24-inch cover soil layer to a 22-inch RF alluvium soil cover plus a 2-inch (minimum) RF alluvium soil cover with vegetation stripped from the site. This change was performed to better utilize the material stripped from the site having some vegetation and organics. This change is documented in RFI No. 170 and is included in the final earthwork specification Section 02221 (Appendix A).

The thirteenth design change involved revision of the strip drain and seep collection and treatment system based upon field conditions encountered and changes to the East Face subsurface drainage system (seventh design change). This revised design includes collection of the strip drain flows and GWIS drainage in one manhole and collection of the original seep in another manhole with routing of flows from both manholes to the seep treatment system. This is documented in the Contact Record (2/17/05) in RFIs No. 189 and 191 and recorded on the As-Built Drawings.

The fourteenth design change involved revision of the strip drains and original seep inflow pipe system. The strip drain flows were collected in a sump with routing to the manhole and both the strip drain and original seep flow pipe trenches were redesigned with a bentonite cutoff wall and perforated pipe to collect small flows within pipe bedding and transfer via pipes to the seep treatment system. This design change is documented in RFI No. 174 and associated attachments and recorded on the As-Built Drawings.

The fifteenth design change involved the removal of existing CMP culverts and replacement with two 36-inch diameter corrugated HDPE culverts in each of the north and southeast perimeter channels, which were not included on the original design drawings. These are designed to convey the peak design flow (1,000-year storm) in the perimeter channels without overtopping the access roads. This also included the elimination of the northeast culvert with a swale section at the outfall and revision of the southeast channel outfall. These design changes were first started as RFIs (No. 198, 200 and 221) from the construction contractor and the designs are recorded on As-Built Drawings.

The sixteenth design change involved the revision of the seeding specification Section 02900 to provide for revised seed bed preparation methods. This change is recorded in RFIs No. 170 and 242 and documented in the final Specification Section 02900. The final seed specification was also changed as a part of this design change.

The seventeenth design change involved elimination of the steel reinforcement in the concrete steps for the seep treatment structure and replacement with fiber reinforcement. This change was requested by the construction contractor (RFI No. 208) and required a design revision to the structure (Dwg. 018) to provide for fiber reinforcement with steel tie bars into the walls at the edges of the steps as recorded on the As-Built drawings.

The eighteenth design change involved the elimination of the flow meter from the original seep collection system. This change was made because the flow from the seep diminished to less than 0.5 gpm following installation of the liner system. The seep flow had been in the range of approximately 2.5 to 3.5 gpm for years prior to this. The south manhole and 1-inch piping through the manhole are in place to allow installation of a flow meter at a later date if necessary. This is documented in RFI No. 211 and is recorded on the As-Built drawings.

The nineteenth design change involved design of intermediate steel supports for the grating over the seep treatment structure. This was required because the grating span did not have the required rigidity for potential live loads over the entire width of the structure. Two steel 4-inches wide by 8-inch deep I-beams were installed longitudinally under the grating to provide support. This change was made in late April, is documented in RFI No. 246 and recorded on the As-Built drawings.

The twentieth design change involved the recalculation of stresses in the concrete seep structure walls to allow a 28-day compressive strength of 3,000 psi. This was required because the concrete used for the north, south and west walls were below the originally-specified strength of 4,000 psi. This change is documented in RFI No. 238 and associated calculations.

The twenty first design change included design of two rock-lined trapezoidal surface drainage channels at the toe of the East Face 4:1 slope to provide drainage of storm water from the cover, as discussed above in Section 4.12.5. These ditches extend downstream of the seep treatment structure and replace the temporary rough swales installed during Field Change 24 (Section 5.4). This design change was constructed in early August and is documented in Appendix 0.

5.3 East Face Subsurface Investigations and Final Design

Final design of the East Face PLF closure was performed during construction and was based in part on six geotechnical borings. Three of these boring were drilled from access pads constructed out from the existing crest and three were drilled near the East Face embankment toe. These borings indicated that waste materials extended under the East Face embankment. The borings at the toe did not encounter waste materials and indicated that soft soils extended only in a relatively narrow area downstream of the toe of the embankment.

Based on these borings, the decision was made to extend the PLF cover geosynthetic liner system down the East Face 4:1 buttress slope to just beyond the toe of the pre-construction embankment. This required the used of a textured FML material (60-mil LLDPE-T), a GCL with a high internal strength and high interface friction (Bentomat DN) and the project GDN (TexDrain 200 DS 8) on top of the textured FML.

The stability of the textured FML, Bentomat DN and GDN materials was demonstrated through laboratory interface friction tests (Submittals No. 045A, 066 and 082; Appendix D.2). The contractor (Stoller/TRI Environmental Inc.) performed these interface friction tests on materials proposed for use on the East Face of the PLF. These tests included interface tests of the textured FML (60-mil LLDPE-T) adjacent to the GCL (Bentomat DN) and the interface between the textured FML and the GDN. These tests were performed on saturated samples in accordance with ASTM D 5321 and ASTM D 6243 for both peak and post-peak (large displacement) friction angles. The peak friction angles varied from 28.3 to 33.7 degrees and the post-peak friction angles varied from 17.3 to 19.7 degrees, which indicate acceptable conditions for the 4:1

(14 degrees) East Face closure slope. Therefore, the veneer stability of the East Face closure slope was determined to be acceptable.

Additional stability and East Face closure design analyses were performed by Earth Tech for the East Face closure and are documented in the Final Design Report (EarthTech, 2005).

During clearing and grubbing of the East Face, areas of seepage were noted primarily along the north portion of the East Face. To collect such seeps and direct them into the new seep collection system, a series of strip drains were designed on the East Face. These include 1-foot wide "Akwadrain" strip drains consisting of a 1-foot wide single cuspated core of high impact polystyrene with non-woven geotextile surrounding the core. These strip drains have a flow capacity of 20 gallons per minute (gpm) per foot of width at a gradient of 0.1 feet/foot (ft/ft) and pressure of 10 pounds per square inch (psi). They have a composite material compressive strength of 66 psi (acceptable for up to 70 feet of fill). These strip drains were designed to discharge into a polyethylene-lined sump with gravity drainage to the new seep treatment system (see As-Built Drawings).

Following construction, drainage from the rock layer and GDN on the East Face 4:1 slope just above the toe and below the anchor trench was observed, as expected. Temporary rough swales were installed to drain this water to the toe, but did not adequately provide for storm water drainage. In addition, the regulatory agencies requested a post-construction stability analysis of the East Face including a saturated toe condition and veneer stability of the cover system assuming saturated conditions with seepage forces. These were performed and are included in Appendix N. Rock-lined trapezoidal drainage channels were designed as described above in Section 5.2 (Appendix O), and installed as described above in Section 4.12.5, to provide control of the storm water drainage. This provided a revised grading plan for the east face toe of the PLF as shown on the As-Built Drawings.

5.4 Field Changes

All of the following field changes were made either at the request of the construction contractor or in consultation between the contractor, design team, CTR and CQAE to provide for better or more efficient construction. Most field changes are recorded in the RFIs (Appendix E) and some are recorded on daily QC and/or QA logs.

The first field change was made to allow various waste materials encountered within the landfill to be moved, compacted and covered under the compacted regrade fill. This was performed to minimize the amount of non-contaminated waste material requiring removal from the site and was determined to be acceptable based on proof rolling of the areas. Waste materials encountered were tested by the Rocky Flats Rad-Waste group for contamination. All contaminated materials and asbestos materials, not under the final RCRA cover, were removed and disposed offsite.

The second field change was made to allow the original landfill vent pipes to be filled with bentonite rather than grout. This provided for acceptable closure of the vent pipes.

The third field change was made to allow placement of the GCL with the woven side of the Bentomat ST facing up, adjacent to the FML. This was determined to be acceptable on the top of the PLF where slopes are less than 5 percent and the higher friction angle of non-woven geotextile adjacent to FML is not required.

The fourth field change was made to provide geotextile over the top of gravel covering the horizontal vent collection pipes under the liner system. This provided additional protection of the overlying GCL material.

The fifth field change was made to allow the use of a small rubber-tired "mule" as well as a small rubber-track skid steer on the FML to facilitate placement of the overlying GDN. The use of this equipment was field demonstrated to verify that no damage was done to the FML. Operation of this equipment was monitored by QA/QC personnel to verify that the underlying FML was not damaged.

The sixth field change was made to clarify the compaction requirements of cushion soil placed in the anchor trench. The material was compacted to 95 percent of the maximum dry density (MDD) using a hand tamper with compaction tests performed every 500 feet along the anchor trench rather than every 5,000 square feet as specified for the cushion soils on the PLF.

The seventh field change was made to allow the GDN to end at the edge of the rock layer rather than extend to the invert of the perimeter channel as indicated on the original design drawings. This is documented on the As-Built drawings.

The eighth field change was made to allow the use of a pipe riser detail for the vent pipes as proposed by the liner installers. This included an HDPE pipe boot extrusion welded to the FML and to the HDPE riser pipe with a stainless steel clamp below the top extrusion weld. This was determined to be acceptable because the horizontal vent pipes are near the top of the landfill and significant differential settlement is not anticipated, which would have required a flexible connection detail as the original design drawings indicated.

The ninth field change involved procedures for removal of the East Pond sediments. In order to remove the East Pond sediments, it was necessary to provide a temporary catch pond between the original seep treatment system and the East Pond. This was used to store the seep waters and receive pumped water from the East Pond prior to pumping to a Baker Tank located on the hillside adjacent to the pond. This was performed using a field change, along with removal of the sediments and stabilization of the sediments.

The tenth field change involved adjustments to the placement of the rock layer on the PLF, where placement resulted in some segregation of the fine-grained materials from the rock. Therefore, a field decision was made to provide additional fines within these segregated rock zones by adding cushion soil. This was performed on a number of areas to provide the required in-place gradation prior to placing the overlying RF alluvium cover soils.

The eleventh field change was required in order to certify the final grade of the landfill surface by the certifying engineer. It was necessary to place the 22-inch plus 2-inch layers and final grade the surface prior to ripping and disking necessary for the seeding.

The twelfth field change involved the east pond sediment removals, which were not included in the original design. This included removal of the sediment and placement on the PLF and stabilization with cement kiln dust prior to compaction under the liner system. The pond area from which sediments were removed was regraded as necessary. This design change is documented in the Contact Records and is reflected in the As-Built drawings.

The thirteenth field change involved the repair of the existing seep treatment system, which was necessary because of damages sustained during construction. This also allowed the filling with gravel of the existing concrete structure associated with the original seep collection system, rather than removal of the structure.

The fourteenth field change was made to repair the strip drain polyethylene sump which required excavation of the sump and repair to direct the majority of the flow from the sump into the discharge pipe rather than through the gravel surrounding the pipe.

The fifteenth field change was made to provide for flexible slip boots on the three riser cleanout pipes associated with the seep and strip drain collection system. These were proposed by the liner installer to allow some movement between the deeper cleanout pipes and the liner system on the 4:1 East Face slope.

The sixteenth field change was made to allow an increased seeding rate, which was necessary following field calibration of the drill seeding equipment. This increased the seeding rate for all three mixes over the original minimum design seeding rate.

The seventeenth field change was made to provide for removal of asbestos-containing materials (ACM) located in southeast and northeast of the PLF liner system. Rather than make a design change to extend the PLF cover system over this area, it was decided to remove the ACM. The north ACM excavation area outside the PLF cover contained some water and soft clay materials at depth. Because this area was located adjacent to the northeast anchor trench along the East Face, it required stabilization. Therefore it was stabilized with large rock prior to placement of RF alluvial fill to final grade. Following removal of ACM from these areas and stabilization as necessary, they were regraded and seeded.

The eighteenth field change was made to allow a minor revision of the panel liner layout on the southeast portion of the PLF. This was proposed by the liner installer as a minor adjustment to their layout diagrams to allow placement of panels in a north-south orientation (rather than an east-west orientation) as reflected on the final survey record drawings (Appendix L).

The nineteenth field change was made to revise the GWIS piping system joints from solvent welded to bell and spigot on the PVC pipe. This change was made to allow greater flexibility in the line. This change has also included the use of cushion soil in the upper portion of the GWIS pipe trench rather than gravel.

The twentieth field change involved the revision of the extent of erosion control mat to include the entire surface of the landfill cap, instead of just covering the diversion berms, perimeter channel side slopes and East Face slope. In order to remain consistent with other Rocky Flats closure sites, biodegradable erosion matting is installed on the 2 to 5 percent top slopes of the

PLF cover. This was not included in the original design and was initiated by K-H and DOE and is documented in the Contact Records (4/14/05; Appendix I).

The twenty first field change was made to provide a better collection of water in the gravel-filled (bedding) pipe trenches from the east toe seep and strip drain flows just upstream of the bentonite cutoff wall to reduce the possibility of seepage into the underlying alluvium. This required modification of the base of the pipe bedding to eliminate any gravel beneath the pipe with a short section (10 ft) of liner under the perforated pipes to force all water into the pipes extending to the seep treatment system.

The twenty second field change was made to provide riprap at the outfall of the northeast channel. Although a culvert is not included in this area, the observed erosion below the outfall indicated the need for permanent erosion protection.

The twenty third field change was made to provide stabilization of the southwest portion of the East Pond which experienced embankment movement following a very wet period in the spring. This area was regraded to reduce the slope and RFA was compacted along the slope to stabilize the area.

The twenty fourth field change was made to provide limited swale drainage from the end of the rock layer and GDN at the toe of the East Face 4:1 slope just northwest of the seep treatment structure. This was required to provide better surface drainage of local runoff and drainage from the slope GDN and overlying rock layer in that area. This temporary swale system was removed and replaced by an engineered, permanent riprap-lined storm-water drainage channel system as discussed above for the twenty first design change (Section 5.2).

5.5 Requests for Information

The construction management team (Stoller) submitted a total of 258 Requests for Information (RFIs) during construction. A log of these submittals in included in Appendix E.1. Many of these RFIs pertained to schedule and cost impacts to the project and are not necessary for the certification process. Only technical RFIs are included in App. E.2 which required approval by the CTR and signoff by the CQAE.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL DURING CONSTRUCTION

This section presents the quality control and quality assurance procedures performed for the construction of the PLF accelerated action closure. As discussed above in Section 1.4, construction quality control (QC) was performed by Golder on behalf of Stoller and construction quality assurance (QA) was performed by Tetra Tech.

All QA/QC was performed in accordance with the QA/QC Plan (Appendix B) and in general conformance with industry accepted standards (EPA, 1993 and Daniel and Koerner, 2004). An overall summary of field QA and QC tests performed at the PLF is presented in Table 6.1.

6.1 Quality Control

Construction QC was performed continuously for all construction activities performed at the site including earthwork, geosynthetics installations, seep system construction, seeding and all associated construction. Record surveys were prepared continuously and monthly record survey drawings were developed. The QCSM or designated representative performed daily management of all QC activities at the site. All QC at the site was overseen by construction quality assurance personnel as discussed below in Section 6.2. The construction QC records are presented in Appendix F.

6.1.1 QC Inspections and Reports

Daily QC inspections were performed during the PLF closure and daily reports prepared by Golder and approved by the QCSM are presented in Appendix F.1.

6.1.2 QC for Materials

All materials delivered to the site were first inspected and logged by QC personnel. This included the geosynthetics for the cover and drainage systems, pipes, erosion control materials, concrete, seed and all associated materials. Delivery documentation and manufacturer's quality control (MQC) data delivered to the site along with the various roll goods and other material deliveries were reviewed by QC personnel. Such information was then passed along to the QA personnel for verification of conformance with project requirements and specifications.

Cast-in-place concrete used in the seep treatment structure was field QC tested for slump (ASTM C 143) and air entrainment (ASTM C 143). Cylinders were obtained for compressive strength testing at 7-days and 28-days (ASTM C 31 and ASTM C 39). All QC tests for the base slab, steps and west wall met specifications. The QC field test for air entrainment for the north, south and west structure walls was higher than specified and subsequent compressive strength tests at 7 and 28-days were below specifications. Therefore, as discussed above in Section 5.2, a design check was made to determine if the 12-inch thick walls would be acceptable using concrete having a 28-day compressive strength of 3,000 psi rather than the originally-specified 4,000 psi. This check indicated that the design strength could be changed to 3,000 psi and therefore the concrete in the seep structure met specifications. Final structure tolerances were all within specified limits.

6.1.3 QC for Earthwork

Construction QC for earthwork included performance of all necessary tests required by Table 4.2 of the QA/QC Plan (Appendix B). This required field inspections, field tests and laboratory tests for the RF alluvium used for regrading and cover soils, the cushion layer soils and the rock biota layer materials. Such field and laboratory tests and logs are presented in Appendix F.2.1.

The compacted RF alluvium required for fill and regrading of the PLF and East Face buttress was developed in the test program as discussed above in Section 5.1. The QC inspections then focused on adequate lift thickness, moisture content and sufficient passes of the large sheepsfoot compactor.

Grain size analyses (GSA) were performed for various sources of the RF alluvium based on ASTM D 422. A total of 26 QC tests were performed on RF alluvium used as compacted regrade soil. The ASTM D 422 procedure is typically used for soils with zero to minor amounts of cobble and rock larger than 3 inches. These initial QC tests for grain size analysis of the RF alluvium were performed to determine the grain-size consistency of various RF alluvium materials. As discussed above in Section 5.1, and below in this section, the GSA field tests for RF alluvium were revised to characterize the overall grain size of the materials.

The RF alluvium used for the top two feet of cover soil was tested by ASTM D 422 as well as field tests utilizing ASTM D 422 in combination with ASTM D 5519 as discussed above in Section 5.1 to characterize the overall grain size of the placed material. This included a total of 15 QC tests on the PLF cover plus three tests at the Centennial Pit. The QA/QC Plan required a total of 14 tests based on a total RFA cover soil volume of 86,900 cy and a frequency of one test every 6,500 cy.

A summary of QC soils index tests for compacted fine-grained cushion soils is presented on Table 6.2. Field compaction tests were performed on the 6-inch and 10-inch cushion soil layers for every 5,000 square feet of cushion soil placed and compacted. This included 451 nuclear gage tests and 24 sand cone tests to verify the accuracy of the nuclear gage. The QA/QC Plan required a total of 400 compaction tests based on one test for every 5,000 square feet per lift of compacted cushion soil. The average compaction of cushion soils was approximately 97 percent of the maximum dry density as determined by the Standard Proctor Density Test (ASTM D 698). The sand cone tests were similar to the nuclear density tests and indicated an average compaction of the cushion soils in excess of 98 percent of the maximum dry density. Table 6.3 summarizes the field compaction tests for cushion soils used for the 6 and 10-inch layers, the anchor trenches and around structures and pipes.

Field compaction tests were performed for compacted cushion soils in the anchor trenches with at least one test for every 500 feet of anchor trench. The length of anchor trench around the PLF with compacted fill is approximately 5,300 linear feet, which required at least 11 compaction tests. The 22 tests indicated acceptable compaction of materials with average densities in excess of the specified 95 percent of the MDD.

Compacted fill around pipes, structures and culverts was specified at a minimum of 90 percent of the MDD. The average compaction of backfill around the seep structure was approximately 94.7 percent of the MDD, in the GWIS pipe trench approximately 93 percent and at the north and southeast culverts approximately 94.5 percent of the MDD.

6.1.4 QC for Geosynthetics

Geosynthetics installations included visual inspections of all GCL, FML and GDN and various QC tests. Panel deployment logs were maintained for the GCL, FML and GDN materials and indicated the panel numbers, general condition of panels, panel dimensions, overlaps, area covered and date of deployment. Panel deployment logs for the FML also record the field measurement of material thickness. The average material thickness of all FML is in excess of the specified 60-mils.

Fusion trial seam tests at the beginning of each shift and destructive seam tests every 500 feet of field seam were performed for the FML. These all indicated seam shear and peel strengths typically 10 percent, or more, in excess of the specifications. The destructive seam tests for the textured FML on the East Face slope indicated higher seam (avg. of 112 lbs/in) and peel (avg. of 100 lbs/in) strengths than the smooth FML (shear avg. of 100 lbs/in; peel avg. of 90 lbs/in) on the PLF top area.

Vacuum test and double seam pressurization tests were also performed for the FML. If vacuum tests indicated problems with extrusion welds, the area was re-welded and then retested until the vacuum test passed. The double seam pressurization tests included sealing off a section of the field fusion weld and pressurizing to approximately 35 to 36 pounds per square inch (psi). If the measured pressure after 5 minutes was within 3 psi of this value (i.e. 32 psi for 35 psi initial), the test passed. Almost all field pressurization tests passed, with only a few areas on the top of the PLF not passing. These areas were then isolated to determine the area of the defective seam and the entire seam was capped with FML or the seam was reconstructed.

Any defective areas of the FML were adequately repaired by either capping the area with another geomembrane with extrusion welding of the seams, or by repairing a seam with extrusion welding or installing a reconstructed seam until a subsequent vacuum box or pressure test passed. A total of approximately 500 areas of the FML were repaired, most with small patches of a few square feet. A total of 23 seams were reconstructed, varying in length from a few feet to 125 feet, maximum. The polyethylene boots around vertical gas vents were also included in the FML repair log. All damaged or defective areas of the FML were adequately repaired.

Defect logs were maintained for the materials including type and location of defects and date of inspection and repair of defective area. Panel repair logs for each of the geosynthetic materials were maintained which included the type, size and location of each repair and date of repairs (Appendix F 2.2). A total of approximately 67 areas of the GCL were repaired and a total of approximately 150 areas of the GDN were repaired during construction. All defective or damaged areas of the GCL and GDN were adequately repaired.

6.1.5 QC Intermediate Record Surveying

Continuous QC surveying was performed during construction to set grades and stakes to guide the earthwork operators and to verify that design grades and layer thicknesses were achieved following construction of various sections. Surveying was also performed to document the placement of the various panels, seams and repair areas for the geosynthetics installations.

Monthly intermediate record survey drawings were developed for the top of regraded surfaces, top of cushion layers, top of rock and top of cover soil layers to verify layer thicknesses and grades. Soil test locations are also indicated on the intermediate survey drawings. Intermediate survey drawings included panel layouts for the GCL, FML and GDN materials indicating panel numbers, seams, defect/repair locations and destructive sample locations.

The final record survey drawing certified by a Professional Land Surveyor (PLS) in Colorado are presented in the Drawings section map pocket and the record surveys for each layer of earthwork and geosynthetics at the PLF are included in Appendix M.

6.2 Quality Assurance

Construction QA was performed continuously during the PLF closure to provide assurance that the construction and testing was performed in accordance with the final design plans, specifications, approved field and design changes during construction and in accordance with the final QA/QC Plan. All QA reports and documentation are presented in Appendix G.

6.2.1 QA Inspections and QC Review

Construction QA inspections were performed daily to provide oversight of all construction activities associated with the PLF closure. All QC reports, including daily reports, and tests were reviewed by the SQAM. The hold point/release approvals, which were used to approve various portions of the construction and installations prior to proceeding with subsequent portions, were signed in the field by the SQAM for the CQA team.

Daily QA reports were prepared as were weekly and monthly reports. Field changes and daily construction decisions regarding earthwork, geosynthetics and other materials were reviewed by the SQAM as were various construction work plans prepared by the construction subcontractor (Stoller).

6.2.2 QA Review of RFIs and Submittals

The CQAE reviewed all technical RFIs and submittals for conformance with the specifications and QA/QC plan. All such RFIs and submittals were approved by the CTR with concurrence signoff by the CQAE. Various RFIs or submittals proposing construction methods or materials differing from the design and QA/QC documents were also reviewed by the design team with review by the CQAE and approval by the CTR.

Many of the RFIs were not technical in nature but rather addressed cost, schedule or personnel issues associated with the project. These RFIs were not reviewed by CQA but were reviewed and addressed by the CTR.

6.2.3 QA Laboratory Testing

Laboratory testing for CQA included primarily testing of geosynthetics as required by the QA/QC Plan (Table 4.1 in Appendix B). Typically this included various index, strength and performance tests for every 100,000 square feet of GCL, FML and GDN installed with additional tests for differing materials (e.g. textured FML and smooth FML). If any tests failed for a material roll or lot, additional tests were performed on new rolls or lots until passing test results were achieved. Typically, materials were shipped directly from the manufacturer to the QA laboratory (ATT). Some materials were, however, obtained from the field such as destructive seam samples for FML, which were required for every 20 QC tests performed on destructive seams. The total number of QA tests for geosynthetics exceeded the number of tests required by the QA/QC Plan as shown in Appendix G.5.1. Laboratory QA testing for geosynthetics demonstrated general conformance with manufacturer's quality control (MQC) test submittals as well as the QA/QC Plan requirements.

All QA tests passed for the geosynthetics with the exception of one delivery of GCL (Bentomat ST) which did not meet the free swell test requirements and two rolls of FML (60-mil LLDPE) which did not meet the minimum thickness requirements. These materials were rejected for use at the site and additional rolls of FML and an additional lot of GCL were subsequently QA tested with passing results. All QA laboratory testing results and summaries are presented in Appendix G.5.1.

Tensile strength tests for the turf reinforcement mat (TRM; NAG C350) indicated acceptable strength for one sample. The tensile strength for the other sample was slightly below the project requirements. Therefore, the staple pattern was increased slightly during installation to provide additional strength on the East Face 4:1 slope.

Laboratory QA testing for soils and rock included Atterberg Limits and Grain Size Analyses for cushion soils, grain size analyses for drainage rock and unconfined compressive strength of rock materials in the rock layer. All QA laboratory tests for soils met specifications and the data are presented in Appendix G.5.2.

6.2.4 QA Field Testing

Field QA testing including compaction testing of the cushion soil layers at a frequency of one per 20 QC field tests performed. Twenty-four QA compaction tests were performed using the nuclear gage on the cushion soils (6 and 10-inch layers and anchor trench; Table 6.4) during construction and indicated compaction to an average in excess of 100 percent of the MDD with no tests below the specified minimum of 95 percent.

Two field QA grain size analyses tests were performed by ATT on the rock layer materials in accordance with ASTM D 5519. One of these tests indicated a portion of the rock materials were slightly out of specification. Following this, a field modification in the material production was made. A subsequent field QA test, following these material modifications, indicated that the gradation of the rock layer materials were within specifications.

Two field QA tests were performed on the RF alluvial cover soils based on ASTM D 422 and ASTM D 5519, one for the 22-inch layer soil and one for the 2-inch layer soil. These tests were consistent with the QC tests performed on soils at the PLF cover.

One field gradation test was performed on the riprap materials used for the perimeter channels based on ASTM D 5519. This test, consistent with a QC test, indicated that the D50 of the riprap was smaller than the D50=12 inches required by the specifications and design change for the southeast channel outfall. Therefore, based on a calculation by QC, additional large riprap was added to the materials to provide a D50 in excess of 12-inches. A smaller riprap (D50=6 inches) was used in the East Face storm-water channels, which was verified by field inspection as required in the EPA/CDPHE-approved Contact Record (July 27, 2005; see Appendix I)

6.3 Non-Conformances and Resolutions

Various non-conformances with the Final Specifications and/or QA/QC Plan occurred during the course of the project. This section briefly discusses such non-conformances and the resolution to the non-conformance. Some of the issues discussed in this section are also addressed elsewhere in this CCR, and references are made to the section(s) in which the issues are discussed.

Two earthwork material non-conformances occurred during the project, one related to the rock layer gradation and one related to the cushion soil compaction tests. The rock layer grain size analysis (GSA) was initially presented as a submittal (Submittal No. 91, Appendix D). This material was out of specification for the 3/8-inch and 6-inch sizes by approximately 1.9 to 4.2 percent, respectively, in this submittal initial test. Slight variations in the method of production of the rock material were then made and subsequent QC tests (6 total; Appendix F 2.1) all passed the grain size analyses tests. As discussed above in Section 6.2.4, one QA test later indicated that a sample was out of specification a few percentage points and, following field modification, subsequent QA and QC tests passed. Slight variations in production and sampling techniques of rock materials can result in variations in tested grain size distribution for rock materials and may cause out-of-specification test results with relatively tight specifications as at the PLF. The functional characteristics of such materials, however, will not change with slight variations in test results. Because most the GSA tests for the rock layer materials met specifications, the overall production of such material for the PLF was acceptable. Therefore, such GSA test results indicate that the rock layer materials installed at the PLF should function according to the intended purposes.

The second earthwork material non-conformance was related to the field moisture-density testing for the 10-inch cushion soils. Three of these tests indicated moisture contents varying from approximately 2.3 to 3.3 percent dry of optimum, which were above the specification limit of 2 percent dry of optimum (Table 6.3). Two of these tests were performed with the nuclear gage and one test was performed with a sand-cone method. Each of these tests, however, indicated compactions well in excess of the specified minimum of 95 percent of the maximum dry density (MDD), with the tests indicating 98, 100 and 103 percent of the MDD. The most important test criterion for a material such as the cushion soil is the compacted density. All of the compacted field density tests were well in excess of specifications. Therefore, the compacted in-place cushion soils should function as designed.

One earthwork placement non-conformance occurred during construction of the 24-inch soil cover, which was placed in one approximately 22-inch lift plus one approximately 2-inch lift. Four of the 485 survey points on the cover indicated a placement thickness of the two layers less than the required 24 inches. One of these points appears to be within the North Perimeter Channel, while one appears to be outside the limits of the southeast liner system anchor trench. One of these points indicated that the thickness of the underlying soils (rock and cushion layers) were thicker than required so that the total soil cover thickness (over the geosynthetics) of this point exceeded the required total thickness (3.83 ft). Two of the four survey points appear to be within the limits of the lined portion of the PLF, one in the west central area and one over the north-central anchor trench. The measured thickness of the cover soil in these two areas is approximately 1.48 to 1.49 feet and the corresponding total soil cover thicknesses over the liner system at these two locations are approximately 3.32 to 3.44 feet. The maximum thickness of the 24-inch soil cover is 2.45 feet and the average of all 485 tests is 2.13 feet with a standard deviation of 0.11 ft. Therefore, although two of the 485 tests within the lined PLF indicate soil thickness less than specified, the average 24-inch soil cover thickness is in excess of specifications by approximately 6.5 percent and the soil cover system should provide adequate landfill soil cover.

Another non-conformance related to the structural concrete placed for a portion of the walls at the seep treatment structure. The 28-day compressive strengths of the concrete tested for these wall pours indicated strengths less than the originally-specified 4,000 pounds per square inch (psi). Two compressive strength tests of these materials indicated an average 28-day compressive strength of 3,040 psi. The entrained air content of the field sample obtained for this material was also out-of-specification with an air content of approximately 10 percent, as compared with the specification of 4 percent. The concrete producer may have utilized too much air entrainment agent, which can affect the cured concrete strength if too agent is included. The twentieth design change, as discussed above in Section 5.2, was performed to verify that a 3,000 psi concrete would function for the wall design loads (as documented in RFI No. 238).

One procedural non-conformance occurred during the project involving the functions of the Quality Control Site Manager (QCSM) for the project. In the opinion of the regulatory agencies, the QCSM did not appear have day-to-day involvement in the project. The QCSM, as discussed above in Section 1.4.5, was from Stoller while the QC team consisted of personnel from Golder and Paragon. The daily QC documents were not signed by the QCSM on a daily basis, although they were reviewed regularly by the QCSM, and the QCSM oversaw all portion of the QC program. This is clarified in a letter from the QCSM at Stoller (Appendix F.1).

7.0 SEEP MONITORING DURING CONSTRUCTION

This section presents the summary of the seep monitoring performed during construction of the PLF closure.

The seep at the East Face toe of the PLF was monitored via an existing flow meter during the majority of the construction. The seep flow rate remained relatively constant at approximately 2.5 gpm, as it had been for several years. When the old seep system was removed (including the flow meter) during construction of the East Face buttress and liner system, flow measurements were continued using manual means (bucket and stop watch). Following completion of the PLF liner system in Spring 2005, the flow rate from the seep diminished to less than 0.4 gpm and remained low through the remainder of construction.

Flow of the seep and the flows from the strip drain system and GWIS into the new seep treatment structure were approximately 0.8 gpm total at the end of construction. Seep flow measurements during construction are found in Appendix K.

8.0 CONSTRUCTION REPORTING RECORDS

This section summarizes the construction reporting for the PLF closure including the daily QA and QC reports, weekly and monthly QA reports, the QA/QC data documentation and the photographic log. Intermediate record QC surveys, health and safety records and storm water and Best Management Practice (BMP) records are also summarized in this section.

8.1 Daily Reports

Daily summary reports were maintained throughout the construction by both the QC and QA personnel. The Golder QC representative prepared the QC daily reports for review by the QCSM and subsequent submittal to the SQAM. The SQAM or assistant SQAM for Tetra Tech prepared the QA daily reports.

8.1.1 Daily QC Reports

Daily QC reports included weather conditions, a summary of work performed and QC inspections and tests performed for each day.

8.1.2 Daily QA Reports

Daily QA reports for the initial weeks of construction included the hours of work, weather conditions, equipment onsite and a summary of the work performed that day. Because the amount of work being performed was less during this early phase, the QA reports were typically more concise. Subsequent daily QA reports included the information listed above as well as deficiencies and non conforming work or materials and follow-up inspections of previously reported deficiencies.

8.1.3 Daily QA/QC Data

Daily QC data was maintained in ongoing logs of earthwork and geosynthetics testing for the PLF by CQC personnel. Such data were copied and given regularly to the SQAM for review. The SQAM also maintained QA data for soils compaction tests, primarily of compacted cushion soils.

8.1.4 Photographic Log

Photographic logs were maintained by the construction contractor, K-H personnel and the SQAM on digital cameras to record all major components of the construction. The construction contractor also utilized video recording of various portions of the construction. A photographic log of the PLF closure is included in Appendix C.

8.2 Weekly QA Reports

Weekly QA reports were prepared by the SQAM and reviewed by the CQAE for discussion at the weekly site construction meetings every Thursday. These weekly reports included a construction synopsis, non-conformances, intermediate record surveys, hold point/releases, CQA geosynthetic testing and materials received, CQA and CQC soil sampling and testing, meetings and CQA/CQC personnel on site. The weekly reports were signed by the SQAM and the CQAE. A total of 35 weekly reports were prepared during the project and are included in Appendix G.2.

8.3 Monthly QA Data Reports

Monthly QA data reports were prepared by the SQAM and reviewed by the CQAE to summarize the soils, geosynthetic and survey QC and QA data generated each month. These included summary tables and detailed tables of soils testing and geosynthetic liner panel deployment, seaming, testing and repair logs for the GCL, FML and GDN materials. Intermediate record surveys of the various soil layers and geosynthetic liner system layers were also presented in the monthly QA data reports. The early months of construction did not produce significant amounts of QA data and therefore the first monthly report includes work through the end of October 2004. A total of six monthly data summary reports were prepared. Appendix G.3 includes these monthly QA summary reports, while the various appendices (F.2, G.4 and G.5) of this CCR include the data. The final data for the months of April and May are included in the appropriate appendices.

8.4 Intermediate Record Surveys

The survey personnel for the construction QC team developed regular intermediate record surveys in both tabular form and on plan views. These were developed for all earthwork surfaces such as the regrade, cushion soil, rock and cover soil layers as well as for the GCL, FML and GDN geosynthetic layers. The geosynthetic intermediate record drawings included all panels, seams, test areas and repair areas.

8.5 Hold Point/Release Records

Hold point/release records were maintained by the construction contractor following signoffs by the appropriate field personnel for the various layers of earthwork. These signoffs were done on a regular basis for various portions of the PLF from west to east to allow the subsequent layers of earthwork or geosynthetics to be installed in that area. The hold point/release records are included in Appendix H.

8.6 Storm Water and BMP Inspection Records

Storm water and BMP records were maintained during construction as necessary to record storm water events and condition of the various BMP devices installed for erosion control. All such data is found in the project files.

9.0 PRE-FINAL AND FINAL INSPECTIONS

This section presents the pre-final and final inspections of the PLF Accelerated Action closure at RFETS performed in mid-May.

9.1 Pre-Final Inspection and Punch List

The pre-final inspection was performed at the PLF closure site on May 9, 2005 with the construction contractor (Stoller and Neilsons/Skanska), QCSM, CTR, CQAE and SQAM. Representatives of the regulatory agencies (EPA and CDPHE) and U.S. Fish and Wildlife Service were also present at the pre-final inspection.

Based on this inspection, a punch list was developed for the construction completion requirements excluding the seeding, mulching and erosion mat work. This punch list included completion the culverts at the perimeter channel outfalls, placement of the covers/screens on the vertical vent pipes and covers on the cleanout pipes on the East Face, placement of fill and riprap below the seep treatment structure, installation of the steel support beams for the seep structure grating, and repair of an area at the southwest portion of the East Pond that experienced embankment movement.

9.2 Final Inspection

Following completion of the punch list items, a final inspection of the PLF closure was performed on May 17, 2005 by the CTR, CQAE and Designers. All punch list items had been performed as required and three additional items were required for completion. These included addition of a small amount of riprap at the south top east berm outfall to the south perimeter channel, addition of a small amount of fill over the southeast culverts to prevent potential overtopping during an extreme flood event and the addition of a small temporary swale at the toe of the East Face 4:1 slope to promote drainage of surface water in this area (Field Change 24). These were subsequently completed by May 20, 2005.

Final work at the site was then completed in June and early August with the installation of the down gradient groundwater monitoring wells and installation of the seep structure grating supports in June, and the construction of the East Face storm-water drainage channels (including removal of the temporary swales) in early August. Final inspection of these facilities by the CTR, CQA and the Designers occurred on August 9, 2005.

10.0 REFERENCES

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Earth Tech, Inc., 2005. Final Design Report and Design Calculation Documentation for the Accelerated Action for the Present Landfill at the Rocky Flats Environmental Technology Site, prepared for Kaiser-Hill Company and U.S. Department of Energy.

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U.S. Environmental Protection Agency, 1993. Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities by David E. Daniel and Robert M. Koerner, Risk Reduction Engineering Laboratory, Office of Research and Development (EPA/600/R-93/182), Cincinnati, Ohio.

TABLE 6.1
SUMMARY OF QA/QC FIELD TESTS

Quality Control Item	QA/QC Item	QC Action	QA Action	QC Tests		QA Tests		Total Material Placed
				Required	Actual	Required	Actual	
6-inch Cushion	Field Density Test	1/5000 ft^2	1 per 20 QC	197	209	10	11, Average 97%, QC tests similar	984,224 ft^2
6-inch Cushion	Field Sand Cone Density	1 per 20 Field Density Test	Observe	10	11	N/A	N/A	N/A
10-inch Cushion	Field Density Test	1/5000 ft^2	1 per 20 QC	197	220	10	11, Average 99%, QC tests similar	984,224 ft^2
10-inch Cushion	Field Sand Cone Density Test	1 per 20 Field Density Test	Observe	11	11	N/A	N/A	N/A
Anchor Trench Backfill	Field Density Test	1 per 500 linear feet (lf) per 1 foot lift	1 per 20 QC	22	22	2	2	5,300 lf
Rocky Flats Alluvium	Atterberg limits D4318	1/6,500 yd^3	1 per 20 QC	14	15	1	1	86,900 yd^3 Approximately
Rocky Flats Alluvium	Bulk Gradation ASTM D422 and D5519	1/6,500 yd^3	1 per 20 QC	14	15	1	1	86,900 yd^3 Approximately
Rock Layer	Sieve Analysis ASTM D422/D 5519	1/6,500 yd^3	1 per 20 QC	7	7 total with 1 out of spec and 1 retest	1	1 out of spec, and 1 retest	45,200 yd^3
Rock Layer	Unconfined Compressive Strength ASTM D 2938	1/6,500 yd^3	1 per 20 QC	7	7	1	1	45,200 yd^3
Riprap	Grain Size Analysis ASTM D5519	1 per material type	1 per material type	1	1	1	1	N/A

Notes:
ft^2 = square feet
lf = linear feet
yd^3 = cubic yards

Table 6.2
Summary of Cushion Soil Laboratory Testing

Soil ID #	Sample #	U.S.C.S.	Atterberg Limits			Grain Size Distribution			Standard Proctor		Location
			LL (%)	PL (%)	PI (%)	% Finer 3/4"	% Finer #4	% Finer #200	DD (pcf)	MC (%)	
1	PF-1	SC	39	19	20	100	84	30	120.6	10.7	Centennial
2	PF-2	SC	43	19	24	100	85	29	119.9	11.7	Centennial
3	PF-3	SC	43	18	25	100	81	30	121.0	10.9	Centennial
4	PF-4	SC	35	16	19	100	89	30	122.9	10.6	Centennial
5	PF-5	SC	37	19	18	100	86	29	121.9	10.8	Centennial
6	PF-6	SC	45	20	25	100	82	30	120.3	12.5	Centennial
7	PF-7	SC	35	18	17	100	87	24	125.1	10.3	Centennial
8	PF-8	SC	41	19	22	100	82	28	117.9	11.9	Centennial
9	PF-9	SC	38	18	20	100	87	25	125.1	10.4	Centennial
10	PF-10	SC	43	18	25	100	83	28	122.1	11.0	Centennial
11	CLP-1	SC	46	17	29	98	77	26	122.9	10.8	CL-033
12	CLP-2	SC	37	17	20	100	85	26	123.6	10.6	CL-136
13	CUP-1	SC	46	17	29	100	84	27	123.1	11.3	CL-040
14	CUP-2	SC	60	18	42	100	85	29	122.8	12.2	CU-083
15	CUP-3	SC	44	17	27	100	85	27	124.5	11.3	CU-120
16	CLP-3	SC	37	15	22	100	87	25	119.6	12.5	CL-205
17	CUP-4	SC	40	16	24	99	78	27	120.6	12.1	CU-153
18	CUP-5	SC	38	15	23	100	84	25	123.8	11.2	CU-200
19	CUP-6	SC	39	17	22	100	83	24	123.3	10.5	CU-219

Notes:

U.S.C.S.	Unified Soil Classification System
LL	Liquid limit, %
PL	Plastic Limit, %
PI	Plasticity Index, %
DD	Dry density
MC	Moisture content
pcf	Pounds per cubic foot
PF	Atterberg, Grain Size, and Proctor tests on Pit Fines From Centennial
CL	6" cushion soil nuclear gauge test
CLP	Atterberg, Grain Size, and Proctor tests on 6" Cushion
CU	10" cushion soil nuke gauge test
CUP	Atterberg, Grain Size, and Proctor tests on 10" Cushion

Table 6.3
Summary of Field QC Compaction Tests
Quality Control Field Density Test Log

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
10/27/2004	CL-001	6-inch Cushion Layer	139	9.8	-	126.6	10.4	125.1	-0.6	101%	PASS
10/27/2004	CL-002	6-inch Cushion Layer	139.9	10.2	-	127.0	10.4	125.1	-0.2	101%	PASS
10/27/2004	CL-003	6-inch Cushion Layer	133.8	10.7	-	120.9	10.4	125.1	0.3	97%	PASS
10/27/2004	CL-004	6-inch Cushion Layer	135.7	10.3	-	123.0	10.4	125.1	-0.1	98%	PASS
10/27/2004	CL-005	6-inch Cushion Layer	135.4	10.8	-	122.2	10.4	125.1	0.4	98%	PASS
10/27/2004	CL-006	6-inch Cushion Layer	130.3	9.4	-	119.1	10.4	125.1	-1.0	95%	PASS
10/27/2004	CL-007	6-inch Cushion Layer	136.7	9.6	-	124.7	10.4	125.1	-0.8	100%	PASS
10/27/2004	CL-008	6-inch Cushion Layer	134	10.7	-	121.0	10.4	125.1	0.3	97%	PASS
10/27/2004	CL-009	6-inch Cushion Layer	140.1	9.8	-	127.6	10.4	125.1	-0.6	102%	PASS
11/4/2004	CL-010	6-inch Cushion Layer	133.2	8.7	-	122.5	10.4	125.1	-1.7	98%	PASS
11/4/2004	CL-011	6-inch Cushion Layer	130.3	11.4	-	117.0	11.9	117.9	-0.5	99%	PASS
11/4/2004	CL-012	6-inch Cushion Layer	130.6	12.0	-	116.6	11.9	117.9	0.1	99%	PASS
11/4/2004	CL-013	6-inch Cushion Layer	133.2	10.8	-	120.2	10.4	125.1	0.4	96%	PASS
11/4/2004	CL-014	6-inch Cushion Layer	136.5	11.7	-	122.2	10.4	125.1	1.3	98%	PASS
11/5/2004	CL-015	6-inch Cushion Layer	144	9.4	-	131.6	10.4	125.1	-1.0	105%	PASS
11/5/2004	CL-016	6-inch Cushion Layer	135.6	10.4	-	122.8	10.4	125.1	0.0	98%	PASS
11/5/2004	CL-017	6-inch Cushion Layer	135.1	10.1	-	122.7	10.4	125.1	-0.3	98%	PASS
11/5/2004	CL-018	6-inch Cushion Layer	129.8	8.8	-	119.3	10.4	125.1	-1.6	95%	PASS
11/5/2004	CL-019	6-inch Cushion Layer	130.3	8.9	-	119.7	10.4	125.1	-1.5	96%	PASS
11/5/2004	CL-020	6-inch Cushion Layer	135.4	11.5	-	121.4	10.4	125.1	1.1	97%	PASS
11/8/2004	CL-021	6-inch Cushion Layer	132.9	8.5	-	122.5	10.4	125.1	-1.9	98%	PASS
11/8/2004	CL-022	6-inch Cushion Layer	134.9	8.9	-	123.9	10.4	125.1	-1.5	99%	PASS
11/8/2004	CL-023	6-inch Cushion Layer	135	10.1	-	122.6	10.4	125.1	-0.3	98%	PASS
11/8/2004	CL-024	6-inch Cushion Layer	135	9.9	-	122.8	10.4	125.1	-0.5	98%	PASS
11/8/2004	CL-025	6-inch Cushion Layer	130.2	8.7	-	119.8	10.4	125.1	-1.7	96%	PASS
11/8/2004	CL-026	6-inch Cushion Layer	134.1	10.1	-	121.8	10.4	125.1	-0.3	97%	PASS
11/16/2004	CL-027	6-inch Cushion Layer	135.9	9.1	-	124.6	11	122.1	-1.9	102%	PASS
11/16/2004	CL-028	6-inch Cushion Layer	138.6	12.4	-	123.3	11	122.1	1.4	101%	PASS
11/16/2004	CL-029	6-inch Cushion Layer	137.9	12.5	-	122.6	11	122.1	1.5	100%	PASS
11/16/2004	CL-030	6-inch Cushion Layer	134.5	12.7	-	119.3	11	122.1	1.7	98%	PASS
11/16/2004	CL-031	6-inch Cushion Layer	133.4	12.0	-	119.1	11	122.1	1.0	98%	PASS
11/16/2004	CL-032	6-inch Cushion Layer	136.8	11.6	11.4	122.8	11	122.1	0.4	101%	PASS
11/16/2004	CL-033	6-inch Cushion Layer	139.3	11.9	-	124.5	10.8	122.9	1.1	101%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%) Nuclear Gage MC	Oven MC	Dry Density (pcf)	Proctor Results Optimum MC (%)	Optimum DD (pcf)	-2 to 2 % off MC	> 95% % Comp.	Pass/Fail
11/17/2004	CL-034	6-inch Cushion Layer	138.3	11.6	-	123.9	10.4	125.1	1.2	99%	PASS
11/17/2004	CL-035	6-inch Cushion Layer	131.6	12.1	-	117.4	11	122.1	1.1	96%	PASS
11/17/2004	CL-036	6-inch Cushion Layer	138.6	11.3	-	124.5	10.4	125.1	0.9	100%	PASS
11/17/2004	CL-037	6-inch Cushion Layer	135.3	11.1	-	121.8	11	122.1	0.1	100%	PASS
11/17/2004	CL-038	6-inch Cushion Layer	135.5	11.2	-	121.9	10.4	125.1	0.8	97%	PASS
11/17/2004	CL-039	6-inch Cushion Layer	136.3	12.6	-	121.0	11	122.1	1.6	99%	PASS
11/18/2004	CL-040	6-inch Cushion Layer	140.7	10.7	-	127.1	10.4	125.1	0.3	102%	PASS
11/18/2004	CL-041	6-inch Cushion Layer	135.1	9.6	-	123.3	10.4	125.1	-0.8	99%	PASS
11/18/2004	CL-042	6-inch Cushion Layer	141.2	9.2	-	129.3	10.4	125.1	-1.2	103%	PASS
11/18/2004	CL-043	6-inch Cushion Layer	132.7	9.1	-	121.6	10.4	125.1	-1.3	97%	PASS
11/18/2004	CL-044	6-inch Cushion Layer	137.2	10.4	-	124.3	10.4	125.1	0.0	99%	PASS
11/18/2004	CL-045	6-inch Cushion Layer	130.8	9.5	-	119.5	10.4	125.1	-0.9	95%	PASS
11/18/2004	CL-046	6-inch Cushion Layer	135	8.9	-	124.0	10.4	125.1	-1.5	99%	PASS
12/6/2004	CL-047	6-inch Cushion Layer	136.8	10.4	-	123.9	11	122.1	-0.6	101%	PASS
12/6/2004	CL-048	6-inch Cushion Layer	130.1	11.5	-	116.7	11	122.1	0.5	96%	PASS
12/6/2004	CL-049	6-inch Cushion Layer	137.9	11.5	10.6	124.7	11	122.1	-0.4	102%	PASS
12/6/2004	CL-050	6-inch Cushion Layer	135.4	9.4	-	123.8	10.4	125.1	-1.0	99%	PASS
12/6/2004	CL-051	6-inch Cushion Layer	137.6	10.8	-	124.2	10.4	125.1	0.4	99%	PASS
12/6/2004	CL-052	6-inch Cushion Layer	130.8	9.1	-	119.9	10.4	125.1	-1.3	96%	PASS
12/6/2004	CL-053	6-inch Cushion Layer	135.9	9.5	-	124.1	10.4	125.1	-0.9	99%	PASS
12/6/2004	CL-054	6-inch Cushion Layer	133.7	11.3	-	120.1	11	122.1	0.3	98%	PASS
12/6/2004	CL-055	6-inch Cushion Layer	137.5	11.1	-	123.8	10.4	125.1	0.7	99%	PASS
12/6/2004	CL-056	6-inch Cushion Layer	140.6	11.9	-	125.6	10.4	125.1	1.5	100%	PASS
12/6/2004	CL-057	6-inch Cushion Layer	135.2	11.1	-	121.7	10.4	125.1	0.7	97%	PASS
12/6/2004	CL-058	6-inch Cushion Layer	141.4	11.6	-	126.7	10.4	125.1	1.2	101%	PASS
12/7/2004	CL-059	6-inch Cushion Layer	130.7	10.0	-	118.8	10.8	122.9	-0.8	97%	PASS
12/7/2004	CL-060	6-inch Cushion Layer	134.7	11.3	-	121.0	10.8	122.9	0.5	98%	PASS
12/7/2004	CL-061	6-inch Cushion Layer	130.7	12.2	-	116.5	11	122.1	1.2	95%	PASS
12/7/2004	CL-062	6-inch Cushion Layer	129.9	11.4	-	116.6	11	122.1	0.4	96%	PASS
12/7/2004	CL-063	6-inch Cushion Layer	134.7	11.3	-	121.0	10.8	122.9	0.5	98%	PASS
12/7/2004	CL-064	6-inch Cushion Layer	129.8	11.8	-	116.1	11	122.1	0.8	95%	PASS
12/7/2004	CL-065	6-inch Cushion Layer	133.1	10.5	-	120.5	10.8	122.9	-0.3	98%	PASS
12/7/2004	CL-066	6-inch Cushion Layer	133.5	10.5	-	120.8	10.8	122.9	-0.3	98%	PASS
12/7/2004	CL-067	6-inch Cushion Layer	133	10.7	-	120.1	10.8	122.9	-0.1	98%	PASS
12/7/2004	CL-068	6-inch Cushion Layer	132	10.0	-	120.0	10.8	122.9	-0.8	98%	PASS
12/7/2004	CL-069	6-inch Cushion Layer	129.5	10.8	-	116.9	11	122.1	-0.2	96%	PASS
12/7/2004	CL-070	6-inch Cushion Layer	130.7	10.5	-	118.3	10.8	122.9	-0.3	96%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%) Nuclear Gage MC	Oven MC	Dry Density (pcf)	Proctor Results Optimum MC (%)	Optimum DD (pcf)	-2 to 2 % off MC	> 95% % Comp.	Pass/Fail
12/7/2004	CL-071	6-inch Cushion Layer	136	11.1	-	122.4	10.8	122.9	0.3	100%	PASS
12/7/2004	CL-072	6-inch Cushion Layer	132.3	9.8	-	120.5	10.8	122.9	-1.0	98%	PASS
12/7/2004	CL-073	6-inch Cushion Layer	134.4	11.4	11.7	120.3	10.8	122.9	0.9	98%	PASS
12/7/2004	CL-074	6-inch Cushion Layer	132.3	9.7	-	120.6	10.8	122.9	-1.1	98%	PASS
12/8/2004	CL-075	6-inch Cushion Layer	133.1	9.8	-	121.2	10.4	125.1	-0.6	97%	PASS
12/8/2004	CL-076	6-inch Cushion Layer	132.5	9.7	-	120.8	10.4	125.1	-0.7	97%	PASS
12/8/2004	CL-077	6-inch Cushion Layer	133.9	10.3	-	121.4	10.4	125.1	-0.1	97%	PASS
12/8/2004	CL-078	6-inch Cushion Layer	136.2	9.4	-	124.5	10.4	125.1	-1.0	100%	PASS
12/8/2004	CL-079	6-inch Cushion Layer	133.9	11.4	10.8	120.8	10.4	125.1	0.4	97%	PASS
12/8/2004	CL-080	6-inch Cushion Layer	128.8	11.0	-	116.0	11	122.1	0.0	95%	PASS
12/8/2004	CL-081	6-inch Cushion Layer	134.7	11.0	-	121.4	11	122.1	0.0	99%	PASS
12/8/2004	CL-082	6-inch Cushion Layer	135	11.4	-	121.2	11	122.1	0.4	99%	PASS
12/9/2004	CL-083	6-inch Cushion Layer	134.1	10.2	-	121.7	11	122.1	-0.8	100%	PASS
12/9/2004	CL-084	6-inch Cushion Layer	130.4	9.8	-	118.8	10.8	122.9	-1.0	97%	PASS
12/9/2004	CL-085	6-inch Cushion Layer	135.2	10.4	-	122.5	10.8	122.9	-0.4	100%	PASS
12/9/2004	CL-086	6-inch Cushion Layer	135.3	9.7	-	123.3	10.4	125.1	-0.7	99%	PASS
12/9/2004	CL-087	6-inch Cushion Layer	135.7	10.1	-	123.3	10.4	125.1	-0.3	99%	PASS
12/9/2004	CL-088	6-inch Cushion Layer	133.1	9.3	-	121.8	10.4	125.1	-1.1	97%	PASS
12/9/2004	CL-089	6-inch Cushion Layer	135.7	10.6	-	122.7	10.4	125.1	0.2	98%	PASS
12/9/2004	CL-090	6-inch Cushion Layer	138.1	10.2	-	125.3	10.4	125.1	-0.2	100%	PASS
12/13/2004	CL-091	6-inch Cushion Layer	130.6	9.0	-	119.8	10.8	122.9	-1.8	97%	PASS
12/13/2004	CL-092	6-inch Cushion Layer	127.5	8.9	-	117.1	10.8	122.9	-1.9	95%	PASS
12/13/2004	CL-093	6-inch Cushion Layer	138.2	9.6	-	126.1	10.4	125.1	-0.8	101%	PASS
12/13/2004	CL-094	6-inch Cushion Layer	136	10.0	-	123.6	10.4	125.1	-0.4	99%	PASS
12/13/2004	CL-095	6-inch Cushion Layer	136.9	9.6	-	124.9	10.4	125.1	-0.8	100%	PASS
12/13/2004	CL-096	6-inch Cushion Layer	136.2	10.4	-	123.4	10.4	125.1	0.0	99%	PASS
12/13/2004	CL-097	6-inch Cushion Layer	137.2	10.2	-	124.5	10.4	125.1	-0.2	100%	PASS
12/13/2004	CL-098	6-inch Cushion Layer	136.5	9.8	-	124.3	10.4	125.1	-0.6	99%	PASS
12/13/2004	CL-099	6-inch Cushion Layer	131	9.1	-	120.1	10.8	122.9	-1.7	98%	PASS
12/14/2004	CL-100	6-inch Cushion Layer	129.1	11.3	-	116.0	11	122.1	0.3	95%	PASS
12/14/2004	CL-101	6-inch Cushion Layer	129.8	9.0	-	119.1	10.8	122.9	-1.8	97%	PASS
12/14/2004	CL-102	6-inch Cushion Layer	133.1	9.6	-	121.4	10.8	122.9	-1.2	99%	PASS
12/14/2004	CL-103	6-inch Cushion Layer	129.7	9.0	-	119.0	10.4	125.1	-1.4	95%	PASS
12/14/2004	CL-104	6-inch Cushion Layer	133.4	8.7	-	122.7	10.8	122.9	-2.1	100%	FAIL*
12/14/2004	CL-105	6-inch Cushion Layer	138.4	11.4	-	124.2	10.4	125.1	1.0	99%	PASS
12/14/2004	CL-106	6-inch Cushion Layer	133.1	9.0	-	122.1	10.4	125.1	-1.4	98%	PASS
12/14/2004	CL-107	6-inch Cushion Layer	136.3	9.5	-	124.5	10.4	125.1	-0.9	100%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%) Nuclear Gage MC	Oven MC	Dry Density (pcf)	Proctor Results Optimum MC (%)	Optimum DD (pcf)	-2 to 2 % off MC	> 95% % Comp.	Pass/Fail
12/14/2004	CL-108	6-inch Cushion Layer	139	10.1	-	126.2	10.4	125.1	-0.3	101%	PASS
12/15/2004	CL-109	6-inch Cushion Layer	130.6	9.6	-	119.2	10.4	125.1	-0.8	95%	PASS
12/15/2004	CL-110	6-inch Cushion Layer	131.9	10.4	-	119.5	10.4	125.1	0.0	96%	PASS
12/15/2004	CL-111	6-inch Cushion Layer	130.6	9.5	-	119.3	10.4	125.1	-0.9	95%	PASS
12/15/2004	CL-112	6-inch Cushion Layer	133.2	9.6	-	121.5	10.4	125.1	-0.8	97%	PASS
12/15/2004	CL-113	6-inch Cushion Layer	131.4	10.5	-	118.9	10.4	125.1	0.1	95%	PASS
12/15/2004	CL-114	6-inch Cushion Layer	135.7	11.1	-	122.1	10.4	125.1	0.7	98%	PASS
12/15/2004	CL-115	6-inch Cushion Layer	132.1	9.5	-	120.6	10.4	125.1	-0.9	96%	PASS
12/15/2004	CL-116	6-inch Cushion Layer	137.1	11.6	-	122.8	10.4	125.1	1.2	98%	PASS
12/15/2004	CL-117	6-inch Cushion Layer	138.7	11.0	-	125.0	10.4	125.1	0.6	100%	PASS
12/16/2005	CL-118	6-inch Cushion Layer	130.7	11.5	9.9	118.9	10.8	122.9	-0.9	97%	PASS
12/16/2004	CL-119	6-inch Cushion Layer	135.2	11.3	-	121.5	10.4	125.1	0.9	97%	PASS
12/18/2004	CL-120	6-inch Cushion Layer	135	11.6	-	121.0	10.8	122.9	0.8	98%	PASS
12/18/2004	CL-121	6-inch Cushion Layer	136.7	11.4	12.1	121.9	10.8	122.9	1.3	99%	PASS
12/18/2004	CL-122	6-inch Cushion Layer	132.9	9.3	-	121.6	10.8	122.9	-1.5	99%	PASS
12/18/2004	CL-123	6-inch Cushion Layer	136.3	10.9	-	122.9	10.8	122.9	0.1	100%	PASS
12/18/2004	CL-124	6-inch Cushion Layer	139.1	9.5	-	127.0	10.8	122.9	-1.3	103%	PASS
12/18/2004	CL-125	6-inch Cushion Layer	134.9	9.9	-	122.7	10.4	125.1	-0.5	98%	PASS
12/18/2004	CL-126	6-inch Cushion Layer	141.4	9.4	-	129.3	10.4	125.1	-1.0	103%	PASS
12/18/2004	CL-127	6-inch Cushion Layer	138.1	8.9	-	126.8	10.8	122.9	-1.9	103%	PASS
12/18/2004	CL-128	6-inch Cushion Layer	135.2	11.8	-	120.9	10.4	125.1	1.4	97%	PASS
12/18/2004	CL-129	6-inch Cushion Layer	135.1	9.0	-	123.9	10.4	125.1	-1.4	99%	PASS
12/18/2004	CL-130	6-inch Cushion Layer	135.8	11.1	-	122.2	10.8	122.9	0.3	99%	PASS
12/18/2004	CL-131	6-inch Cushion Layer	139.1	9.8	-	126.7	10.8	122.9	-1.0	103%	PASS
12/18/2004	CL-132	6-inch Cushion Layer	137.3	9.7	-	125.2	10.8	122.9	-1.1	102%	PASS
12/18/2004	CL-133	6-inch Cushion Layer	139.5	9.7	-	127.2	10.4	125.1	-0.7	102%	PASS
12/18/2004	CL-134	6-inch Cushion Layer	134.7	10.6	-	121.8	10.4	125.1	0.2	97%	PASS
12/18/2004	CL-135	6-inch Cushion Layer	134.4	9.0	-	123.3	10.4	125.1	-1.4	99%	PASS
12/18/2004	CL-136	6-inch Cushion Layer	136.6	9.5	-	124.7	10.6	123.6	-1.1	101%	PASS
12/18/2004	CL-137	6-inch Cushion Layer	134.3	11.9	-	120.0	10.6	123.6	1.3	97%	PASS
2/10/2005	CL-138	6-inch Cushion Layer	132.5	11.2	-	119.2	11.3	124.5	-0.1	96%	PASS
2/10/2005	CL-139	6-inch Cushion Layer	137.1	9.7	-	125.0	11.3	124.5	-1.6	100%	PASS
2/10/2005	CL-140	6-inch Cushion Layer	138.4	10.1	-	125.7	11.3	124.5	-1.2	101%	PASS
2/10/2005	CL-141	6-inch Cushion Layer	130.6	11.3	-	117.3	12.2	122.8	-0.9	96%	PASS
2/10/2005	CL-142	6-inch Cushion Layer	133.8	10.1	-	121.5	11.3	124.5	-1.2	98%	PASS
2/10/2005	CL-143	6-inch Cushion Layer	137.8	12.0	-	123.0	11.3	124.5	0.7	99%	PASS
2/10/2005	CL-144	6-inch Cushion Layer	133.6	10.9	-	120.5	11.3	124.5	-0.4	97%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
2/10/2005	CL-145	6-inch Cushion Layer	132.3	13.0	-	117.1	12.2	122.8	0.8	95%	PASS
2/10/2005	CL-146	6-inch Cushion Layer	133.6	10.3	-	121.1	11.3	124.5	-1.0	97%	PASS
2/11/2005	CL-147	6-inch Cushion Layer	133.7	12.1	-	119.3	11.3	124.5	0.8	96%	PASS
2/11/2005	CL-148	6-inch Cushion Layer	136.5	9.8	-	124.3	11.3	124.5	-1.5	100%	PASS
2/11/2005	CL-149	6-inch Cushion Layer	130.9	11.8	-	117.1	12.2	122.8	-0.4	95%	PASS
2/11/2005	CL-150	6-inch Cushion Layer	134.8	12.2	11.9	120.5	12.2	122.8	-0.3	98%	PASS
2/11/2005	CL-151	6-inch Cushion Layer	135.1	11.5	-	121.2	12.2	122.8	-0.7	99%	PASS
2/11/2005	CL-152	6-inch Cushion Layer	134.1	11.5	-	120.3	12.2	122.8	-0.7	98%	PASS
2/11/2005	CL-153	6-inch Cushion Layer	134.6	12.7	-	119.4	12.2	122.8	0.5	97%	PASS
2/11/2005	CL-154	6-inch Cushion Layer	134.2	11.0	-	120.9	11.3	124.5	-0.3	97%	PASS
2/11/2005	CL-155	6-inch Cushion Layer	133.2	11.6	-	119.4	11.3	124.5	0.3	96%	PASS
2/11/2005	CL-156	6-inch Cushion Layer	136.6	10.8	10.0	124.2	11.3	124.5	-1.3	100%	PASS
2/11/2005	CL-157	6-inch Cushion Layer	136.1	12.7	-	120.8	11.3	124.5	1.4	97%	PASS
2/11/2005	CL-158	6-inch Cushion Layer	135.5	11.4	-	121.6	11.3	124.5	0.1	98%	PASS
2/11/2005	CL-159	6-inch Cushion Layer	136.2	10.2	-	123.6	11.3	124.5	-1.1	99%	PASS
2/11/2005	CL-160	6-inch Cushion Layer	135.9	13.3	-	119.9	12.2	122.8	1.1	98%	PASS
2/11/2005	CL-161	6-inch Cushion Layer	138	12.1	-	123.1	11.3	124.5	0.8	99%	PASS
2/11/2005	CL-162	6-inch Cushion Layer	133.2	12.8	-	118.1	12.2	122.8	0.6	96%	PASS
2/11/2005	CL-163	6-inch Cushion Layer	133	10.5	-	120.4	12.2	122.8	-1.7	98%	PASS
2/11/2005	CL-164	6-inch Cushion Layer	129.8	10.3	-	117.7	12.2	122.8	-1.9	96%	PASS
3/19/2005	CL-165	6-inch Cushion Layer	135.3	11.8	-	121.0	10.6	123.6	1.2	98%	PASS
3/19/2005	CL-166	6-inch Cushion Layer	130	9.7	-	118.5	10.6	123.6	-0.9	96%	PASS
3/19/2005	CL-167	6-inch Cushion Layer	132.3	10.5	-	119.7	10.6	123.6	-0.1	97%	PASS
3/19/2005	CL-168	6-inch Cushion Layer	130.3	9.7	-	118.8	10.6	123.6	-0.9	96%	PASS
3/19/2005	CL-169	6-inch Cushion Layer	137.6	10.5	-	124.5	10.6	123.6	-0.1	101%	PASS
3/19/2005	CL-170	6-inch Cushion Layer	131.9	9.7	-	120.2	10.6	123.6	-0.9	97%	PASS
3/19/2005	CL-171	6-inch Cushion Layer	131.8	9.4	-	120.5	10.6	123.6	-1.2	97%	PASS
3/19/2005	CL-172	6-inch Cushion Layer	135.9	10.0	-	123.5	10.6	123.6	-0.6	100%	PASS
3/19/2005	CL-173	6-inch Cushion Layer	138.2	13.0	-	122.3	12.2	122.8	0.8	100%	PASS
3/22/2005	CL-174	6-inch Cushion Layer	142.9	9.5	-	130.5	10.4	125.1	-0.9	104%	PASS
3/22/2005	CL-175	6-inch Cushion Layer	136.2	9.2	-	124.7	10.4	125.1	-1.2	100%	PASS
3/22/2005	CL-176	6-inch Cushion Layer	135.8	9.0	-	124.6	10.4	125.1	-1.4	100%	PASS
3/22/2005	CL-177	6-inch Cushion Layer	137.2	8.8	-	126.1	10.4	125.1	-1.6	101%	PASS
3/22/2005	CL-178	6-inch Cushion Layer	140.4	10.1	11.2	126.3	10.4	125.1	0.8	101%	PASS
3/22/2005	CL-179	6-inch Cushion Layer	141.4	9.5	-	129.1	10.4	125.1	-0.9	103%	PASS
3/22/2005	CL-180	6-inch Cushion Layer	139.9	9.9	-	127.3	10.4	125.1	-0.5	102%	PASS
3/22/2005	CL-181	6-inch Cushion Layer	138.3	9.2	-	126.6	10.4	125.1	-1.2	101%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
3/22/2005	CL-182	6-inch Cushion Layer	137.5	8.9	-	126.3	10.4	125.1	-1.5	101%	PASS
3/22/2005	CL-183	6-inch Cushion Layer	128.2	9.6	-	117.0	11	122.1	-1.4	96%	PASS
3/22/2005	CL-184	6-inch Cushion Layer	136.5	12.0	-	121.9	11	122.1	1.0	100%	PASS
3/22/2005	CL-185	6-inch Cushion Layer	134.9	10.3	-	122.3	11	122.1	-0.7	100%	PASS
3/22/2005	CL-186	6-inch Cushion Layer	139.6	11.0	-	125.8	10.4	125.1	0.6	101%	PASS
3/22/2005	CL-187	6-inch Cushion Layer	140.3	9.2	12.9	124.3	11	122.1	1.9	102%	PASS
3/22/2005	CL-188	6-inch Cushion Layer	138.4	9.7	10.9	124.8	11	122.1	-0.1	102%	PASS
3/23/2005	CL-189	6-inch Cushion Layer	138.9	9.7	-	126.6	10.4	125.1	-0.7	101%	PASS
3/23/2005	CL-190	6-inch Cushion Layer	137.9	9.7	-	125.7	10.4	125.1	-0.7	100%	PASS
3/23/2005	CL-191	6-inch Cushion Layer	132.3	9.4	-	120.9	10.4	125.1	-1.0	97%	PASS
3/23/2005	CL-192	6-inch Cushion Layer	130.9	9.3	-	119.8	10.4	125.1	-1.1	96%	PASS
3/23/2005	CL-193	6-inch Cushion Layer	133.5	9.4	-	122.0	10.4	125.1	-1.0	98%	PASS
4/1/2005	CL-194	6-inch Cushion Layer	134.5	10.7	11.4	120.7	10.8	122.9	0.6	98%	PASS
4/1/2005	CL-195	6-inch Cushion Layer	139.2	10.4	-	126.1	10.8	122.9	-0.4	103%	PASS
4/1/2005	CL-196	6-inch Cushion Layer	130	9.7	-	118.5	10.8	122.9	-1.1	96%	PASS
4/1/2005	CL-197	6-inch Cushion Layer	131.7	11.0	-	118.6	12.2	122.8	-1.2	97%	PASS
4/1/2005	CL-198	6-inch Cushion Layer	130.9	11.4	-	117.5	12.2	122.8	-0.8	96%	PASS
4/1/2005	CL-199	6-inch Cushion Layer	134.6	10.5	-	121.8	12.2	122.8	-1.7	99%	PASS
4/1/2005	CL-200	6-inch Cushion Layer	132.9	11.1	-	119.6	12.2	122.8	-1.1	97%	PASS
4/1/2005	CL-201	6-inch Cushion Layer	128.5	9.0	-	117.9	10.8	122.9	-1.8	96%	PASS
4/1/2005	CL-202	6-inch Cushion Layer	130.9	11.4	-	117.5	12.2	122.8	-0.8	96%	PASS
4/1/2005	CL-203	6-inch Cushion Layer	131.5	10.2	10.8	118.7	10.8	122.9	0.0	97%	PASS
4/1/2005	CL-204	6-inch Cushion Layer	135.5	10.9	-	122.2	10.8	122.9	0.1	99%	PASS
4/1/2005	CL-205	6-inch Cushion Layer	135.6	11.6	-	121.5	11.3	124.5	0.3	98%	PASS
4/1/2005	CL-206	6-inch Cushion Layer	133.9	12.2	-	119.3	11.3	124.5	0.9	96%	PASS
4/1/2005	CL-207	6-inch Cushion Layer	132.7	12.3	-	118.2	12.2	122.8	0.1	96%	PASS
4/1/2005	CL-208	6-inch Cushion Layer	136.2	10.7	11.0	122.7	10.8	122.9	0.2	100%	PASS
4/1/2005	CL-209	6-inch Cushion Layer	137.9	10.3	-	125.0	10.8	122.9	-0.5	102%	PASS
11/5/2004	CLS-001	6-inch Cushion Layer Sand Cone	132.4	-	9.4	121.0	10.4	125.1	-1.0	97%	PASS
11/18/2004	CLS-002	6-inch Cushion Layer Sand Cone	139.4	-	10.4	126.3	10.4	125.1	0.0	101%	PASS
12/8/2004	CLS-003	6-inch Cushion Layer Sand Cone	130.7	-	9.7	119.1	10.8	122.9	-1.1	97%	PASS
12/8/2004	CLS-04	6-inch Cushion Layer Sand Cone	131.7	-	10.7	119.0	11	122.1	-0.3	97%	PASS
12/14/2004	CLS-05	6-inch Cushion Layer Sand Cone	130.9	-	11.0	117.9	11	122.1	0.0	97%	PASS
12/18/2004	CLS-06	6-inch Cushion Layer Sand Cone	136.1	-	10.8	122.8	10.8	122.9	0.0	100%	PASS
2/10/2005	CLS-07	6-inch Cushion Layer Sand Cone	135.5	-	11.1	122.0	11.3	124.5	-0.2	98%	PASS
2/11/2005	CLS-08	6-inch Cushion Layer Sand Cone	135.5	-	12.1	120.9	12.2	122.8	-0.1	98%	PASS
3/22/2005	CLS-09	6-inch Cushion Layer Sand Cone	140.4	-	11.1	126.4	10.4	125.1	0.7	101%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
4/1/2005	CLS-10	6-inch Cushion Layer Sand Cone	133.5	-	10.7	120.6	10.8	122.9	-0.1	98%	PASS
4/1/2005	CLS-11	6-inch Cushion Layer Sand Cone	134	-	10.2	121.6	10.8	122.9	-0.6	99%	PASS
11/15/2004	AT-001	Anchor Trench	134.7	12.4	-	119.8	11	122.1	1.4	98%	PASS
11/16/2004	AT-002	Anchor Trench	130.5	8.8	-	119.9	10.4	125.1	-1.6	96%	PASS
11/18/2004	AT-3	Anchor Trench	130.5	10.7	-	117.9	11	122.1	-0.3	97%	PASS
11/18/2004	AT-4	Anchor Trench	141.2	11.0	-	127.2	10.4	125.1	0.6	102%	PASS
11/18/2004	AT-5	Anchor Trench	135.1	12.5	-	120.1	11	122.1	1.5	98%	PASS
11/19/2004	AT-006	Anchor Trench	136.8	11.9	-	122.3	11	122.1	0.9	100%	PASS
11/19/2004	AT-007	Anchor Trench	130.4	12.0	-	116.4	11	122.1	1.0	95%	PASS
11/19/2004	AT-008	Anchor Trench	131.5	12.6	-	116.8	11	122.1	1.6	96%	PASS
11/19/2004	AT-009	Anchor Trench	132.3	9.8	-	120.5	11	122.1	-1.2	99%	PASS
11/19/2004	AT-010	Anchor Trench	136.2	11.6	-	122.0	11	122.1	0.6	100%	PASS
2/14/2005	AT-11	Anchor Trench	130	8.7	-	119.6	10.6	123.6	-1.9	97%	PASS
2/14/2005	AT-12	Anchor Trench	132.6	8.8	-	121.9	10.6	123.6	-1.8	99%	PASS
2/14/2005	AT-13	Anchor Trench	128.9	9.7	-	117.5	10.6	123.6	-0.9	95%	PASS
2/14/2005	AT-14	Anchor Trench	130.3	9.0	-	119.5	10.6	123.6	-1.6	97%	PASS
3/29/2005	AT-15	Anchor Trench	130.4	10.4	-	118.1	11	122.1	-0.6	97%	PASS
3/29/2005	AT-16	Anchor Trench	135	10.6	-	122.1	11	122.1	-0.4	100%	PASS
4/4/2005	AT-17	Anchor Trench	130.9	11.4	-	117.5	10.8	122.9	0.6	96%	PASS
4/4/2005	AT-18	Anchor Trench	132.1	12.3	-	117.6	10.8	122.9	1.5	96%	PASS
4/4/2005	AT-19	Anchor Trench	137.2	10.4	-	124.3	10.8	122.9	-0.4	101%	PASS
4/4/2005	AT-20	Anchor Trench	135.7	10.1	-	123.3	10.8	122.9	-0.7	100%	PASS
4/4/2005	AT-21	Anchor Trench	135	10.5	-	122.2	10.8	122.9	-0.3	99%	PASS
4/4/2005	AT-22	Anchor Trench	136	10.7	-	122.9	10.8	122.9	-0.1	100%	PASS
1/3/2005	CU-001	10-inch Cushion Layer	133.5	8.6	-	122.9	10.4	125.1	-1.8	98%	PASS
1/3/2005	CU-002	10-inch Cushion Layer	137.5	9.3	-	125.8	10.4	125.1	-1.1	101%	PASS
1/3/2005	CU-003	10-inch Cushion Layer	137.6	8.7	-	126.6	10.4	125.1	-1.7	101%	PASS
1/3/2005	CU-004	10-inch Cushion Layer	136.8	10.2	10.4	123.9	10.4	125.1	0.0	99%	PASS
1/3/2005	CU-005	10-inch Cushion Layer	133.7	9.5	-	122.1	10.4	125.1	-0.9	98%	PASS
1/3/2005	CU-006	10-inch Cushion Layer	137.6	8.7	-	126.6	10.4	125.1	-1.7	101%	PASS
1/3/2005	CU-007	10-inch Cushion Layer	135.8	9.8	-	123.7	10.4	125.1	-0.6	99%	PASS
1/3/2005	CU-008	10-inch Cushion Layer	140.1	9.3	-	128.2	10.4	125.1	-1.1	102%	PASS
1/3/2005	CU-009	10-inch Cushion Layer	140.5	9.1	-	128.8	10.4	125.1	-1.3	103%	PASS
1/3/2005	CU-010	10-inch Cushion Layer	130.1	8.9	-	119.5	10.4	125.1	-1.5	95%	PASS
1/7/2004	CU-011	10-inch Cushion Layer	140.5	9.8	-	128.0	10.8	122.9	-1.0	104%	PASS
1/7/2004	CU-012	10-inch Cushion Layer	128.5	9.3	-	117.6	10.8	122.9	-1.5	96%	PASS
1/7/2004	CU-013	10-inch Cushion Layer	137.4	9.0	-	126.1	10.4	125.1	-1.4	101%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%) Nuclear Gage MC	Oven MC	Dry Density (pcf)	Proctor Results Optimum MC (%)	Optimum DD (pcf)	-2 to 2 % off MC	> 95% % Comp.	Pass/Fail
1/7/2004	CU-014	10-inch Cushion Layer	130.1	9.3	-	119.0	10.8	122.9	-1.5	97%	PASS
1/7/2004	CU-015	10-inch Cushion Layer	130.3	8.7	-	119.9	10.4	125.1	-1.7	96%	PASS
1/7/2004	CU-016	10-inch Cushion Layer	135	8.7	-	124.2	10.4	125.1	-1.7	99%	PASS
1/7/2004	CU-017	10-inch Cushion Layer	132.7	9.5	-	121.2	10.8	122.9	-1.3	99%	PASS
1/7/2004	CU-018	10-inch Cushion Layer	134.7	9.9	-	122.6	10.8	122.9	-0.9	100%	PASS
1/10/2005	CU-019	10-inch Cushion Layer	134.8	9.2	-	123.4	10.4	125.1	-1.2	99%	PASS
1/10/2005	CU-020	10-inch Cushion Layer	136.8	8.9	-	125.6	10.6	123.6	-1.7	102%	PASS
1/10/2005	CU-021	10-inch Cushion Layer	133.2	9.9	-	121.2	10.4	125.1	-0.5	97%	PASS
1/10/2005	CU-022	10-inch Cushion Layer	135.8	8.8	-	124.8	10.4	125.1	-1.6	100%	PASS
1/10/2005	CU-023	10-inch Cushion Layer	139.8	8.5	-	128.8	10.4	125.1	-1.9	103%	PASS
1/10/2005	CU-024	10-inch Cushion Layer	134.6	9.5	-	122.9	10.4	125.1	-0.9	98%	PASS
1/10/2005	CU-025	10-inch Cushion Layer	135.4	9.6	-	123.5	10.4	125.1	-0.8	99%	PASS
1/10/2005	CU-026	10-inch Cushion Layer	135.4	9.6	-	123.5	10.4	125.1	-0.8	99%	PASS
1/10/2005	CU-027	10-inch Cushion Layer	137.9	8.9	-	126.6	10.4	125.1	-1.5	101%	PASS
1/10/2005	CU-028	10-inch Cushion Layer	135	8.5	-	124.4	10.4	125.1	-1.9	99%	PASS
1/10/2005	CU-029	10-inch Cushion Layer	130.1	11.0	-	117.2	10.8	122.9	0.2	95%	PASS
1/10/2005	CU-030	10-inch Cushion Layer	137.1	10.3	-	124.3	10.8	122.9	-0.5	101%	PASS
1/10/2005	CU-031	10-inch Cushion Layer	135.8	10.8	-	122.6	10.8	122.9	0.0	100%	PASS
1/10/2005	CU-032	10-inch Cushion Layer	138.2	9.6	-	126.1	10.4	125.1	-0.8	101%	PASS
1/11/2005	CU-033	10-inch Cushion Layer	130.4	11.2	-	117.3	10.8	122.9	0.4	95%	PASS
1/11/2005	CU-034	10-inch Cushion Layer	130.7	10.1	-	118.7	10.8	122.9	-0.7	97%	PASS
1/11/2005	CU-035	10-inch Cushion Layer	130.9	8.6	-	120.5	10.4	125.1	-1.8	96%	PASS
1/11/2005	CU-036	10-inch Cushion Layer	135.4	11.1	-	121.9	10.8	122.9	0.3	99%	PASS
1/11/2005	CU-037	10-inch Cushion Layer	132.5	9.0	-	121.6	10.4	125.1	-1.4	97%	PASS
1/11/2005	CU-038	10-inch Cushion Layer	132.1	12.0	-	117.9	10.8	122.9	1.2	96%	PASS
1/18/2005	CU-039	10-inch Cushion Layer	128.7	9.5	-	117.5	10.8	122.9	-1.3	96%	PASS
1/18/2005	CU-040	10-inch Cushion Layer	132.9	10.0	-	120.8	11.3	123.1	-1.3	98%	PASS
1/18/2005	CU-041	10-inch Cushion Layer	131.1	9.1	-	120.2	10.8	122.9	-1.7	98%	PASS
1/18/2005	CU-042	10-inch Cushion Layer	134.4	8.6	-	123.8	10.4	125.1	-1.8	99%	PASS
1/18/2005	CU-043	10-inch Cushion Layer	131.4	9.6	-	119.9	10.8	122.9	-1.2	98%	PASS
1/18/2005	CU-044	10-inch Cushion Layer	131.4	8.9	-	120.7	10.8	122.9	-1.9	98%	PASS
1/18/2005	CU-045	10-inch Cushion Layer	130.1	8.6	-	119.8	10.4	125.1	-1.8	96%	PASS
1/18/2005	CU-046	10-inch Cushion Layer	133.3	8.6	-	122.7	10.4	125.1	-1.8	98%	PASS
1/18/2005	CU-047	10-inch Cushion Layer	133.1	10.1	11.1	119.8	10.4	125.1	0.7	96%	PASS
1/18/2005	CU-048	10-inch Cushion Layer	133	8.7	-	122.4	10.4	125.1	-1.7	98%	PASS
1/18/2005	CU-049	10-inch Cushion Layer	131.2	9.9	-	119.4	10.8	122.9	-0.9	97%	PASS
1/18/2005	CU-050	10-inch Cushion Layer	132.6	9.0	-	121.7	10.8	122.9	-1.8	99%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
1/18/2005	CU-051	10-inch Cushion Layer	136.9	9.4	-	125.1	10.4	125.1	-1.0	100%	PASS
1/18/2005	CU-052	10-inch Cushion Layer	135.1	9.7	-	123.2	10.4	125.1	-0.7	98%	PASS
1/18/2005	CU-053	10-inch Cushion Layer	133.7	10.2	-	121.3	10.8	122.9	-0.6	99%	PASS
1/20/2005	CU-054	10-inch Cushion Layer	136	8.8	-	125.0	10.4	125.1	-1.6	100%	PASS
1/20/2005	CU-055	10-inch Cushion Layer	141.2	9.0	-	129.5	10.4	125.1	-1.4	104%	PASS
1/20/2005	CU-056	10-inch Cushion Layer	137.5	9.7	-	125.3	10.4	125.1	-0.7	100%	PASS
1/20/2005	CU-057	10-inch Cushion Layer	130.9	8.8	-	120.3	10.8	122.9	-2.0	98%	PASS
1/20/2005	CU-058	10-inch Cushion Layer	139	8.8	-	127.8	10.4	125.1	-1.6	102%	PASS
1/20/2005	CU-059	10-inch Cushion Layer	137.1	9.3	-	125.4	10.4	125.1	-1.1	100%	PASS
1/20/2005	CU-060	10-inch Cushion Layer	136.8	9.5	-	124.9	10.4	125.1	-0.9	100%	PASS
1/20/2005	CU-061	10-inch Cushion Layer	139	8.8	-	127.8	10.4	125.1	-1.6	102%	PASS
1/20/2005	CU-062	10-inch Cushion Layer	142.4	9.1	-	130.5	10.4	125.1	-1.3	104%	PASS
1/20/2005	CU-063	10-inch Cushion Layer	135.4	8.6	-	124.7	10.4	125.1	-1.8	100%	PASS
1/21/2005	CU-064	10-inch Cushion Layer	138.4	10.3	-	125.5	10.4	125.1	-0.1	100%	PASS
1/21/2005	CU-065	10-inch Cushion Layer	139.1	8.9	-	127.7	10.4	125.1	-1.5	102%	PASS
1/21/2005	CU-066	10-inch Cushion Layer	136.9	8.5	-	126.2	10.4	125.1	-1.9	101%	PASS
1/21/2005	CU-067	10-inch Cushion Layer	130.3	9.0	-	119.5	10.8	122.9	-1.8	97%	PASS
1/21/2005	CU-068	10-inch Cushion Layer	134	10.5	-	121.3	10.4	125.1	0.1	97%	PASS
1/21/2005	CU-069	10-inch Cushion Layer	130.8	8.7	-	120.3	10.4	125.1	-1.7	96%	PASS
1/21/2005	CU-070	10-inch Cushion Layer	138.6	9.4	-	126.7	10.4	125.1	-1.0	101%	PASS
1/21/2005	CU-071	10-inch Cushion Layer	136.2	10.2	-	123.6	10.4	125.1	-0.2	99%	PASS
1/21/2005	CU-072	10-inch Cushion Layer	131.1	8.5	-	120.8	10.4	125.1	-1.9	97%	PASS
1/21/2005	CU-073	10-inch Cushion Layer	138.2	10.4	-	125.2	10.4	125.1	0.0	100%	PASS
1/21/2005	CU-074	10-inch Cushion Layer	143.7	10.0	-	130.6	10.4	125.1	-0.4	104%	PASS
1/21/2005	CU-075	10-inch Cushion Layer	136.5	10.3	-	123.8	10.4	125.1	-0.1	99%	PASS
1/21/2005	CU-076	10-inch Cushion Layer	140.7	9.4	-	128.6	10.4	125.1	-1.0	103%	PASS
1/24/2005	CU-077	10-inch Cushion Layer	134.8	9.3	-	123.3	10.8	122.9	-1.5	100%	PASS
1/24/2005	CU-078	10-inch Cushion Layer	139.8	8.7	-	128.6	10.4	125.1	-1.7	103%	PASS
1/24/2005	CU-079	10-inch Cushion Layer	142.8	8.9	-	131.1	10.4	125.1	-1.5	105%	PASS
1/24/2005	CU-080	10-inch Cushion Layer	139.6	9.1	-	128.0	10.4	125.1	-1.3	102%	PASS
1/24/2005	CU-081	10-inch Cushion Layer	134.3	8.9	-	123.3	10.8	122.9	-1.9	100%	PASS
1/24/2005	CU-082	10-inch Cushion Layer	140.4	9.2	-	128.6	10.4	125.1	-1.2	103%	PASS
1/24/2005	CU-083	10-inch Cushion Layer	132.1	10.6	-	119.4	12.2	122.8	-1.6	97%	PASS
1/24/2005	CU-084	10-inch Cushion Layer	137.8	8.9	-	126.5	12.2	122.8	-3.3	103%	FAIL*
1/25/2005	CU-085	10-inch Cushion Layer	131.7	9.0	9.9	119.8	12.2	122.8	-2.3	98%	FAIL*
1/25/2005	CU-086	10-inch Cushion Layer	134.7	10.1	-	122.3	10.4	125.1	-0.3	98%	PASS
1/25/2005	CU-087	10-inch Cushion Layer	133.3	8.7	-	122.6	10.4	125.1	-1.7	98%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
1/25/2005	CU-088	10-inch Cushion Layer	141.2	9.3	-	129.2	10.4	125.1	-1.1	103%	PASS
1/25/2005	CU-089	10-inch Cushion Layer	139.7	9.4	9.3	127.8	10.4	125.1	-1.1	102%	PASS
1/25/2005	CU-090	10-inch Cushion Layer	139.8	9.6	-	127.6	10.4	125.1	-0.8	102%	PASS
1/25/2005	CU-091	10-inch Cushion Layer	137.7	10.1	-	125.1	10.4	125.1	-0.3	100%	PASS
1/25/2005	CU-092	10-inch Cushion Layer	130.9	9.0	-	120.1	10.4	125.1	-1.4	96%	PASS
1/25/2005	CU-093	10-inch Cushion Layer	138.9	8.8	-	127.7	10.4	125.1	-1.6	102%	PASS
1/26/2005	CU-094	10-inch Cushion Layer	139	10.4	-	125.9	10.6	123.6	-0.2	102%	PASS
1/26/2005	CU-095	10-inch Cushion Layer	130	10.0	-	118.2	10.4	125.1	-0.4	94%	PASS
1/26/2005	CU-096	10-inch Cushion Layer	139	8.8	-	127.8	10.4	125.1	-1.6	102%	PASS
1/26/2005	CU-097	10-inch Cushion Layer	135.3	10.0	-	123.0	10.4	125.1	-0.4	98%	PASS
1/26/2005	CU-098	10-inch Cushion Layer	141.1	9.2	-	129.2	10.4	125.1	-1.2	103%	PASS
1/26/2005	CU-099	10-inch Cushion Layer	137.9	9.9	9.9	125.5	10.4	125.1	-0.5	100%	PASS
1/26/2005	CU-100	10-inch Cushion Layer	134.8	10.8	-	121.7	10.6	123.6	0.2	98%	PASS
1/26/2005	CU-101	10-inch Cushion Layer	138.5	9.2	-	126.8	10.4	125.1	-1.2	101%	PASS
1/26/2005	CU-102	10-inch Cushion Layer	137.4	9.3	-	125.7	10.4	125.1	-1.1	100%	PASS
1/26/2005	CU-103	10-inch Cushion Layer	132.4	9.3	-	121.1	10.6	123.6	-1.3	98%	PASS
1/27/2005	CU-104	10-inch Cushion Layer	135.6	8.4	-	125.1	10.4	125.1	-2.0	100%	PASS
1/27/2005	CU-105	10-inch Cushion Layer	132.8	9.0	-	121.8	10.4	125.1	-1.4	97%	PASS
1/27/2005	CU-106	10-inch Cushion Layer	139.7	9.1	-	128.0	10.4	125.1	-1.3	102%	PASS
1/27/2005	CU-107	10-inch Cushion Layer	131.7	8.5	-	121.4	10.6	123.6	-2.1	98%	PASS
1/27/2005	CU-108	10-inch Cushion Layer	133	8.5	-	122.6	10.6	123.6	-2.1	99%	PASS
1/27/2005	CU-109	10-inch Cushion Layer	132	12.4	-	117.4	10.6	123.6	1.8	95%	PASS
1/27/2005	CU-110	10-inch Cushion Layer	139.6	9.2	-	127.8	10.6	123.6	-1.4	103%	PASS
1/27/2005	CU-111	10-inch Cushion Layer	135.5	9.2	-	124.1	10.6	123.6	-1.4	100%	PASS
1/27/2005	CU-112	10-inch Cushion Layer	135.7	12.1	-	121.1	10.6	123.6	1.5	98%	PASS
1/27/2005	CU-113	10-inch Cushion Layer	136.7	9.8	-	124.5	10.6	123.6	-0.8	101%	PASS
1/27/2005	CU-114	10-inch Cushion Layer	141.7	10.0	-	128.8	10.6	123.6	-0.6	104%	PASS
1/27/2005	CU-115	10-inch Cushion Layer	138.2	9.0	-	126.8	10.4	125.1	-1.4	101%	PASS
1/27/2005	CU-116	10-inch Cushion Layer	130.2	9.1	-	119.3	10.4	125.1	-1.3	95%	PASS
1/27/2005	CU-117	10-inch Cushion Layer	133.5	9.0	-	122.5	10.6	123.6	-1.6	99%	PASS
1/27/2005	CU-118	10-inch Cushion Layer	138.7	9.5	-	126.7	10.6	123.6	-1.1	102%	PASS
1/27/2005	CU-119	10-inch Cushion Layer	132.4	10.0	9.8	120.6	10.6	123.6	-0.8	98%	PASS
1/27/2005	CU-120	10-inch Cushion Layer	139.7	12.0	-	124.7	11.3	124.5	0.7	100%	PASS
2/4/2005	CU-121	10-inch Cushion Layer	137.7	10.8	-	124.3	11.3	124.5	-0.5	100%	PASS
2/4/2005	CU-122	10-inch Cushion Layer	133.2	12.0	-	118.9	11.3	123.1	0.7	97%	PASS
2/4/2005	CU-123	10-inch Cushion Layer	136.1	12.3	-	121.2	11.3	123.1	1.0	98%	PASS
2/4/2005	CU-124	10-inch Cushion Layer	136.7	11.0	-	123.2	11.3	123.1	-0.3	100%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
2/4/2005	CU-125	10-inch Cushion Layer	131.8	10.7	-	119.1	12.2	122.8	-1.5	97%	PASS
2/4/2005	CU-126	10-inch Cushion Layer	135.5	9.7	-	123.5	11.3	124.5	-1.6	99%	PASS
2/5/2005	CU-127	10-inch Cushion Layer	138.5	10.8	-	125.0	11.3	124.5	-0.5	100%	PASS
2/5/2005	CU-128	10-inch Cushion Layer	137.6	10.8	-	124.2	11.3	124.5	-0.5	100%	PASS
2/5/2005	CU-129	10-inch Cushion Layer	135.8	11.8	-	121.5	11.3	123.1	0.5	99%	PASS
2/5/2005	CU-130	10-inch Cushion Layer	138.3	11.2	-	124.4	11.3	124.5	-0.1	100%	PASS
2/5/2005	CU-131	10-inch Cushion Layer	137.8	10.3	-	124.9	11.3	124.5	-1.0	100%	PASS
2/24/2005	CU-132	10-inch Cushion Layer	140.5	9.2	-	128.7	10.4	125.1	-1.2	103%	PASS
2/24/2005	CU-133	10-inch Cushion Layer	142.3	9.0	-	130.6	10.4	125.1	-1.4	104%	PASS
2/24/2005	CU-134	10-inch Cushion Layer	141.5	8.9	-	129.9	10.4	125.1	-1.5	104%	PASS
2/24/2005	CU-135	10-inch Cushion Layer	139.7	9.2	-	127.9	10.4	125.1	-1.2	102%	PASS
2/24/2005	CU-136	10-inch Cushion Layer	141.1	8.9	-	129.6	10.4	125.1	-1.5	104%	PASS
2/24/2005	CU-137	10-inch Cushion Layer	139	9.7	-	126.7	10.4	125.1	-0.7	101%	PASS
2/24/2005	CU-138	10-inch Cushion Layer	136.5	9.8	-	124.3	10.4	125.1	-0.6	99%	PASS
2/24/2005	CU-139	10-inch Cushion Layer	137.3	9.9	-	124.9	10.4	125.1	-0.5	100%	PASS
2/24/2005	CU-140	10-inch Cushion Layer	134.2	10.4	-	121.6	11.3	124.5	-0.9	98%	PASS
2/24/2005	CU-141	10-inch Cushion Layer	139.1	10.3	-	126.1	11.3	124.5	-1.0	101%	PASS
2/24/2005	CU-142	10-inch Cushion Layer	133.1	10.1	-	120.9	11.3	124.5	-1.2	97%	PASS
2/24/2005	CU-143	10-inch Cushion Layer	133	9.4	-	121.6	11.3	124.5	-1.9	98%	PASS
2/24/2005	CU-144	10-inch Cushion Layer	128.8	9.9	-	117.2	11.3	124.5	-1.4	94%	PASS
2/24/2005	CU-145	10-inch Cushion Layer	134.1	9.4	-	122.6	11.3	124.5	-1.9	98%	PASS
2/24/2005	CU-146	10-inch Cushion Layer	131.9	10.8	-	119.0	12.2	122.8	-1.4	97%	PASS
2/24/2005	CU-147	10-inch Cushion Layer	131.6	11.1	-	118.5	12.2	122.8	-1.1	96%	PASS
2/24/2005	CU-148	10-inch Cushion Layer	133.6	9.9	-	121.6	11.3	124.5	-1.4	98%	PASS
2/26/2005	CU-149	10-inch Cushion Layer	132.6	9.3	-	121.3	10.4	125.1	-1.1	97%	PASS
2/26/2005	CU-150	10-inch Cushion Layer	134.9	9.7	-	123.0	10.4	125.1	-0.7	98%	PASS
2/26/2005	CU-151	10-inch Cushion Layer	146.2	8.5	-	134.7	10.4	125.1	-1.9	108%	PASS
2/26/2005	CU-152	10-inch Cushion Layer	136.1	9.9	-	123.8	10.4	125.1	-0.5	99%	PASS
2/26/2005	CU-153	10-inch Cushion Layer	134.7	10.4	10.9	121.5	11.3	124.5	-0.4	98%	PASS
2/26/2005	CU-154	10-inch Cushion Layer	133.4	11.2	-	120.0	11.3	124.5	-0.1	96%	PASS
2/26/2005	CU-155	10-inch Cushion Layer	130	8.5	-	119.8	10.4	125.1	-1.9	96%	PASS
2/26/2005	CU-156	10-inch Cushion Layer	137.9	8.6	-	127.0	10.4	125.1	-1.8	102%	PASS
2/26/2005	CU-157	10-inch Cushion Layer	137	8.9	-	125.8	10.4	125.1	-1.5	101%	PASS
4/5/2005	CU-158	10-inch Cushion Layer	139.5	8.5	-	128.6	10.4	125.1	-1.9	103%	PASS
4/5/2005	CU-159	10-inch Cushion Layer	133.2	9.2	-	122.0	10.4	125.1	-1.2	98%	PASS
4/5/2005	CU-160	10-inch Cushion Layer	140.2	8.8	-	128.9	10.4	125.1	-1.6	103%	PASS
4/5/2005	CU-161	10-inch Cushion Layer	136.3	8.4	-	125.7	10.4	125.1	-2.0	101%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)		Dry Density (pcf)	Proctor Results		-2 to 2	> 95%	Pass/Fail
				Nuclear Gage MC	Oven MC		Optimum MC (%)	Optimum DD (pcf)	% off MC	% Comp.	
4/5/2005	CU-162	10-inch Cushion Layer	137.7	8.6	-	126.8	10.4	125.1	-1.8	101%	PASS
4/5/2005	CU-163	10-inch Cushion Layer	136.9	10.5	-	123.9	10.4	125.1	0.1	99%	PASS
4/5/2005	CU-164	10-inch Cushion Layer	134	9.3	-	122.6	10.4	125.1	-1.1	98%	PASS
4/5/2005	CU-165	10-inch Cushion Layer	132.3	9.8	-	120.5	10.4	125.1	-0.6	96%	PASS
4/5/2005	CU-166	10-inch Cushion Layer	133.5	9.8	-	121.6	10.4	125.1	-0.6	97%	PASS
4/6/2005	CU-167	10-inch Cushion Layer	138.1	12.7	12.0	123.3	12.1	120.6	-0.1	102%	PASS
4/6/2005	CU-168	10-inch Cushion Layer	140.1	9.3	-	128.2	10.4	125.1	-1.1	102%	PASS
4/6/2005	CU-169	10-inch Cushion Layer	131.3	9.4	-	120.0	10.4	125.1	-1.0	96%	PASS
4/6/2005	CU-170	10-inch Cushion Layer	130.3	9.0	-	119.5	10.4	125.1	-1.4	96%	PASS
4/6/2005	CU-171	10-inch Cushion Layer	133.2	9.2	-	122.0	10.4	125.1	-1.2	98%	PASS
4/6/2005	CU-172	10-inch Cushion Layer	132.2	10.1	-	120.1	11	122.1	-0.9	98%	PASS
4/6/2005	CU-173	10-inch Cushion Layer	132.4	8.4	-	122.1	10.4	125.1	-2.0	98%	PASS
4/6/2005	CU-174	10-inch Cushion Layer	132.7	11.7	-	118.8	11	122.1	0.7	97%	PASS
4/6/2005	CU-175	10-inch Cushion Layer	131.4	8.9	-	120.7	10.4	125.1	-1.5	96%	PASS
4/6/2005	CU-176	10-inch Cushion Layer	142.9	8.9	-	131.2	10.4	125.1	-1.5	105%	PASS
4/6/2005	CU-177	10-inch Cushion Layer	141.6	8.7	-	130.3	10.4	125.1	-1.7	104%	PASS
4/6/2005	CU-178	10-inch Cushion Layer	132.7	12.1	-	118.4	11	122.1	1.1	97%	PASS
4/6/2005	CU-179	10-inch Cushion Layer	136.3	11.1	-	122.7	11	122.1	0.1	100%	PASS
4/6/2005	CU-180	10-inch Cushion Layer	137.9	11.5	-	123.7	11	122.1	0.5	101%	PASS
4/7/2005	CU-181	10-inch Cushion Layer	129.5	10.7	-	117.0	11	122.1	-0.3	96%	PASS
4/7/2005	CU-182	10-inch Cushion Layer	136.6	8.6	-	125.8	10.4	125.1	-1.8	101%	PASS
4/7/2005	CU-183	10-inch Cushion Layer	138	8.9	-	126.7	10.4	125.1	-1.5	101%	PASS
4/7/2005	CU-184	10-inch Cushion Layer	133.1	8.5	-	122.7	10.4	125.1	-1.9	98%	PASS
4/7/2005	CU-185	10-inch Cushion Layer	138.6	8.4	-	127.9	10.4	125.1	-2.0	102%	PASS
4/7/2005	CU-186	10-inch Cushion Layer	141.6	9.1	-	129.8	10.4	125.1	-1.3	104%	PASS
4/7/2005	CU-187	10-inch Cushion Layer	136.8	8.5	-	126.1	10.4	125.1	-1.9	101%	PASS
4/9/2005	CU-188	10-inch Cushion Layer	133.9	8.4	-	123.5	10.4	125.1	-2.0	99%	PASS
4/9/2005	CU-189	10-inch Cushion Layer	133.6	9.1	-	122.5	10.4	125.1	-1.3	98%	PASS
4/9/2005	CU-190	10-inch Cushion Layer	130.4	8.9	-	119.7	10.4	125.1	-1.5	96%	PASS
4/15/2005	CU-191	10-inch Cushion Layer	141.5	10.7	10.9	127.6	10.4	125.1	0.5	102%	PASS
4/15/2005	CU-192	10-inch Cushion Layer	138.5	10.7	-	125.1	10.4	125.1	0.3	100%	PASS
4/15/2005	CU-193	10-inch Cushion Layer	138.9	9.3	-	127.1	10.4	125.1	-1.1	102%	PASS
4/15/2005	CU-194	10-inch Cushion Layer	138	10.3	-	125.1	10.4	125.1	-0.1	100%	PASS
4/15/2005	CU-195	10-inch Cushion Layer	139.2	9.4	-	127.2	10.4	125.1	-1.0	102%	PASS
4/15/2005	CU-196	10-inch Cushion Layer	133	11.4	-	119.4	11	122.1	0.4	98%	PASS
4/16/2005	CU-197	10-inch Cushion Layer	142.2	8.5	-	131.1	10.4	125.1	-1.9	105%	PASS
4/16/2005	CU-198	10-inch Cushion Layer	138.2	10.0	-	125.6	10.4	125.1	-0.4	100%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%) Nuclear Gage MC	Oven MC	Dry Density (pcf)	Proctor Results Optimum MC (%)	Optimum DD (pcf)	-2 to 2 % off MC	> 95% % Comp.	Pass/Fail
4/16/2005	CU-199	10-inch Cushion Layer	133.7	8.7	-	123.0	10.4	125.1	-1.7	98%	PASS
4/16/2005	CU-200	10-inch Cushion Layer	135.3	10.5	-	122.4	11.2	123.8	-0.7	99%	PASS
4/16/2005	CU-201	10-inch Cushion Layer	132.4	11.1	-	119.2	11.2	123.8	-0.1	96%	PASS
4/16/2005	CU-202	10-inch Cushion Layer	137.3	10.6	9.7	125.2	11.2	123.8	-1.5	101%	PASS
4/16/2005	CU-203	10-inch Cushion Layer	133.3	10.8	-	120.3	11.2	123.8	-0.4	97%	PASS
4/16/2005	CU-204	10-inch Cushion Layer	131.6	10.5	-	119.1	11.2	123.8	-0.7	96%	PASS
4/16/2005	CU-205	10-inch Cushion Layer	133.6	9.8	-	121.7	11.2	123.8	-1.4	98%	PASS
4/16/2005	CU-206	10-inch Cushion Layer	137.6	9.1	-	126.1	10.4	125.1	-1.3	101%	PASS
4/18/2005	CU-207	10-inch Cushion Layer	138.7	8.9	-	127.4	10.4	125.1	-1.5	102%	PASS
4/18/2005	CU-208	10-inch Cushion Layer	139.2	8.8	-	127.9	10.4	125.1	-1.6	102%	PASS
4/18/2005	CU-209	10-inch Cushion Layer	133.4	10.1	-	121.2	11	122.1	-0.9	99%	PASS
4/18/2005	CU-210	10-inch Cushion Layer	133.4	10.3	11.9	119.2	11	122.1	0.9	98%	PASS
4/18/2005	CU-211	10-inch Cushion Layer	138.6	8.6	-	127.6	10.4	125.1	-1.8	102%	PASS
4/18/2005	CU-212	10-inch Cushion Layer	137.3	8.4	-	126.7	10.4	125.1	-2.0	101%	PASS
4/18/2005	CU-213	10-inch Cushion Layer	136.3	9.2	-	124.8	10.4	125.1	-1.2	100%	PASS
4/18/2005	CU-214	10-inch Cushion Layer	131	8.9	-	120.3	10.4	125.1	-1.5	96%	PASS
4/18/2005	CU-215	10-inch Cushion Layer	133.9	8.4	-	123.5	10.4	125.1	-2.0	99%	PASS
4/18/2005	CU-216	10-inch Cushion Layer	138.8	9.3	-	127.0	10.4	125.1	-1.1	102%	PASS
4/18/2005	CU-217	10-inch Cushion Layer	136	8.7	-	125.1	10.4	125.1	-1.7	100%	PASS
4/18/2005	CU-218	10-inch Cushion Layer	134.6	8.4	-	124.2	10.4	125.1	-2.0	99%	PASS
4/18/2005	CU-219	10-inch Cushion Layer	136.1	12.1	-	121.4	10.5	123.3	1.6	98%	PASS
4/18/2005	CU-220	10-inch Cushion Layer	136.7	9.4	11.5	122.6	10.5	123.3	1.0	99%	PASS
1/11/2005	CUS-01	10-inch Cushion Layer Sand Cone	130.2	-	9.4	119.0	10.6	123.6	-1.2	96%	PASS
1/18/2005	CUS-02	10-inch Cushion Layer Sand Cone	132.4	-	10.8	119.5	11.3	123.1	-0.5	97%	PASS
1/20/2005	CUS-03	10-inch Cushion Layer Sand Cone	134.4	-	7.9	124.6	10.4	125.1	-2.5	100%	FAIL*
1/24/2005	CUS-04	10-inch Cushion Layer Sand Cone	141.4	-	8.9	129.8	10.4	125.1	-1.5	104%	PASS
1/26/2005	CUS-05	10-inch Cushion Layer Sand Cone	139.6	-	10.1	126.8	10.6	123.6	-0.5	103%	PASS
1/27/2005	CUS-06	10-inch Cushion Layer Sand Cone	140.4	-	11.2	126.3	10.6	123.6	0.6	102%	PASS
2/24/2005	CUS-07	10-inch Cushion Layer Sand Cone	138.9	-	10.1	126.2	11.3	124.5	-1.2	101%	PASS
4/5/2005	CUS-8	10-inch Cushion Layer Sand Cone	141.8	-	9.6	129.4	10.4	125.1	-0.8	103%	PASS
4/7/2005	CUS-09	10-inch Cushion Layer Sand Cone	140.4	-	11.1	126.4	11	122.1	0.1	103%	PASS
4/16/2005	CUS-10	10-inch Cushion Layer Sand Cone	134.6	-	10.8	121.5	11.2	123.8	-0.4	98%	PASS
4/18/2005	CUS-11	10-inch Cushion Layer Sand Cone	135.6	-	10.0	123.3	10.5	123.3	-0.5	100%	PASS

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%) Nuclear Gage MC	Oven MC	Dry Density (pcf)	Proctor Results Optimum MC (%)	Optimum DD (pcf)	-2 to 2 % off MC	> 90% % Comp.	Pass/Fail
4/21/2005	AEB-1	Aeration Structure Backfill	135.2	12.1	-	120.6	10.8	122.9	1.3	98%	PASS
4/21/2005	AEB-2	Aeration Structure Backfill	132.6	11.7	-	118.7	10.8	122.9	0.9	97%	PASS
4/27/2005	AEB-3	Aeration Structure Backfill	126.9	12.6	-	112.7	12.2	122.8	0.4	92%	PASS
4/27/2005	AEB-4	Aeration Structure Backfill	126.3	14.0	-	110.8	12.2	122.8	1.8	90%	PASS
4/27/2005	AEB-5	Aeration Structure Backfill	132.2	12.2	-	117.8	12.2	122.8	0.0	96%	PASS
4/26/2005	GWN-1	North GWIS Line Backfill	126.6	14.0	-	111.1	12.2	122.8	1.8	90%	PASS
4/26/2005	GWN-2	North GWIS Line Backfill	125.4	13.4	-	110.6	12.2	122.8	1.2	90%	PASS
5/4/2005	GWS-1	South GWIS Line Backfill	126.8	14.1	-	111.1	12.5	119.6	1.6	93%	PASS
5/4/2005	GWS-2	South GWIS Line Backfill	133.4	14.0	-	117.0	12.5	119.6	1.5	98%	PASS
5/10/2005	CPS-1	South Culverts Backfill	132.3	13.2	-	116.9	12.5	119.6	0.7	98%	PASS
5/10/2005	CPS-2	South Culverts Backfill	125.6	13.0	-	111.2	12.5	119.6	0.5	93%	PASS
5/12/2005	CPN-1	North Culverts Backfill	129.7	14.1	-	113.7	12.5	119.6	1.6	95%	PASS
5/12/2005	CPN-2	North Culverts Backfill	126	14.5	-	110.0	12.5	119.6	2.0	92%	PASS

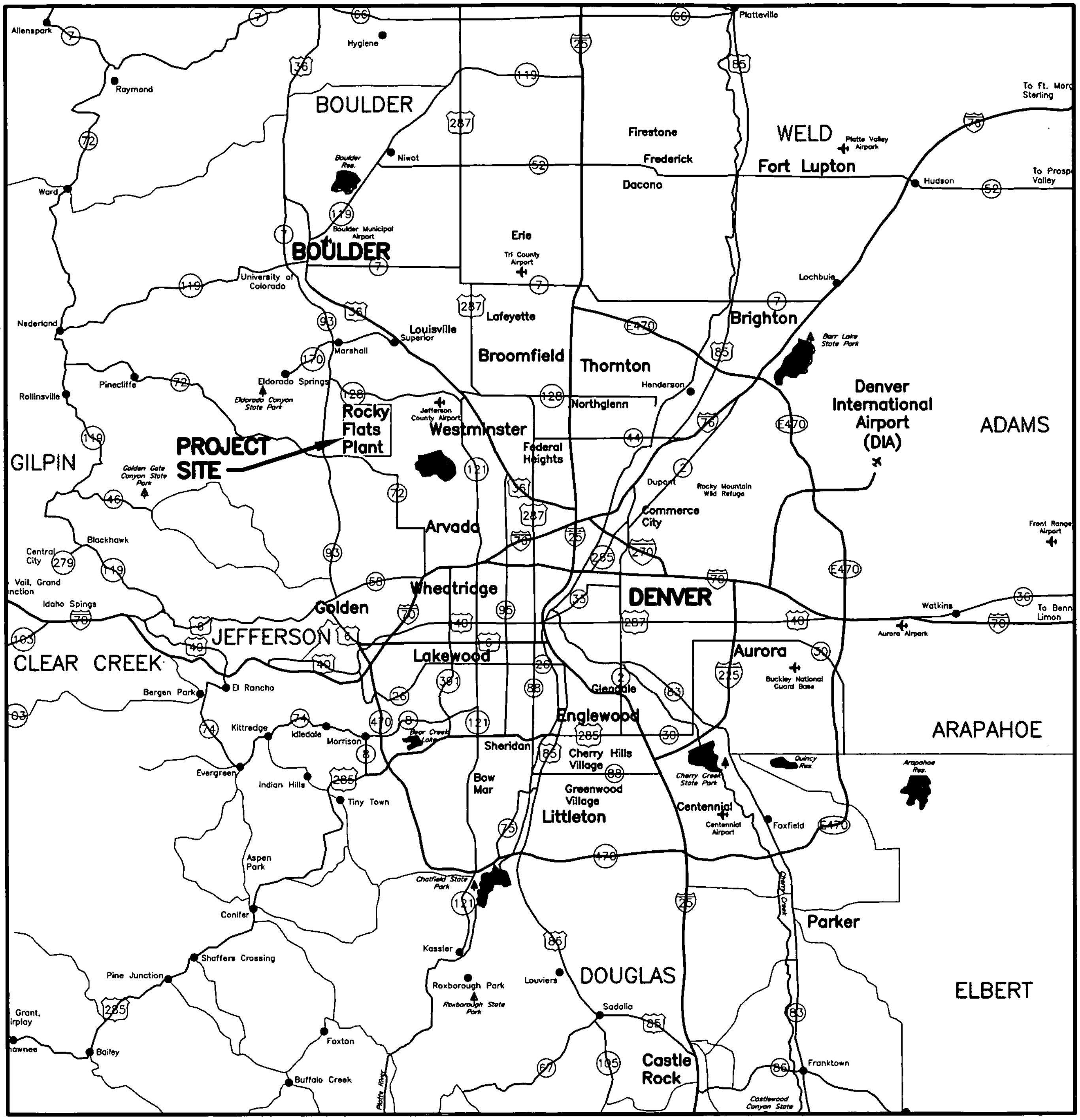
Notes:

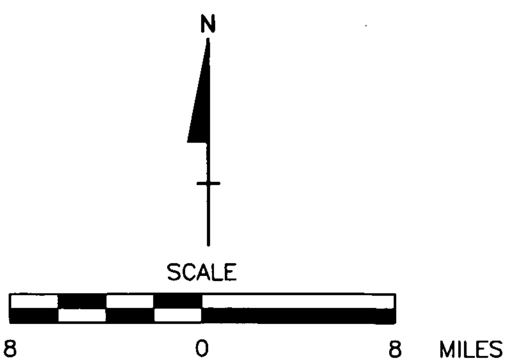
DD	Dry density
MC	Moisture content
pcf	Pounds per cubic foot
CL	6" cushion soil nuke gauge test
CU	10" cushion soil nuke gauge test
CLS	6" cushion soil sand cone test
CUS	10" cushion soil sand cone test
AT	Anchor trench nuke gauge test
AEB	Aeration structure for seep capture system backfill
GWN	GWIS line on the north side of the east face
GWS	GWIS line on the south side of the east face
CPN	Cushion fill over and around the northern culvert pipes
CPS	Cushion fill over and around the southern culvert pipes
*	The moisture samples from the tests were out of specification (dry), but the compactions were above 95% (98 % to 103%), so the compactions were considered acceptable by the CQAE.

Table 6.4
Summary of Field QA Compaction Tests
Quality Assurance Field Density Test Log

Date	Test #	Description	Moist Density (pcf)	Moisture Content (%)	DD	Proctor Results Optimum MC	Proctor Results Maximum DD	-2 to 2 % off MC	> 95% % Comp.	Pass/Fail
11/5/2004	QACL-20	6-inch Cushion Layer	138	10.2	138.0	10.4	125.1	-0.2	110%	Pass
11/18/2004	QACL-40	6-inch Cushion Layer	133.6	10.3	133.6	10.4	125.1	-0.1	107%	Pass
12//8/2004	QACL-60	6-inch Cushion Layer	128.4	9.8	128.4	11.0	122.1	-1.2	105%	Pass
12/9/2004	QACL-80	6-inch Cushion Layer	130.7	10.0	130.7	11.0	122.1	-1.0	107%	Pass
12/15/2004	QACL-100	6-inch Cushion Layer	127.3	10.1	127.3	11.0	122.1	-0.9	104%	Pass
12/18/2004	QACL-120	6-inch Cushion Layer	134.4	10.9	134.4	11.0	122.1	-0.1	110%	Pass
1/11/2005	QACU-20	10-inch Cushion Layer	131.4	8.7	131.4	10.4	125.1	-1.7	105%	Pass
1/18/2005	QACU-40	10-inch Cushion Layer	132.7	10.2	132.7	10.4	125.1	-0.2	106%	Pass
1/20/2005	QACU-60	10-inch Cushion Layer	135.5	8.9	135.5	10.4	125.1	-1.5	108%	Pass
1/24/2005	QACU-80	10-inch Cushion Layer	138.4	8.4	138.4	10.4	125.1	-2.0	111%	Pass
1/26/2005	QACU-100	10-inch Cushion Layer	134.9	10.3	134.9	10.4	125.1	-0.1	108%	Pass
1/27/2005	QACU-120	10-inch Cushion Layer	138.1	10.7	138.1	10.4	125.1	0.3	110%	Pass
2/10/2005	QACL-140	6-inch Cushion Layer	132.3	10.3	132.3	11.0	122.1	-0.7	108%	Pass
2/11/2005	QACL-160	6-inch Cushion Layer	135.9	10.6	135.9	11.0	122.1	-0.4	111%	Pass
2/24/2005	QACU-140	10-inch Cushion Layer	133.5	10.8	133.5	11.0	122.1	-0.2	109%	Pass
3/22/2005	QACL-180	6-inch Cushion Layer	134.8	9.1	134.8	11.0	122.1	-1.9	110%	Pass
4/1/2005	QACL-200	6-inch Cushion Layer	137.3	11.1	137.3	11.0	122.1	0.1	112%	Pass
4/1/2005	QACL-209	6-inch Cushion Layer	139.5	10.5	139.5	11.0	122.1	-0.5	114%	Pass
4/4/2005	QAAT-1	Anchor Trench	135.5	10.5	135.5	11.0	122.1	-0.5	111%	Pass
4/4/2005	QAAT-2	Anchor Trench	134.9	10.6	134.9	11.0	122.1	-0.4	110%	Pass
4/5/2005	QACU-160	10-inch Cushion Layer	139.9	8.6	139.9	10.4	125.1	-1.8	112%	Pass
4/7/2005	QACU-180	10-inch Cushion Layer	135.4	11.1	135.4	11.0	122.1	0.1	111%	Pass
4/16/2005	QACU-200	10-inch Cushion Layer	132.5	9.6	132.5	11.0	122.1	-1.4	109%	Pass
4/18/2005	QACU-220	10-inch Cushion Layer	136.6	9.6	136.6	11.0	122.1	-1.4	112%	Pass

Notes: All tests performed by nuclear density gage.
DD = Dry density
MC = Moisture content
QACL = 6" cushion soil QA test
QACU = 10" cushion soil QA test
QAAT = Anchor trench QA test
pcf = Pounds per cubic foot





U.S. DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

KAISER HILL COMPANY

PRESENT LANDFILL ACCELERATED ACTION CONSTRUCTION CERTIFICATION REPORT

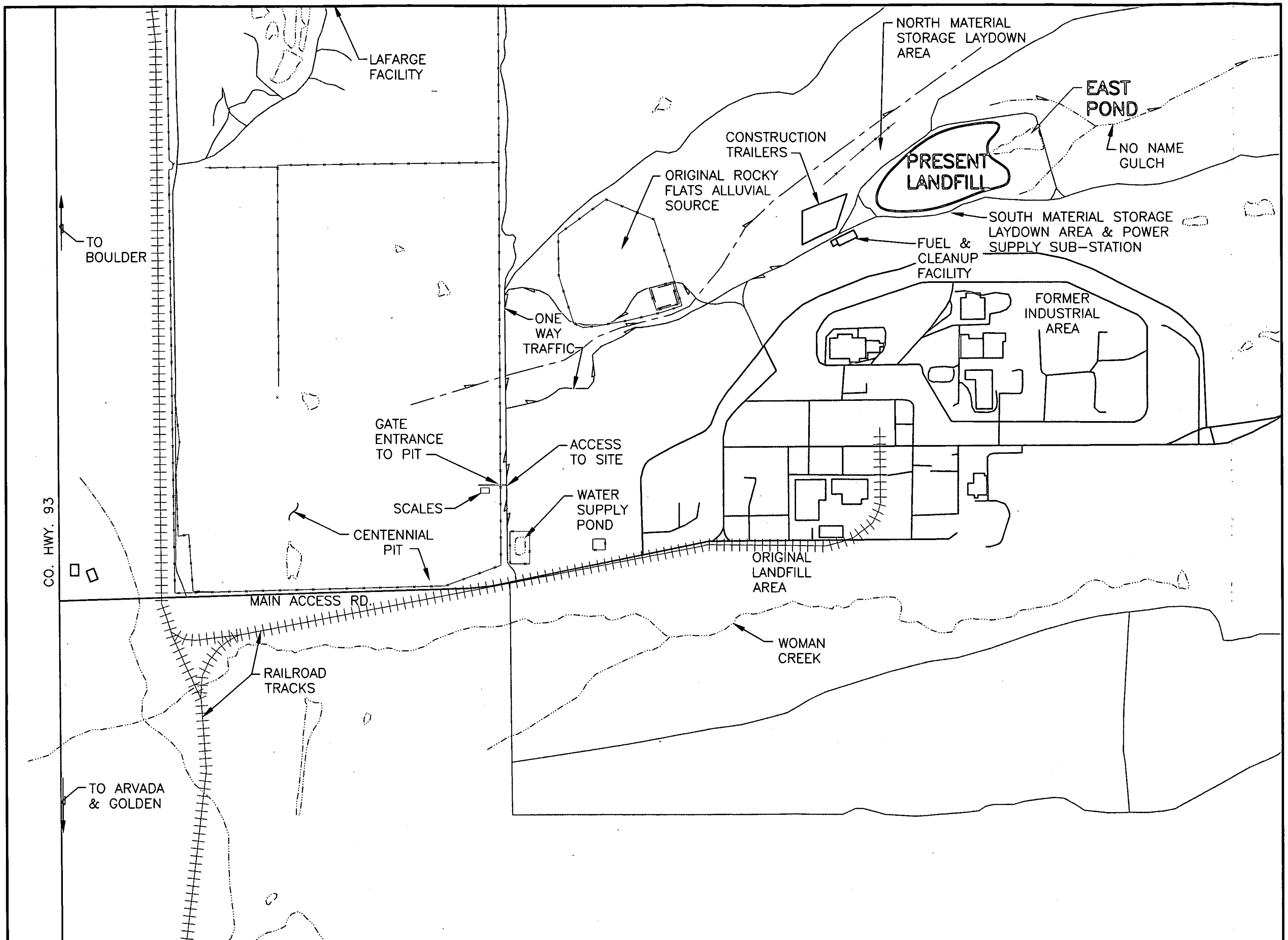
FIGURE 1

VICINITY MAP

PROJECT: 010213X	DATE: AUGUST 2005
REV:	BY: SCG CHECKED: JHR

TETRA TECH, INC.

F:\4886_001\CCR Report\...dwg, Vicinity Map of Metro Denver, 8/23/2005 8:10:15 AM, Letter, 1:1



N

SCALE

1200 0 1200 FEET

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

KAISER HILL COMPANY

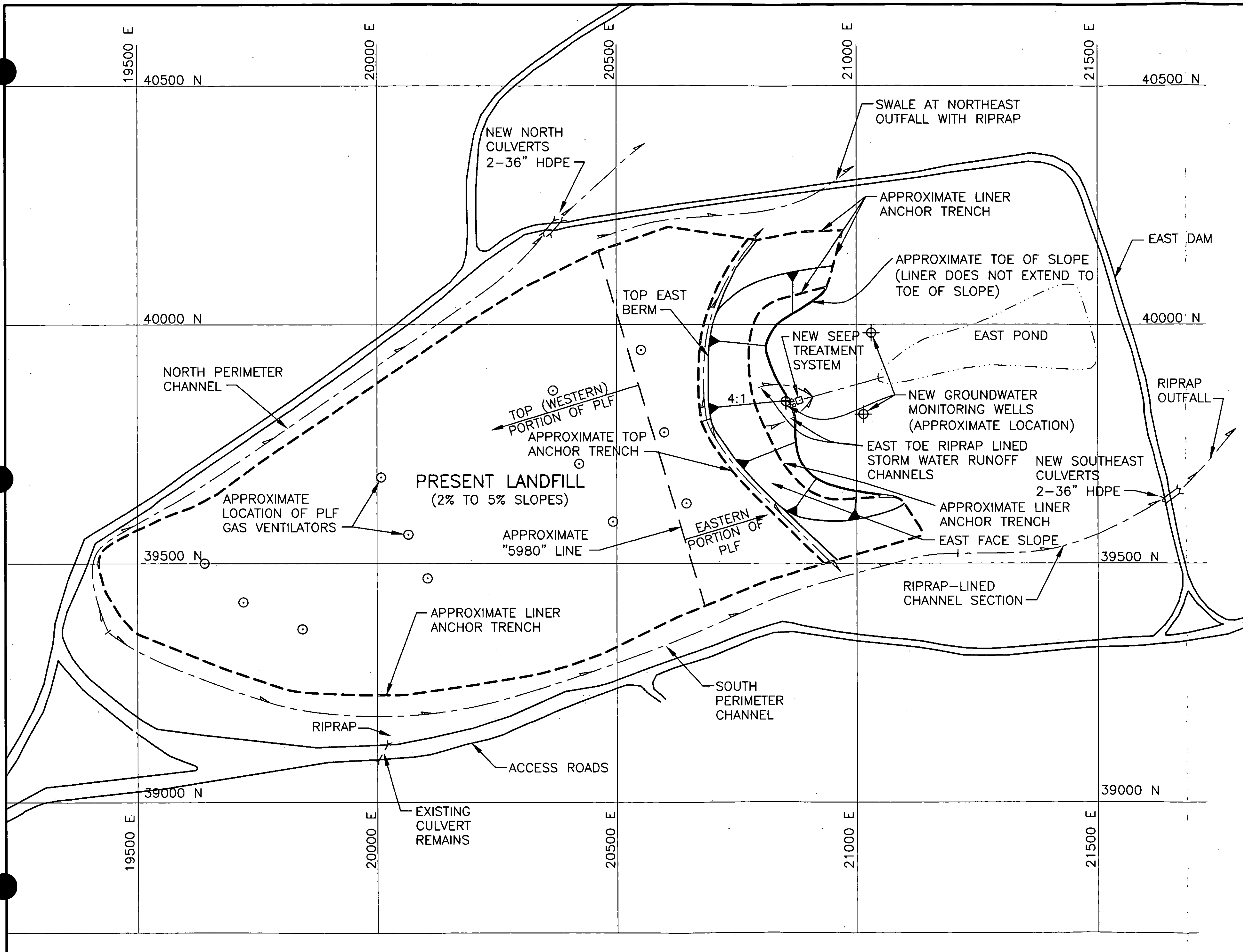
PRESENT LANDFILL ACCELERATED ACTION CONSTRUCTION CERTIFICATION REPORT

FIGURE 2

GENERAL SITE PLAN

PROJECT: 010213X	DATE: AUGUST 2005
REV:	BY: SCG CHECKED: JHR

TETRA TECH, INC.



NOTE:

1. FINAL LOCATIONS SHOWN ARE APPROXIMATE. SEE AS-BUILT DRAWINGS AND FINAL RECORD SURVEY FOR EXACT LOCATIONS.

N

APPROXIMATE SCALE

200 0 200 FEET

U.S. DEPARTMENT OF ENERGY ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

KAISER HILL COMPANY

PRESENT LANDFILL ACCELERATED ACTION CONSTRUCTION CERTIFICATION REPORT

FIGURE 3

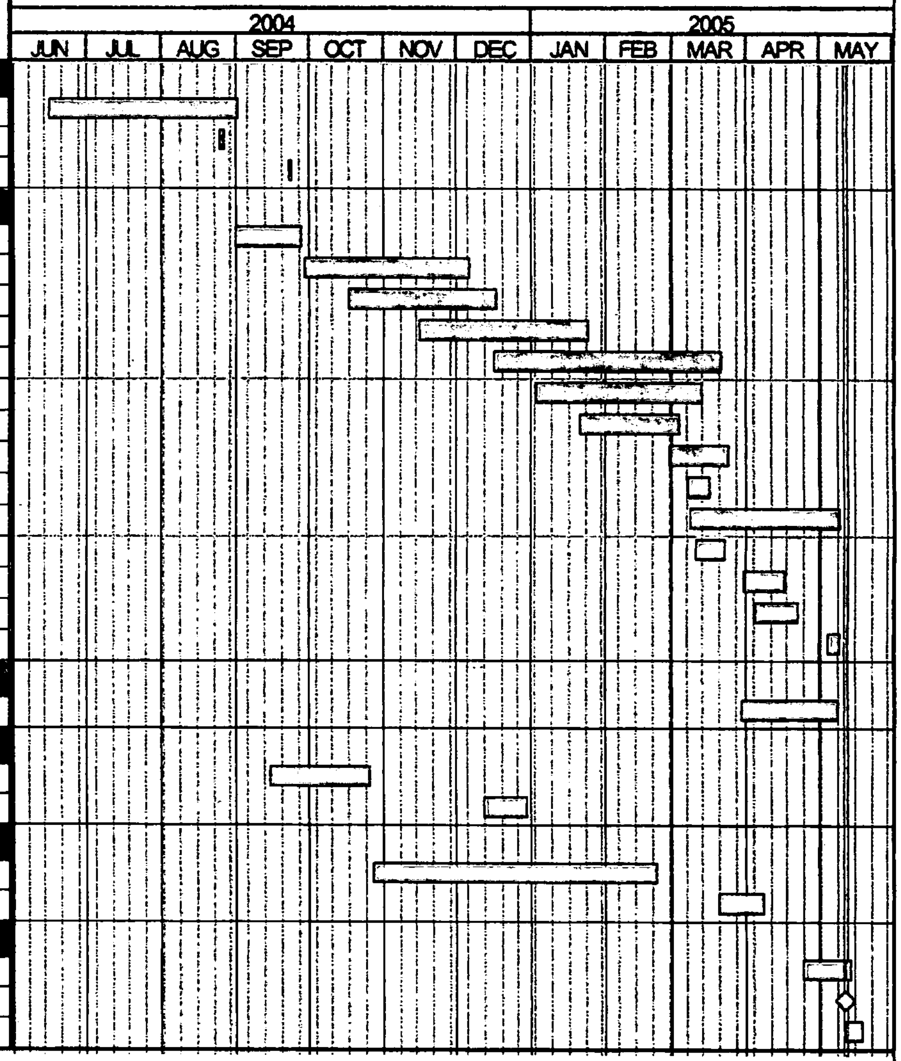
PRESENT LANDFILL PLAN

PROJECT: 010213X	DATE: AUGUST 2005
REV: SEPT. 2005	BY: SCG / CHECKED: JHR

TETRA TECH, INC.

F:\4886_001\CCR Report\C[illegible].dwg, PRESENT LANDFILL PLAN, 9/12/2005 10:01:14 AM, 11x17, 1:1

Activity ID	Activity Description	Actual Start	Actual Finish
Mobilization			
2330	Site Mobilization	16JUN04A	01SEP04A
2220	Regulator Approval of IMRA	26AUG04A	26AUG04A
2320	Regulator Approve Landfill Design (West Side)	23SEP04A	23SEP04A
Earthwork			
2230	Initial Mow/Clear/Grub	01SEP04A	27SEP04A
1110	Prep & Regrade Existing Interim Cap to 5980 line	30SEP04A	06DEC04A
1120	Place 6-Inch Cusion Soil	18OCT04A	17DEC04A
1180	Place 10" Cushion	16NOV04A	24JAN05A
1670	Regrade East Face	17DEC04A	21MAR05A
1080	Rock Layer	04JAN05A	13MAR05A
1060	22-Inch Soil Cover	22JAN05A	03MAR05A
1710	2-Inch Soil Cover	28FEB05A	24MAR05A
1840	Remove "wing area" Asbestos	08MAR05A	16MAR05A
1730	East Face 22" lift	09MAR05A	09MAY05A
1680	East Face 6" Cushion	11MAR05A	22MAR05A
1690	East Face 10" Cushion	31MAR05A	16APR05A
1700	East Face Rock Layer	05APR05A	21APR05A
1740	East Face 2" final Soil Cover	05MAY05A	09MAY05A
Seep Treatment System			
1760	Install Seep Treatment Cascade System	30MAR05A	08MAY05A
Pond			
1590	Cut and Remove Cattails	15SEP04A	26OCT04A
1600	Remove Pond Sediments & Regrade	13DEC04A	30DEC04A
Liner			
1580	Install Geosynthetic Liner System (W. Cap Area)	28OCT04A	22FEB05A
1760	Install Geosynthetic Liner System (E. Face)	21MAR05A	07APR05A
Demobilization			
1260	Demobilization	25APR05A	14MAY05
1100	Physical Completion Date		11MAY05
1340	Prepare/Submit as Builts and Project Close-out	12MAY05	18MAY05



Start Date	**17JUN04**
Finish Date	**18MAY05**
Data Date	**12MAY05**
Run Date	**23MAY05 11:05**

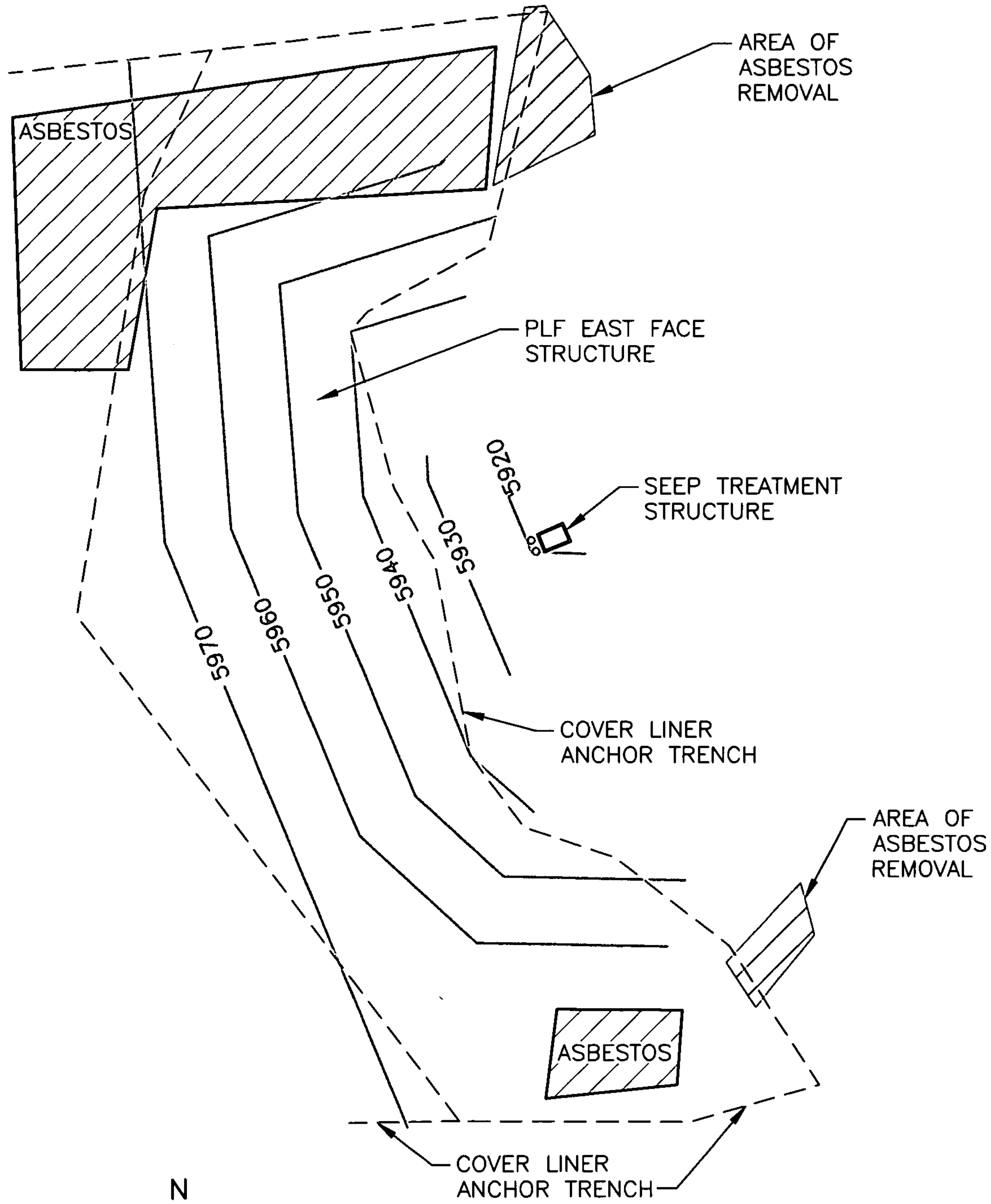
0512 Sheet 1 of 1

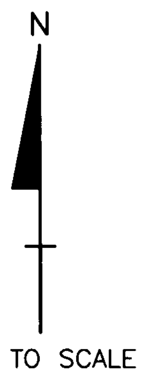
S.M. Stoller Corporation
Construction of the Present Landfill
Accelerated Action

Actual Construction Schedule

Note: Seeding and Groundwater Monitoring Well Installation not Shown.

Figure 4





U.S. DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

KAISER HILL COMPANY

PRESENT LANDFILL ACCELERATED ACTION CONSTRUCTION CERTIFICATION REPORT

FIGURE 5

ASBESTOS REMOVAL AREAS

PROJECT: 010213X	DATE: AUGUST 2005
REV:	BY: SCG CHECKED: JHR

TETRA TECH, INC.

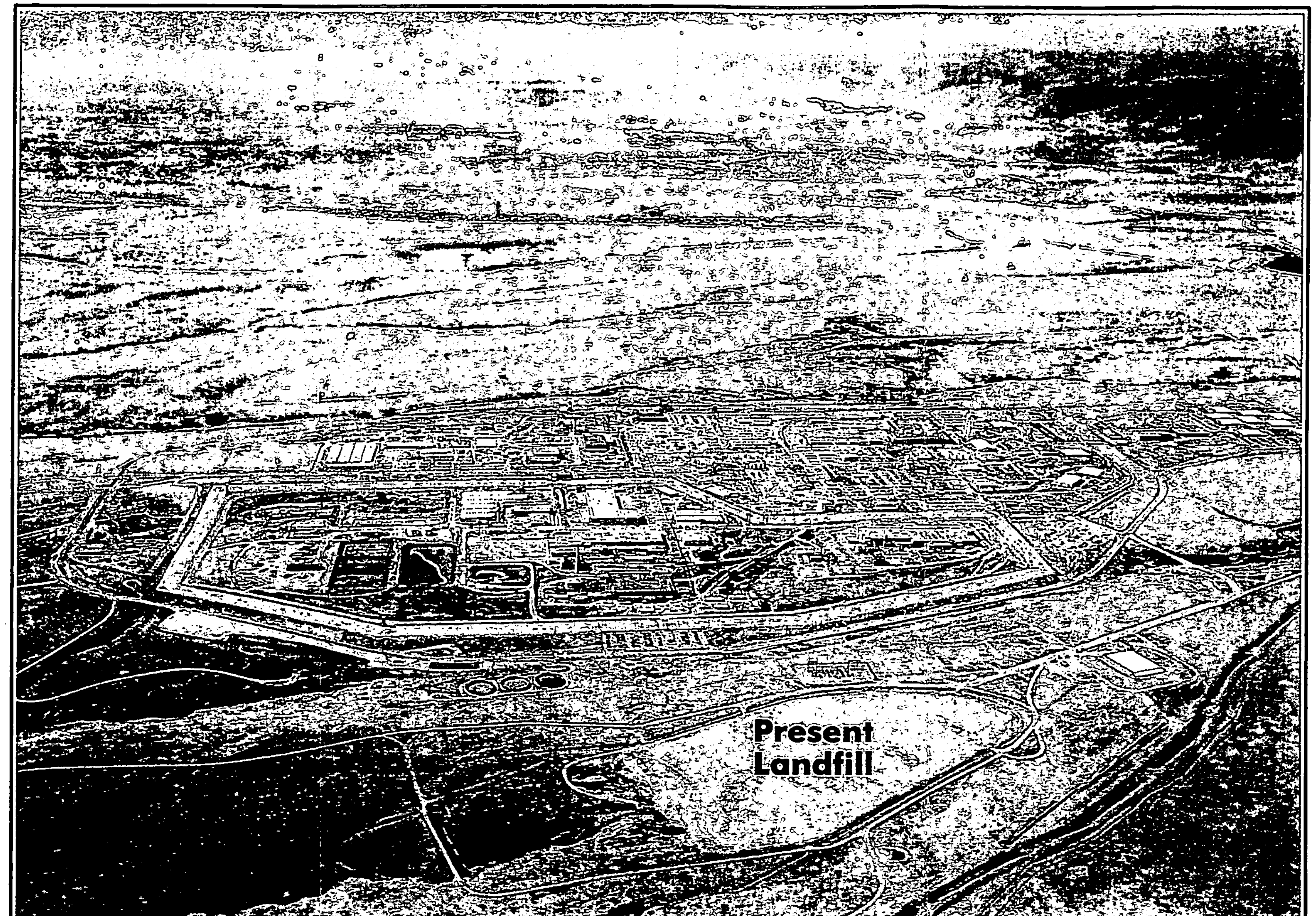
F:\4886_001\CCR Report\ dwg, GENERAL PLAN, 8/23/2005 8:17:45 AM, Letter, 1:1

QUAN.	DESCRIPTION	MATERIAL

ACCELERATED ACTION DESIGN FOR THE PRESENT LANDFILL

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

DRAWINGS



AERIAL VIEW LOOKING SOUTH
June 6, 2000

GOLDEN
COLORADO

AS-BUILT DRAWINGS
AUGUST 2005

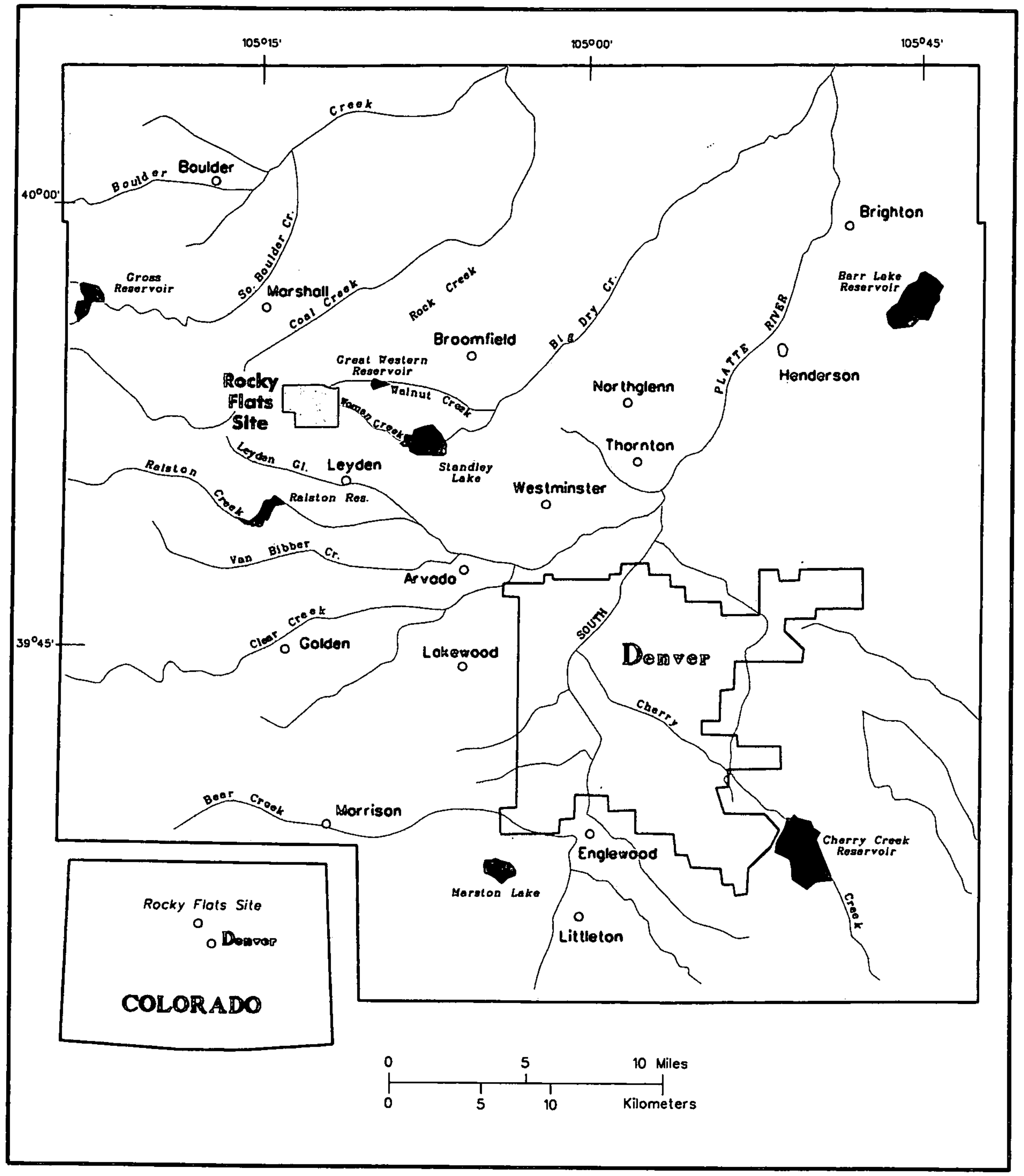
COLORADO REGISTERED PROFESSIONAL ENGINEER
RANDALL C. THOMPSON
30638
8/26/05

EARTH TECH

EARTH TECH, INC.
5575 DTC PARKWAY
SUITE 200
ENGLEWOOD, CO 80111
(303) 694-6660

GROUP\CAD\ROCKY_FLATS\New_Design2005\COVER.DGN 4/13/05

VICINITY MAP



ENGINEERED COVER FOR THE PRESENT LANDFILL SHEET INDEX

SHEET NO.	DESCRIPTION
51781-X001	RFETS PLF COVER SHEET
51781-001	VICINITY MAP AND DRAWING INDEX
51781-002	TRAFFIC FLOW PATTERNS
51781-003	PRE-ACCELERATED ACTION CONDITIONS
51781-004	CUT/FILL ISOPACH TOP OF REGRADED SURFACE
51781-005	TOP OF REGRADED SURFACE
51781-006A	PERIMETER CHANNEL
51787-006B	ANCHOR TRENCH
51781-006C	GRADE BREAKS
51781-007	TOP OF SUBGRADE
51781-008	TOP OF FINAL COVER
51781-009	SURFACE WATER MANAGEMENT PLAN
51781-010	VENT SYSTEM
51781-011	LANDFILL CROSS SECTIONS
51781-012	LANDFILL COVER AND SURFACE WATER DETAILS
51781-013A	LANDFILL COVER DETAILS EAST FACE
51781-013B	LANDFILL COVER DETAILS EAST FACE
51781-014	VENT DETAILS
51781-015	FORMER SEEP PASSIVE TREATMENT SYSTEM
51781-016	NEW SEEP PASSIVE TREATMENT SYSTEM LAYOUT
51781-017	NEW SEEP PASSIVE TREATMENT SYSTEM DETAIL
51781-018	NEW SEEP PASSIVE TREATMENT SYSTEM DETAIL
51781-019	PERIMETER CHANNEL CULVERT
51781-020	NEW SEEP PASSIVE TREATMENT SYSTEM DETAIL
51781-021	EAST FACE RIPRAP-LINED CHANNELS

COLORADO REGISTERED PROFESSIONAL ENGINEER
RANDALL C. THOMPSON
8/26/05
30638

ISSUE	DESCRIPTION	DATE	DSGN	DWN	CHKD	IV	APVD	CLASS	PROJECT/CHARGE NO.
3	AS-BUILT DRAWING — EARTH TECH DESIGN COMPANY	8/26/05							
0	ORIGINAL ISSUE								

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

VICINITY MAP AND DRAWING INDEX
PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

DESIGN COMPANY: EARTH TECH		
DESIGNED BY		
R. THOMPSON	RJ	8/9/04
DRAWN BY		
A. SHOTNIK	AS	8/9/04
CHECKED BY		
R. ARCHIBALD	RA	8/10/04
INDEPENDENT VERIFIER		
S. LAWRENCE	SL	11/10/04
APPROVED BY		
R. THOMPSON	RJ	8/11/04
CLASSIFIER		
LANDLORD		

KEYWORDS
1.
2.
3.
4.
5.

TOLERANCES FRACT. : ANGLE : DEC. : UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

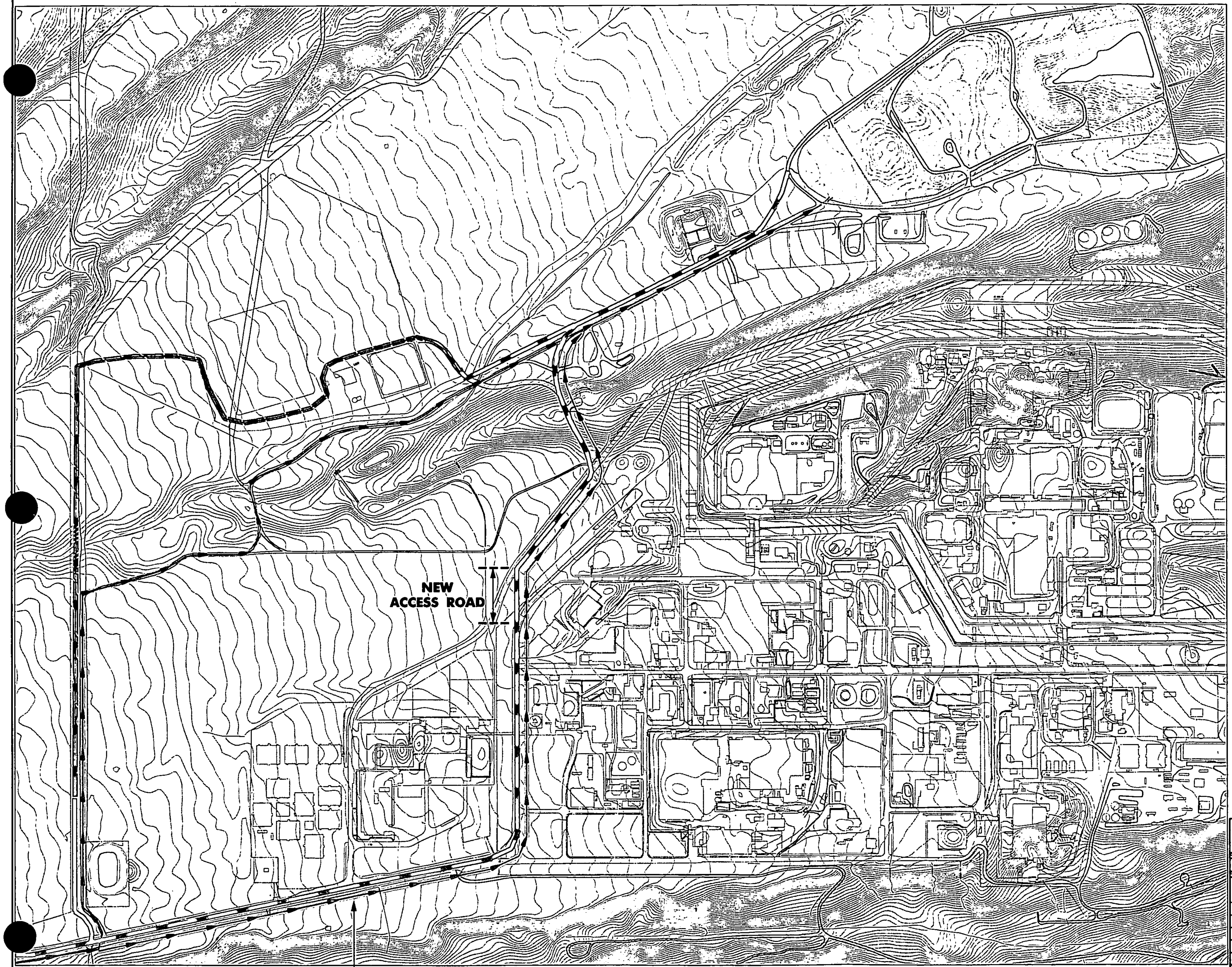
BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

SIZE	DRAWING NUMBER	ISSUE
B	51781-001	2

QUAN.	DESCRIPTION	MATERIAL

GROUP\CAD\ROCKY_FLATS\NewDesign_2003\LOCATION\LOCATION2.DGN 1/13/05

QUAN.	DESCRIPTION	MATERIAL

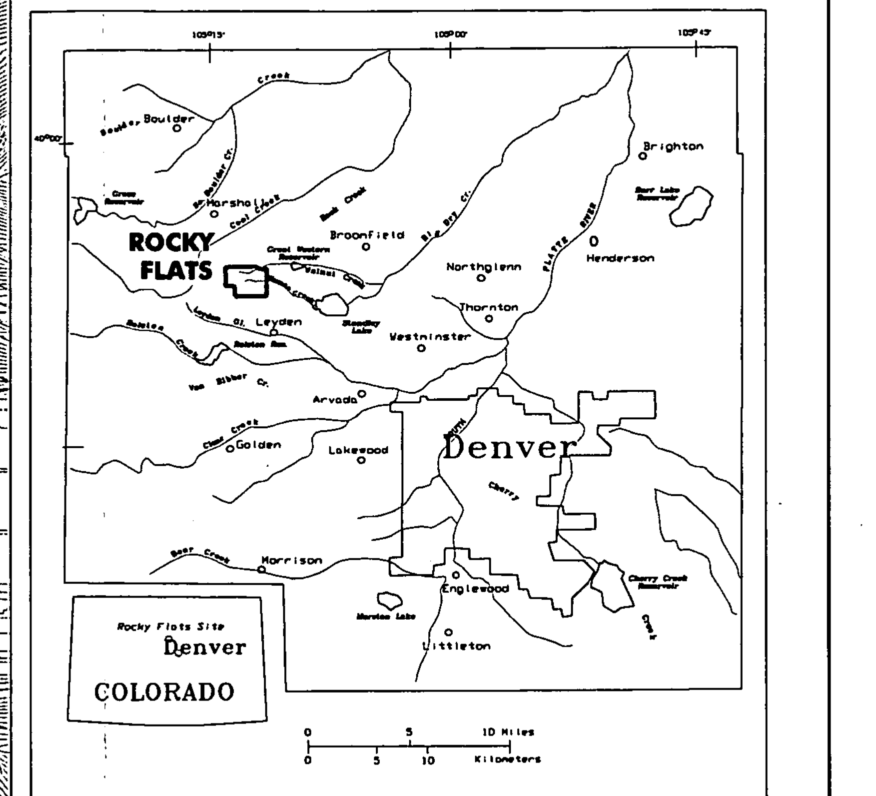


TO WEST ACCESS GATE

DOUBLE TRAFFIC

IN ROUTE

OUT ROUTE



NOTE: ADDITIONAL TRAFFIC PATTERNS INCORPORATED INTO WORK PACKAGES.

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 8/2/05

N

0' 300 600'

ISSUE	AS-BUILT DRAWING / REVISION DESCRIPTION	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
1	DESIGN COMPANY	6/22/05									
0	ORIGINAL ISSUE — DESCRIPTION										

KEYWORDS	TOLERANCES	DESIGN COMPANY:		
1.	FRACT. :	DESIGNED BY R. THOMPSON	RT	8/9/04
2.	ANGLE	DRAWN BY A. SHOTNIK	AS	8/10/04
3.	DEC. :	CHECKED BY R. ARCHIBALD	RA	8/10/04
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER S. LAWRENCE	SL	11/10/04
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY R. THOMPSON	RT	8/11/04
BLDG./FACILITY, SITE	NEXT ASSEMBLY NA			
ROOM/AREA NA		CLASSIFIER		
GRID COORD./COL NO. NA	SCALE: AS SHOWN	LANDLORD		

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

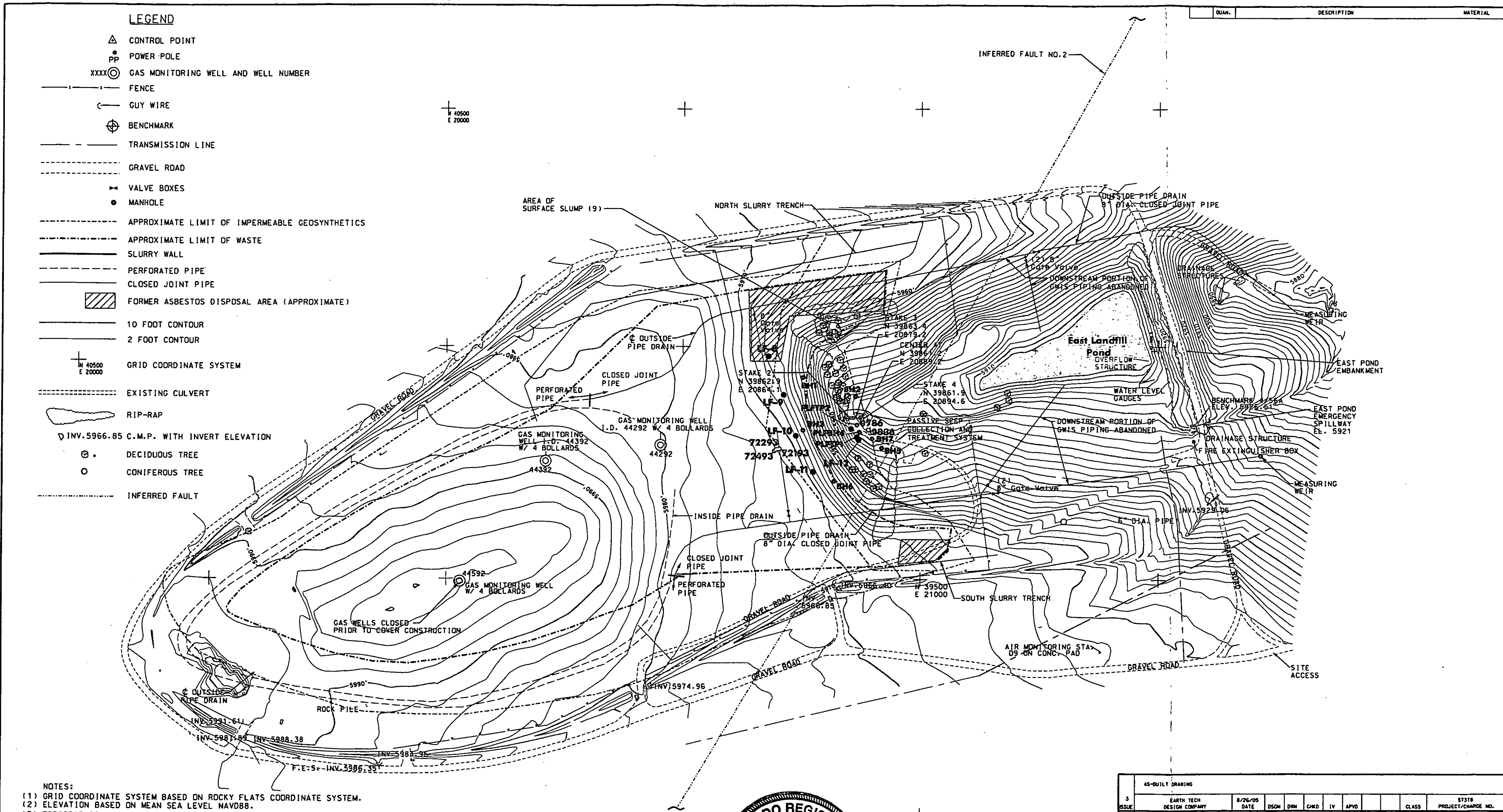
Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

TRAFFIC FLOW PATTERNS

PRESENT LANDFILL AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-002	1

GROUP\CAD\ROCKY_FLATS\New Design2003\Haul_rte\haulrte.dgn Date: 4-2004



NOTES:

(1) GRID COORDINATE SYSTEM BASED ON ROCKY FLATS COORDINATE SYSTEM.
(2) ELEVATION BASED ON MEAN SEA LEVEL NAVD88.
(3) TOPOGRAPHIC MAP AND GENERAL SURFACE FEATURES PROVIDED BY KAISER-HILL [OCTOBER 2003].
(4) SLURRY WALL DETAILS WERE COMPILED FROM DRAWINGS IN THE OU 7 CLOSURE PLAN NORTH SLURRY WALL TECHNICAL SPECIFICATIONS (MAY 1995).
(5) SEEP SYSTEM DETAILS WERE COMPILED FROM DRAWINGS IN THE OU 7 PASSIVE SEEP COLLECTION AND TREATMENT SYSTEM TECHNICAL SPECIFICATIONS (DECEMBER 1995).
(6) GROUNDWATER DIVERSION PIPE DETAILS WERE COMPILED FROM THE SANITARY LANDFILL RENOVATION DRAWINGS (AUGUST 1974).
(7) THE LIMIT OF WASTE WAS DETERMINED IN THE WESTERN HALF OF THE LANDFILL FROM THE SANITARY LANDFILL RENOVATION DRAWINGS (AUGUST 1974), AND IN THE EASTERN HALF OF THE LANDFILL FROM HISTORICAL AERIAL PHOTOGRAPHS.
(8) ASBESTOS CELL DETAILS WERE COMPILED FROM DRAWINGS IN THE OU 7 CLOSURE PLAN NORTH SLURRY WALL TECHNICAL SPECIFICATIONS (MAY 1995).
(9) TEST PITS INDICATE THIS SLUMP IS A LOCALIZED SURFACE DEPRESSION AND NOT A DEEPER LANDSLIDE.

COLORADO REGISTERED RANDALL C. THOMPSON 30638 PROFESSIONAL ENGINEER 8/26/05

QUAN.	DESCRIPTION	MATERIAL

ISSUE	DESCRIPTION	DESIGN COMPANY	DATE	DSGN	DRN	CHKD	IV	APVD	CLASS	PROJECT/CHARGE NO.
3	AS-BUILT DRAWING	EARTH TECH	8/26/05							57378
0	ORIGINAL ISSUE									

KEYWORDS: 1. 2. 3. 4. 5.

TOLERANCES: FRACT. ± ANGLE ± DEC. ±
UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
BLDG./FACILITY — NEXT ASSEMBLY — ROOM/AREA
GRID COORD./COL NO. — SCALE: 1 INCH=200FEET

DESIGN COMPANY:	EARTH TECH		
DESIGNED BY	R. THOMPSON	RJ	8/9/04
DRAWN BY	A. SHOTNIK	AS	8/10/04
CHECKED BY	R. ARCHIBALD	RA	8/10/04
INDEPENDENT VERIFIER	M. WEINSTEIN	SZ	11/10/04
APPROVED BY	R. THOMPSON	RJ	8/11/04
CLASSIFIER			
LANDLORD			

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO
Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

PRE-ACCELERATED ACTION CONDITIONS
PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

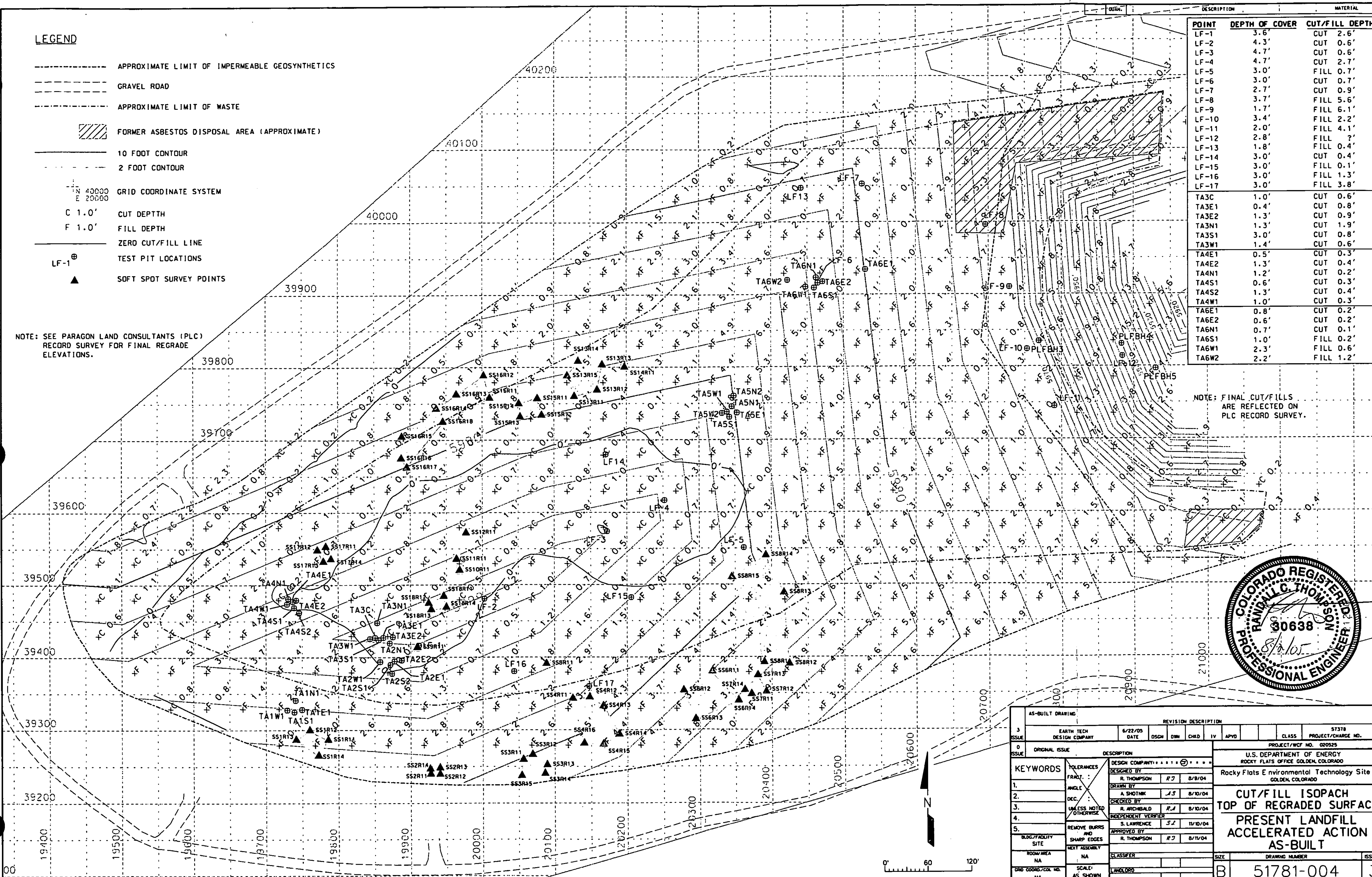
SIZE	DRAWING NUMBER	ISSUE
B	51781-003	2

GROUP\CAD\ROCKY_FLATS\New Design2005\EXISTCOND\EXISTMod.dgn Date: 2-2005

LEGEND

- - - - - - - -	APPROXIMATE LIMIT OF IMPERMEABLE GEOSYNTHETICS
— — — —	GRAVEL ROAD
- · - · - · -	APPROXIMATE LIMIT OF WASTE
//////	FORMER ASBESTOS DISPOSAL AREA (APPROXIMATE)
———	10 FOOT CONTOUR
- - -	2 FOOT CONTOUR
N 40000 E 20000	GRID COORDINATE SYSTEM
C 1.0'	CUT DEPTTH
F 1.0'	FILL DEPTH
———	ZERO CUT/FILL LINE
LF-1 ⊕	TEST PIT LOCATIONS
▲	SOFT SPOT SURVEY POINTS

NOTE: SEE PARAGON LAND CONSULTANTS (PLC) RECORD SURVEY FOR FINAL REGRADE ELEVATIONS.



POINT	DEPTH OF COVER	CUT/FILL DEPTH
LF-1	3.6'	CUT 2.6'
LF-2	4.3'	CUT 0.6'
LF-3	4.7'	CUT 0.6'
LF-4	4.7'	CUT 2.7'
LF-5	3.0'	FILL 0.7'
LF-6	3.0'	CUT 0.7'
LF-7	2.7'	CUT 0.9'
LF-8	3.7'	FILL 5.6'
LF-9	1.7'	FILL 6.1'
LF-10	3.4'	FILL 2.2'
LF-11	2.0'	FILL 4.1'
LF-12	2.8'	FILL ?'
LF-13	1.8'	FILL 0.4'
LF-14	3.0'	CUT 0.4'
LF-15	3.0'	FILL 0.1'
LF-16	3.0'	FILL 1.3'
LF-17	3.0'	FILL 3.8'
TA3C	1.0'	CUT 0.6'
TA3E1	0.4'	CUT 0.8'
TA3E2	1.3'	CUT 0.9'
TA3N1	1.3'	CUT 1.9'
TA3S1	3.0'	CUT 0.8'
TA3W1	1.4'	CUT 0.6'
TA4E1	0.5'	CUT 0.3'
TA4E2	1.3'	CUT 0.4'
TA4N1	1.2'	CUT 0.2'
TA4S1	0.6'	CUT 0.3'
TA4S2	1.3'	CUT 0.4'
TA4W1	1.0'	CUT 0.3'
TA6E1	0.8'	CUT 0.2'
TA6E2	0.6'	CUT 0.2'
TA6N1	0.7'	CUT 0.1'
TA6S1	1.0'	FILL 0.2'
TA6W1	2.3'	FILL 0.6'
TA6W2	2.2'	FILL 1.2'

NOTE: FINAL CUT/FILLS ARE REFLECTED ON PLC RECORD SURVEY.

3 ISSUE	AS-BUILT DRAWING — EARTH TECH DESIGN COMPANY — 6/22/05 DATE
0 ISSUE	ORIGINAL ISSUE

REVISION DESCRIPTION / DSGN / DWN / CHKD / IV / APVD / CLASS / 57378 PROJECT/CHARGE NO.

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS: 1. 2. 3. 4. 5.

TOLERANCES: FRACT. : ANGLE : DEC. : UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

DESIGNED BY		
R. THOMPSON	RT	8/9/04
DRAWN BY		
A. SHOTNIK	AS	8/10/04
CHECKED BY		
R. ARCHIBALD	RA	8/10/04
INDEPENDENT VERIFIER		
S. LAWRENCE	SL	11/10/04
APPROVED BY		
R. THOMPSON	RT	8/11/04
CLASSIFIER		
LANDLORD		

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

CUT/FILL ISOPACH TOP OF REGRADED SURFACE

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

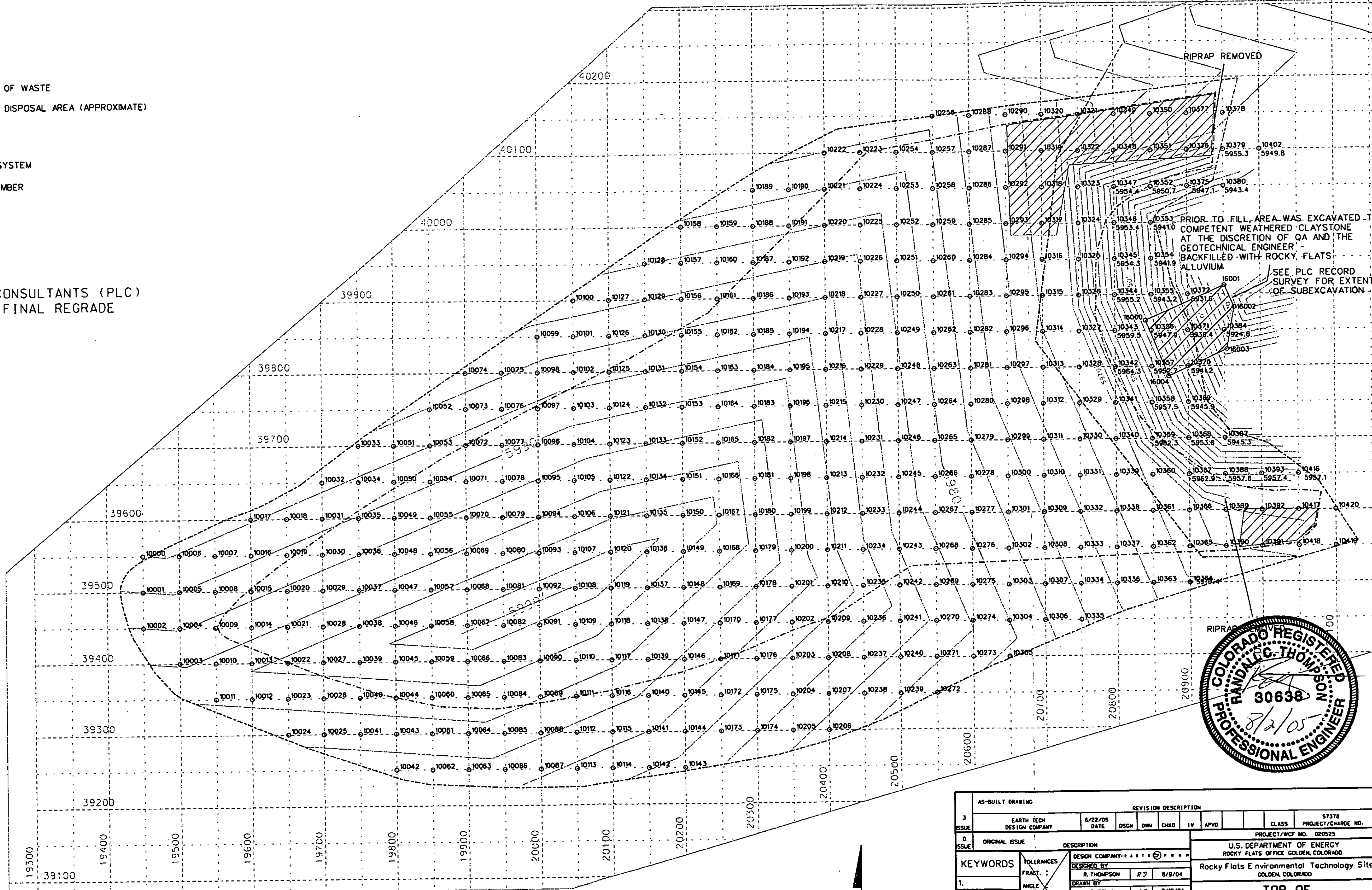
SIZE	DRAWING NUMBER	ISSUE
B	51781-004	3

GROUP\CAD\ROCKY_FLATS\New Design2004\Cut_Fill\Isopach.dgn Date: 9-2004

LEGEND

- ANCHOR TRENCH
- GRAVEL ROAD
- APPROXIMATE LIMIT OF WASTE
- FORMER ASBESTOS DISPOSAL AREA (APPROXIMATE)
- 10 FOOT CONTOUR
- 2 FOOT CONTOUR
- N 40500 E 20000 — GRID COORDINATE SYSTEM
- 10288 — CONTROL POINT NUMBER
- EXTENT OF RIPRAP

NOTE: SEE PARAGON LAND CONSULTANTS (PLC) RECORD SURVEY FOR FINAL REGRADE ELEVATIONS.



3 ISSUE	AS-BUILT DRAWING / EARTH TECH DESIGN COMPANY	6/22/05 DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE	DESCRIPTION									

REVISION DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. :	DESIGNED BY R. THOMPSON	RT	8/9/04
2.	ANGLE :	DRAWN BY A. SHOTNIK	AS	8/10/04
3.	DEC. :	CHECKED BY R. ARCHIBALD	RA	8/10/04
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER S. LAWRENCE	SL	11/10/04
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY R. THOMPSON	RT	8/11/04
BLDG./FACILITY SITE	NEXT ASSEMBLY NA	CLASSIFIER		
ROOM/AREA NA				
GRID COORD./COL NO. NA	SCALE: AS SHOWN	LANDLORD		

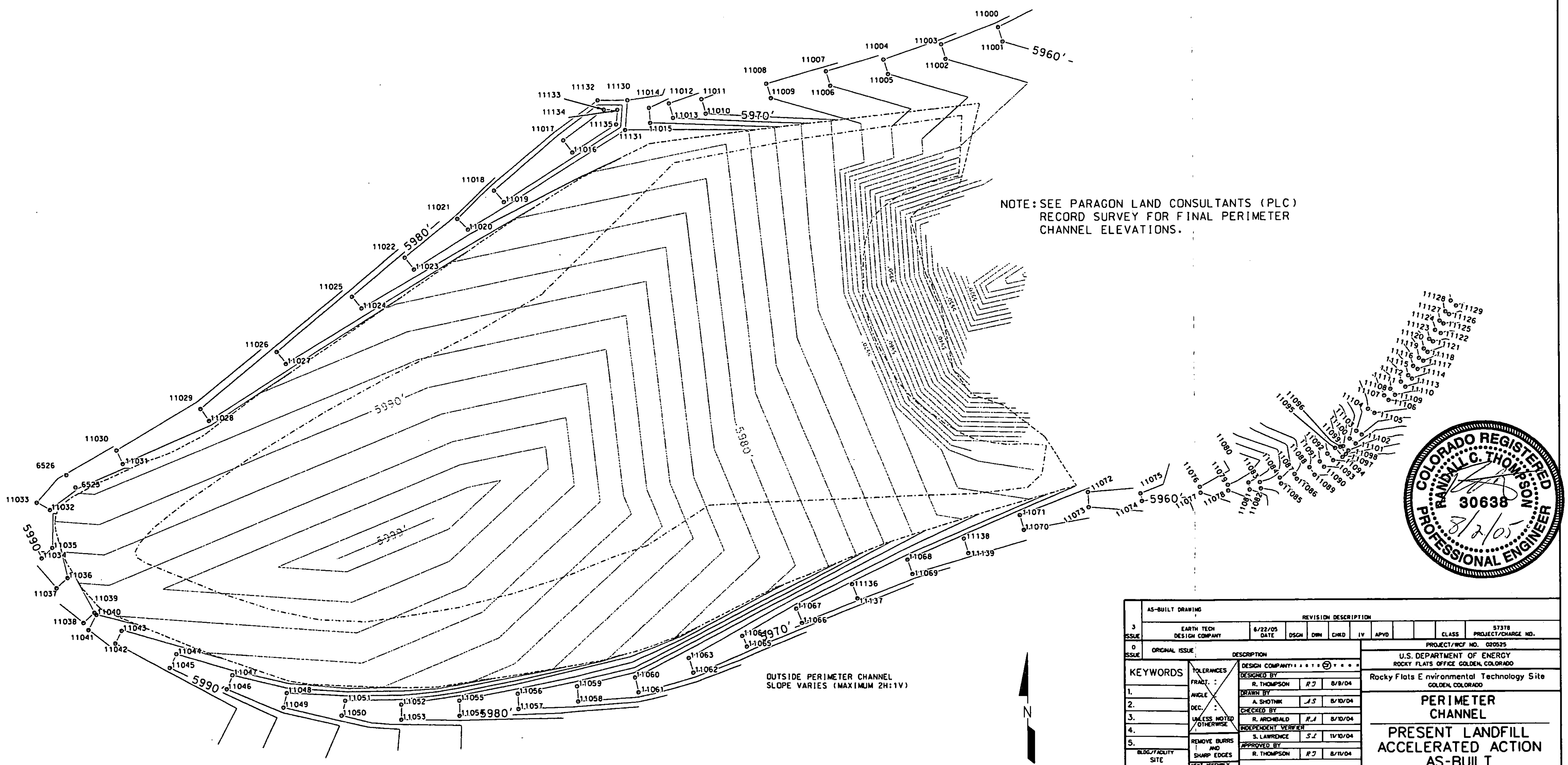
TOP OF REGRADED SURFACE

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-005	3

GROUP\CAD\ROCKY_FLATS\New Design2004\Regrds_Fin\RGPts.dgn Date: 10-2004

QUAN.	DESCRIPTION	MATERIAL



	AS-BUILT DRAWING	REVISION DESCRIPTION									
3 ISSUE	EARTH TECH DESIGN COMPANY	6/22/05 DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE	DESCRIPTION									

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

PERIMETER CHANNEL

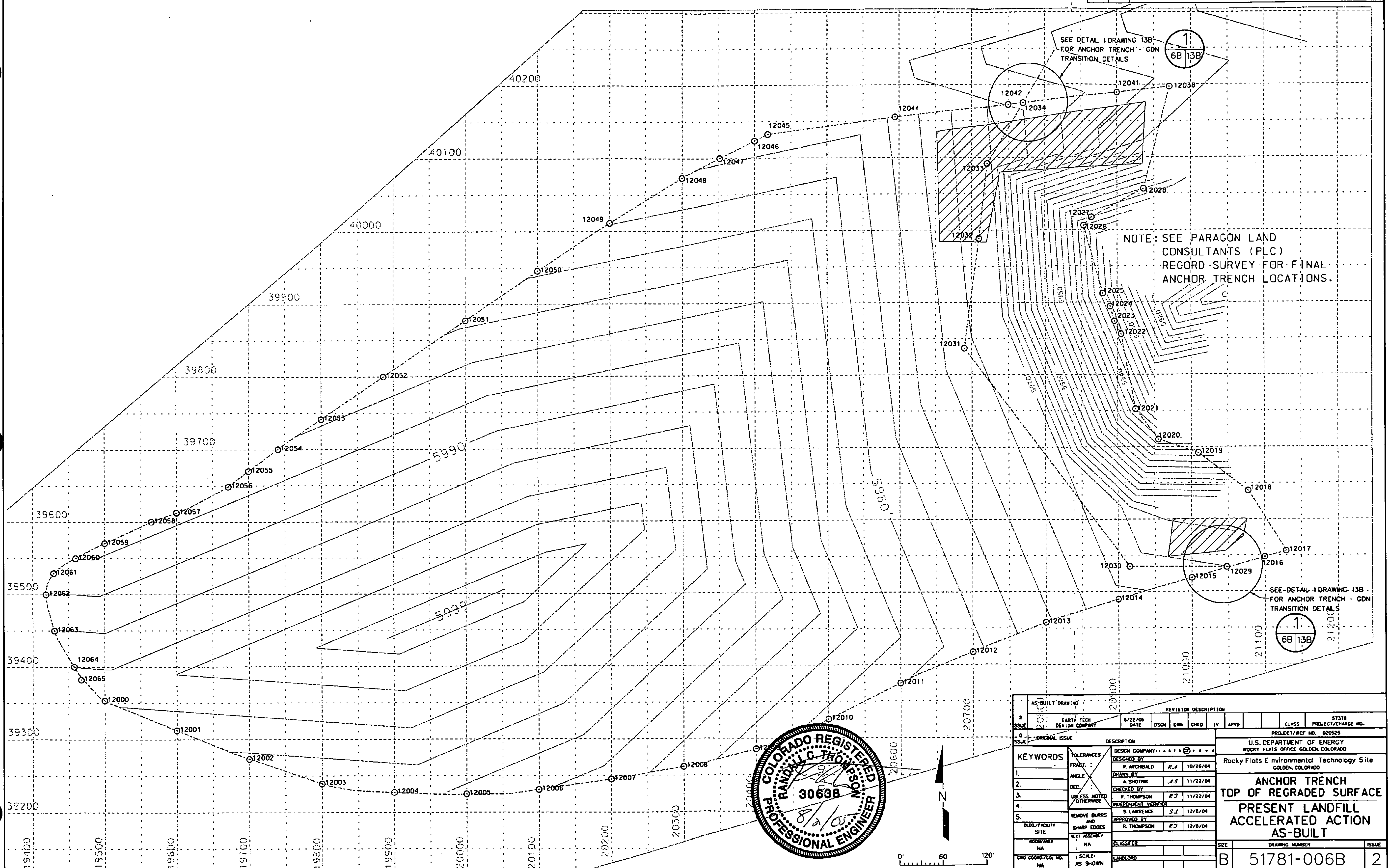
PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. :	DESIGNED BY		
2.	ANGLE :	R. THOMPSON	RT	8/9/04
3.	DEC. :	DRAWN BY		
4.	UNLESS NOTED OTHERWISE	A. SHOTNIK	AS	8/10/04
5.	REMOVE BURRS AND SHARP EDGES	CHECKED BY		
BLDG./FACILITY SITE	NEXT ASSEMBLY NA	R. ARCHIBALD	RA	8/10/04
ROOM/AREA NA		INDEPENDENT VERIFIER		
GRID COORD./COL NO. NA	SCALE: AS SHOWN	S. LAWRENCE	SL	11/10/04
		APPROVED BY		
		R. THOMPSON	RT	8/11/04
		CLASSIFIER		
		LANDLORD		

SIZE	DRAWING NUMBER	ISSUE
B	51781-006A	3

GROUP\CAD\ROCKY_FLATS\New Design_2004\Trench \TrnMod.dgn Date: 10-15-2004

QUAN.	DESCRIPTION	MATERIAL



	AS-BUILT DRAWING											
	REVISION DESCRIPTION											
2 ISSUE	EARTH TECH DESIGN COMPANY	6/22/05 DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	57378 PROJECT/CHARGE NO.	
0 ISSUE	ORIGINAL ISSUE	DESCRIPTION										

KEYWORDS	TOLERANCES FRACT. : ANGLE : DEC. : UNLESS NOTED OTHERWISE	DESIGN COMPANY:		
1.		DESIGNED BY		
2.		R. ARCHIBALD	RA	10/26/04
3.		DRAWN BY		
4.		A. SHOTNIK	AS	11/22/04
5.	REMOVE BURRS AND SHARP EDGES	CHECKED BY		
BLDG./FACILITY SITE		R. THOMPSON	RT	11/22/04
		INDEPENDENT VERIFIER		
		S. LAWRENCE	SL	12/8/04
		APPROVED BY		
		R. THOMPSON	RT	12/8/04
ROOM/AREA NA	NEXT ASSEMBLY NA	CLASSIFIER		
GRID COORD./COL NO. NA	SCALE: AS SHOWN	LANDLORD		

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

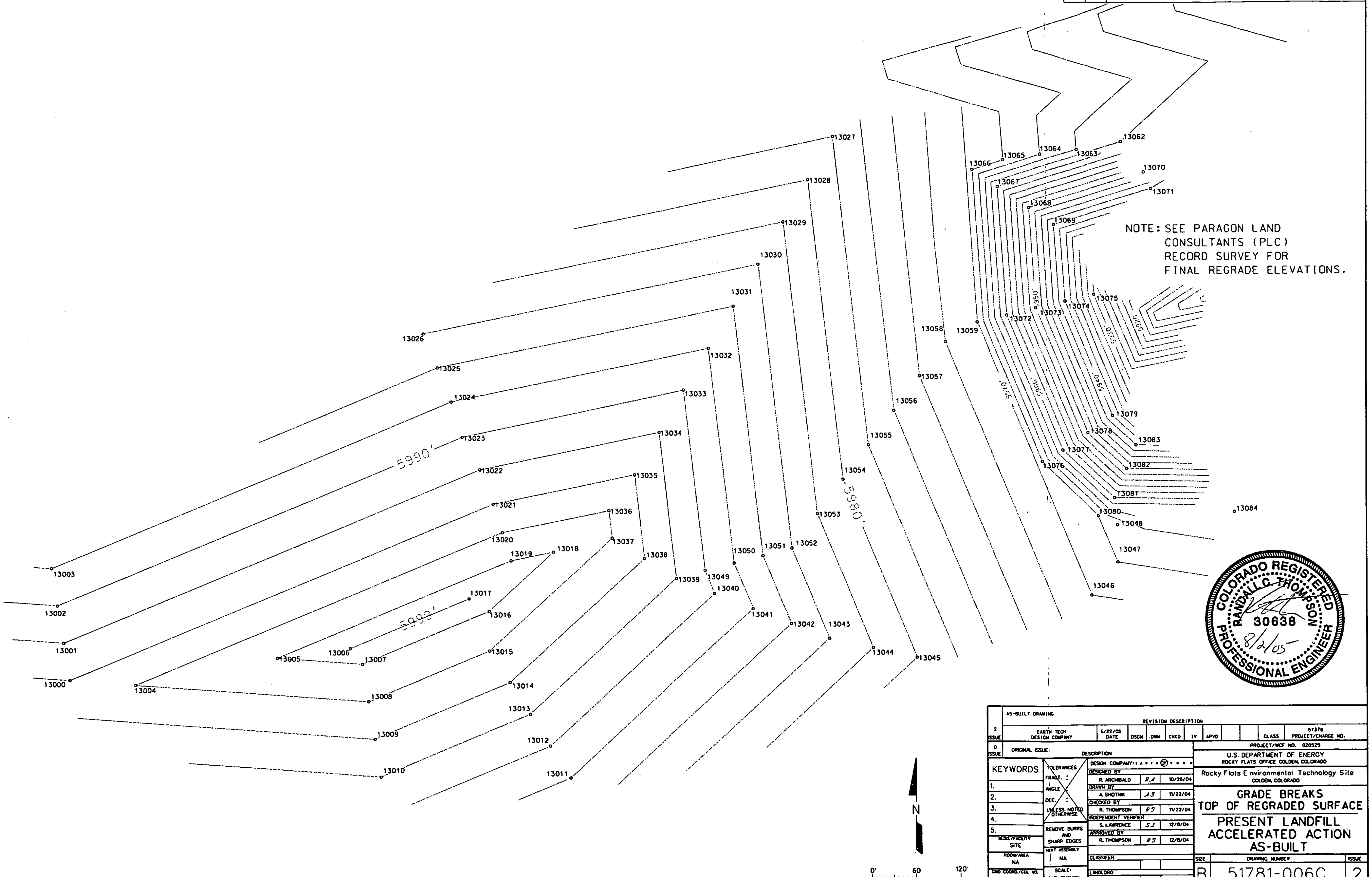
ANCHOR TRENCH TOP OF REGRADED SURFACE

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-006B	2

GROUP\CAD\ROCKY_FLATS\New Design2004\Anchor_Trnch\Cntrlpts.dgn Date: 10-2004

QUAN.	DESCRIPTION	MATERIAL



AS-BUILT DRAWING										
	REVISION DESCRIPTION									
2 ISSUE	EARTH TECH DESIGN COMPANY	6/22/05 DATE	DSGN	DWN	CHKD	IV	APVD		CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE: DESCRIPTION									

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

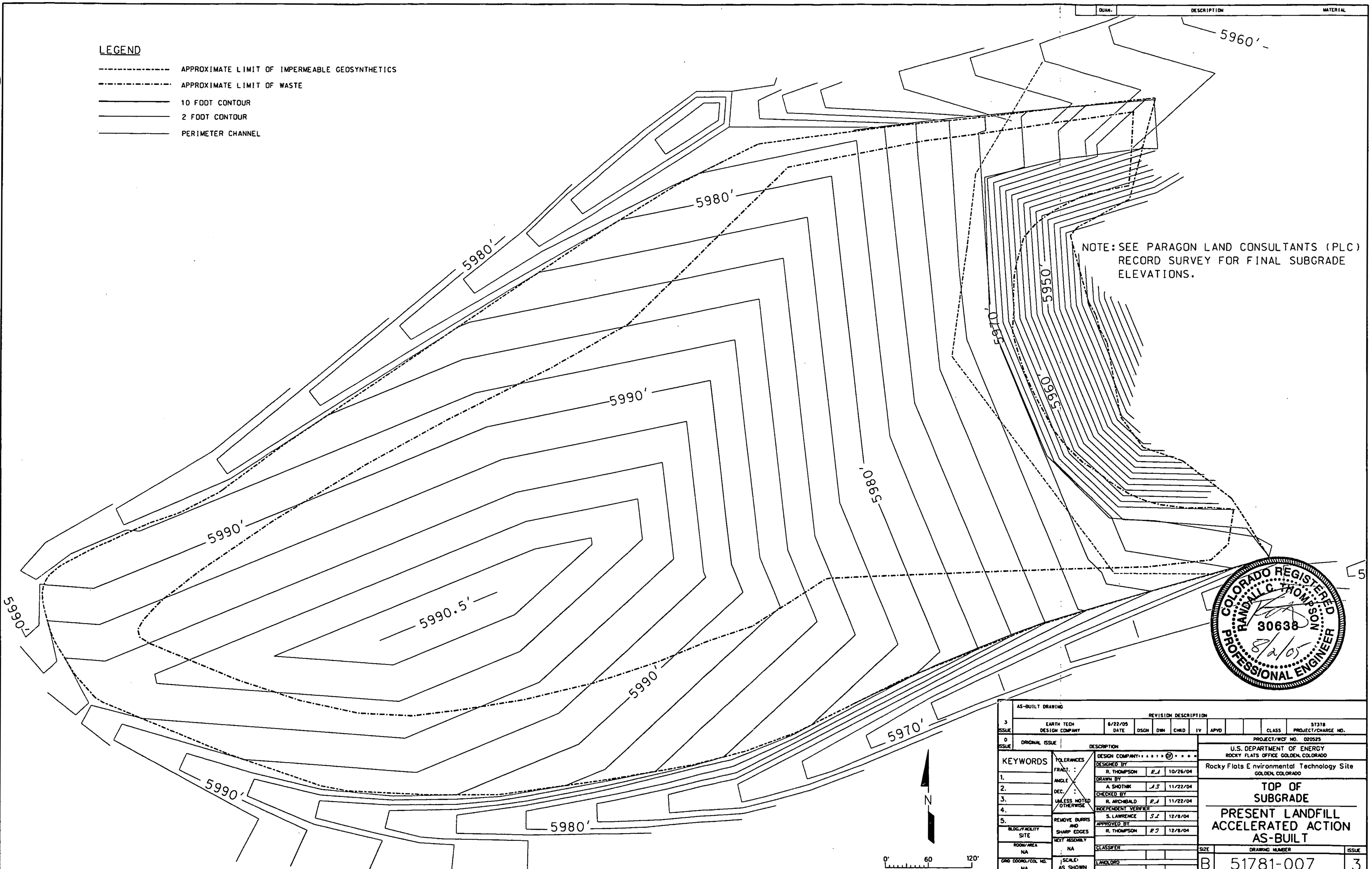
GRADE BREAKS TOP OF REGRADED SURFACE

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. :	DESIGNED BY		
2.	ANGLE :	R. ARCHIBALD	RA	10/26/04
3.	DEC. :	DRAWN BY		
4.	UNLESS NOTED OTHERWISE	A. SHOTNIK	AS	11/22/04
5.	REMOVE BURRS AND SHARP EDGES	CHECKED BY		
BLDG./FACILITY SITE		R. THOMPSON	RT	11/22/04
ROOM/AREA NA	NEXT ASSEMBLY NA	INDEPENDENT VERIFIER		
GRID COORD./COL. NO. NA	SCALE: AS SHOWN	S. LAWRENCE	SL	12/8/04
		APPROVED BY		
		R. THOMPSON	RT	12/8/04
		CLASSIFIER		
		LANDLORD		

SIZE	DRAWING NUMBER	ISSUE
B	51781-006C	2

GROUP\CAD\ROCKY_FLATS\New Design2004\RG_Brkline\RGBrkLns.dgn Date: 10-2004



QUAN. | DESCRIPTION | MATERIAL

AS-BUILT DRAWING

ISSUE		DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
3	EARTH TECH DESIGN COMPANY	6/22/05									57378
0	ORIGINAL ISSUE										

REVISION DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

TOP OF SUBGRADE

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

KEYWORDS
1.
2.
3.
4.
5.

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA

TOLERANCES: FRACT. : ANGLE : DEC. : UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

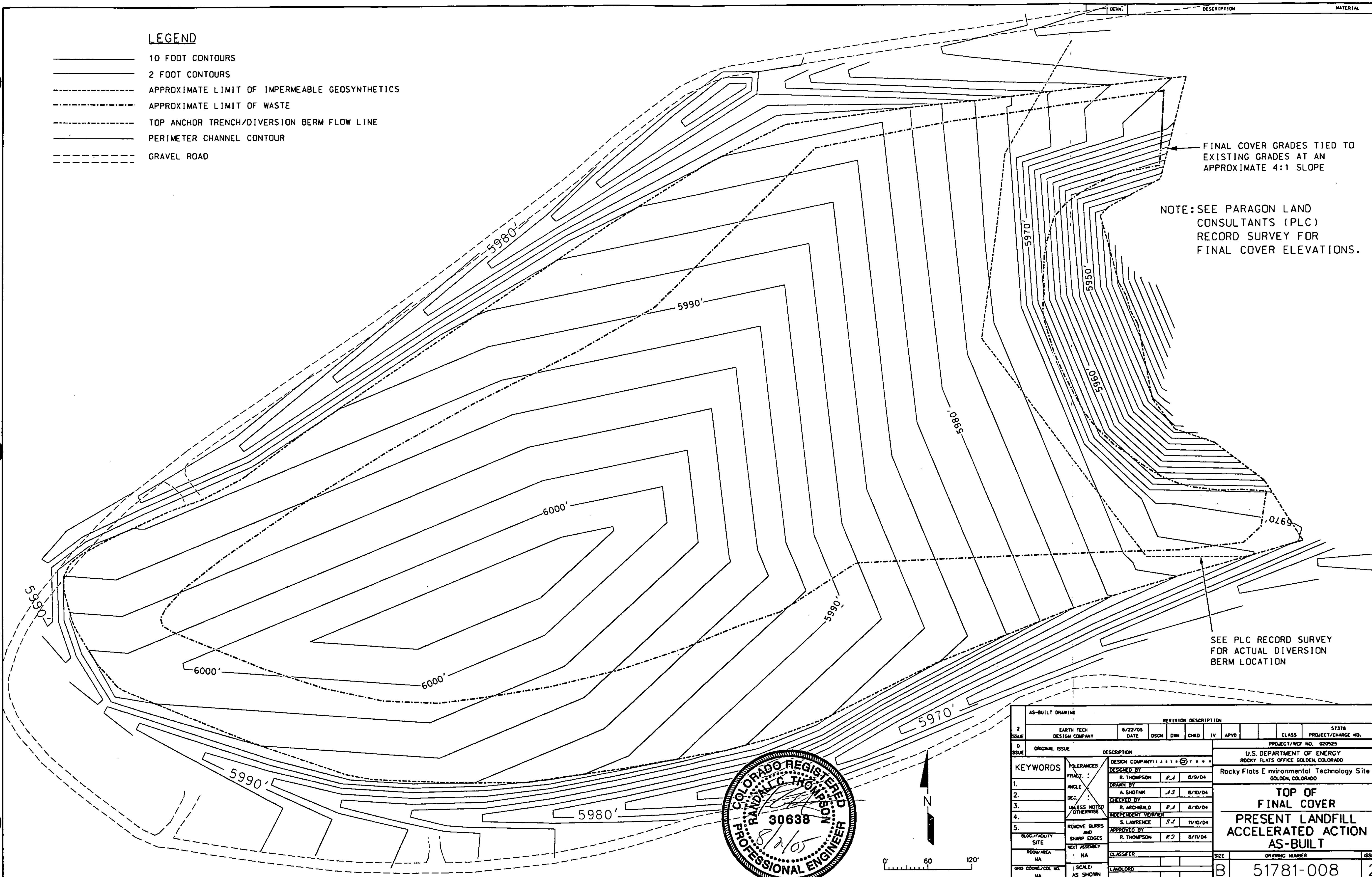
DESIGN COMPANY:

Role	Name	Initials	Date
DESIGNED BY	R. THOMPSON	RA	10/26/04
DRAWN BY	A. SHOTNIK	AS	11/22/04
CHECKED BY	R. ARCHIBALD	RA	11/22/04
INDEPENDENT VERIFIER	S. LAWRENCE	SL	12/8/04
APPROVED BY	R. THOMPSON	RT	12/8/04

CLASSIFIER
LANDLORD

SIZE	DRAWING NUMBER	ISSUE
B	51781-007	3

GROUP\CAD\ROCKY_FLATS\New Design2004\SubGrd_100%\up61122.dgn Date: 11-2004



AS-BUILT DRAWING

REVISION DESCRIPTION

ISSUE	DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
2	EARTH TECH	6/22/05									57378
0	ORIGINAL ISSUE										

DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS
1.
2.
3.
4.
5.

TOLERANCES FRACT. : ANGLE DEC. : UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

DESIGN COMPANY: EARTH TECH

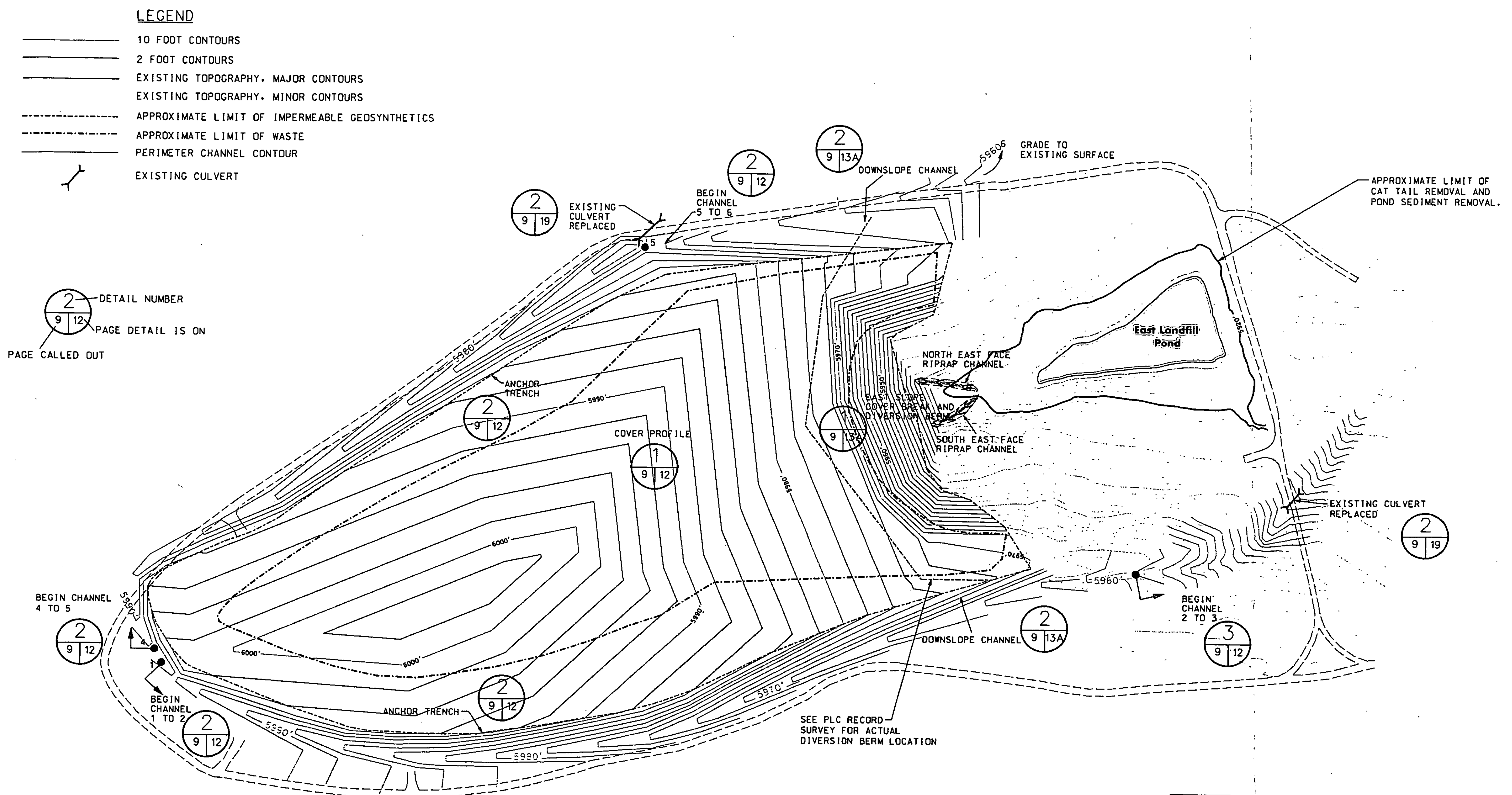
DESIGNED BY		
R. THOMPSON	RT	8/9/04
DRAWN BY		
A. SHOTNIK	AS	8/10/04
CHECKED BY		
R. ARCHIBALD	RA	8/10/04
INDEPENDENT VERIFIER		
S. LAWRENCE	SL	11/10/04
APPROVED BY		
R. THOMPSON	RT	8/11/04
CLASSIFIER		
LANDLORD		

TOP OF FINAL COVER

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-008	2

GROUP\CAD\ROCKY_FLATS\New Design2004\FinalCover\finalgrd.dgn Date: 1-2005



3	AS-BUILT DRAWING									
ISSUE	EARTH TECH DESIGN COMPANY	8/26/05 DATE	DSGN	DWN	CHKD	IV	APVD		CLASS	PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION									

REVISION DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

SURFACE WATER MANAGEMENT PLAN

PRESENT LANDFILL CLOSURE PROJECT AS-BUILT

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. :	DESIGNED BY R. ARCHIBALD	RA	8/9/04
2.	ANGLE :	DRAWN BY A. SHOTNIK	AS	8/10/04
3.	DEC. :	CHECKED BY R. THOMPSON	RT	8/10/04
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER S. LAWRENCE	SL	11/10/04
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY R. THOMPSON	RT	8/11/04
BLDG./FACILITY SITE	NEXT ASSEMBLY NA	CLASSIFIER		
ROOM/AREA NA	SCALE: AS SHOWN	LANDLORD		
GRID COORD./COL NO. NA				

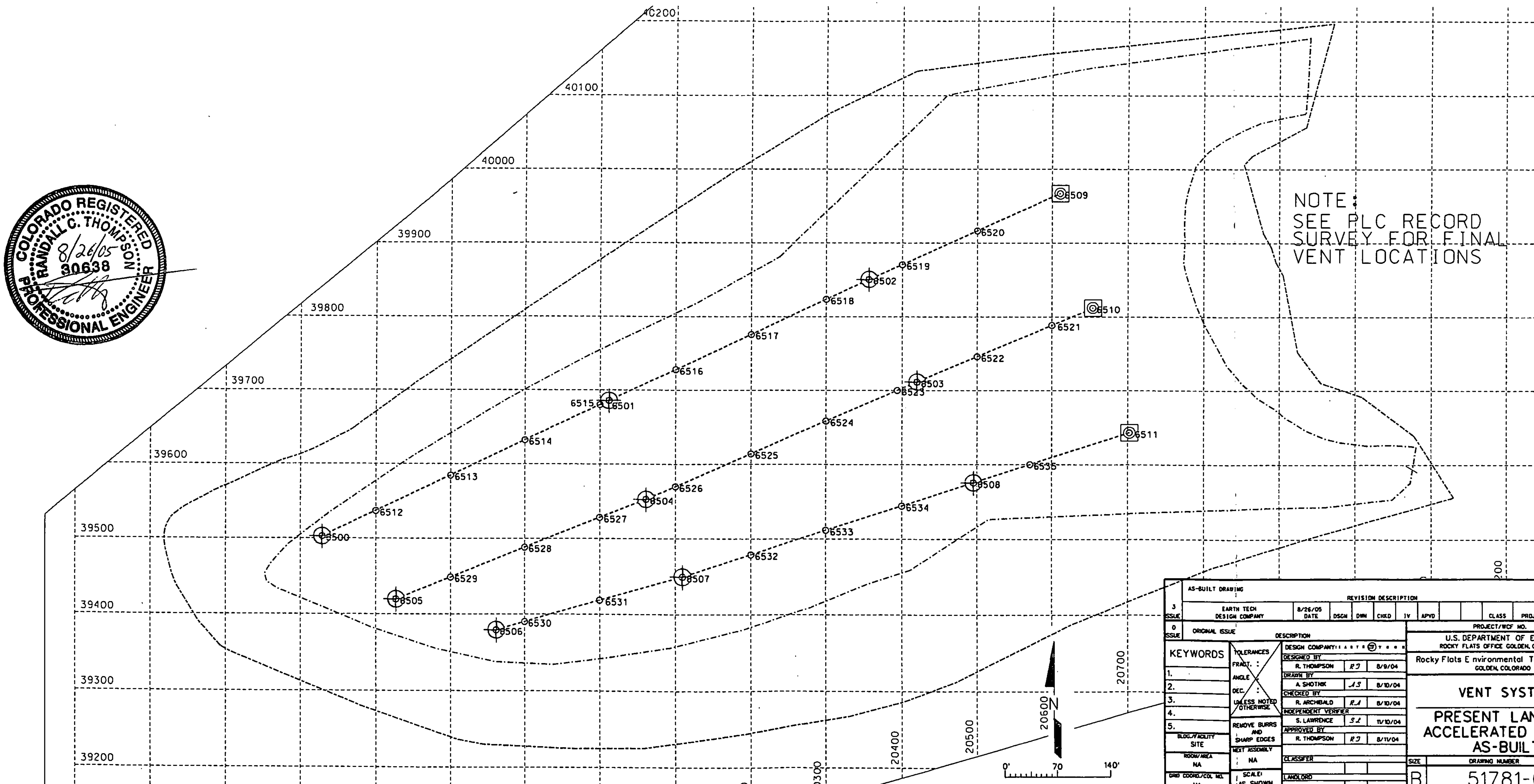
SIZE	DRAWING NUMBER	ISSUE
B	51781-009	2

GROUP\CAD\ROCKY_FLATS\New Design_2004\SURfWtr\SURFWT100.dgn Date: 1-2005

QUAN.	DESCRIPTION	MATERIAL

LEGEND

- ⌖ VENTILATOR
- ◻ HEADER ACCESS RISER
- ------------ VENT TRENCH
- ------------ APPROXIMATE LIMIT OF IMPERMEABLE GEOSYNTHETICS
- -·-·-·-·-·- APPROXIMATE LIMIT OF WASTE



NOTE:
SEE PLC RECORD
SURVEY FOR FINAL
VENT LOCATIONS

	AS-BUILT DRAWING										
3 ISSUE	EARTH TECH DESIGN COMPANY	8/26/05 DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	51378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE	DESCRIPTION									

REVISION DESCRIPTION

KEYWORDS	TOLERANCES FRACT. : ANGLE DEC. : UNLESS NOTED OTHERWISE	DESIGN COMPANY: EARTH TECH			
1.		DESIGNED BY	R. THOMPSON	RT	8/9/04
2.		DRAWN BY	A. SHOTNIK	AS	8/10/04
3.		CHECKED BY	R. ARCHIBALD	RA	8/10/04
4.		INDEPENDENT VERIFIER	S. LAWRENCE	SL	11/10/04
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY	R. THOMPSON	RT	8/11/04
BLDG./FACILITY SITE	NEXT ASSEMBLY NA	CLASSIFIER			
ROOM/AREA NA	SCALE: AS SHOWN	LANDLORD			
GRID COORD./COL NO. NA					

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

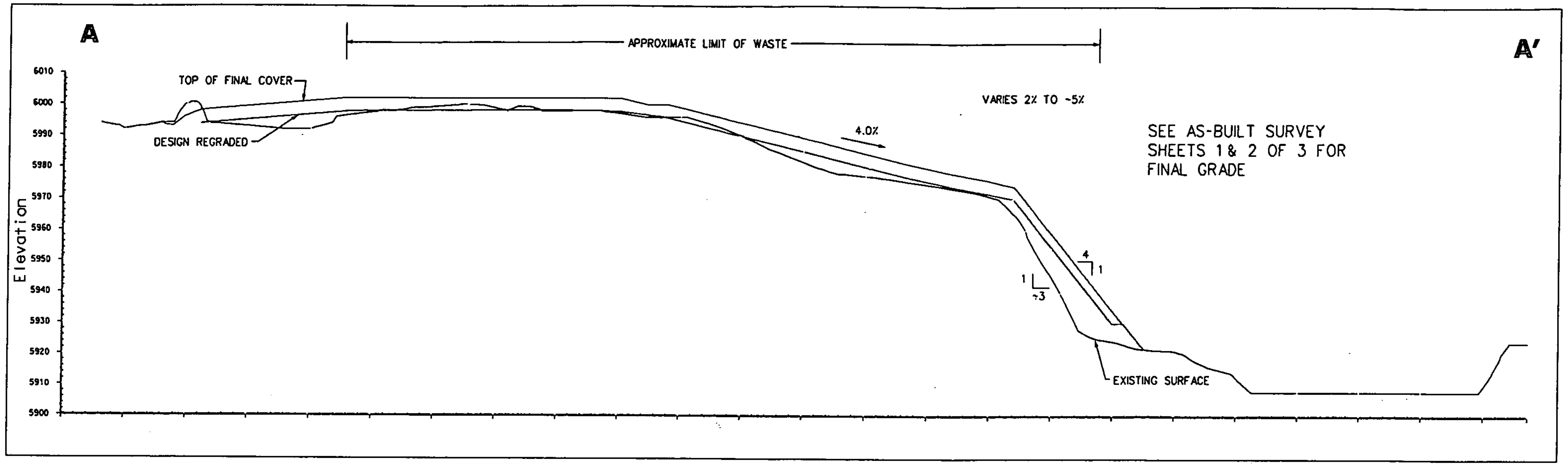
VENT SYSTEM

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-010	2

GROUP\CAD\ROCKY_FLATS\New Design2004\GASMGNT\GASMG100.dgn Date: 10-2004

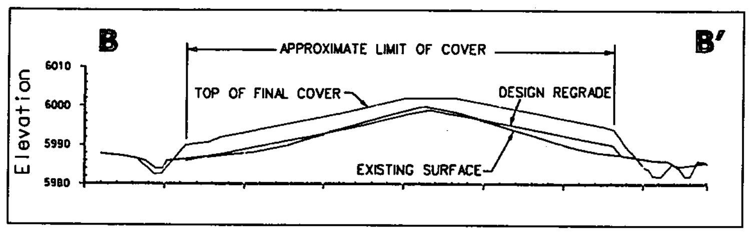
QUAN.	DESCRIPTION	MATERIAL

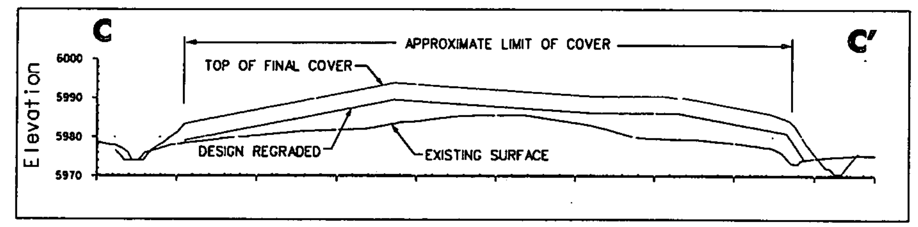


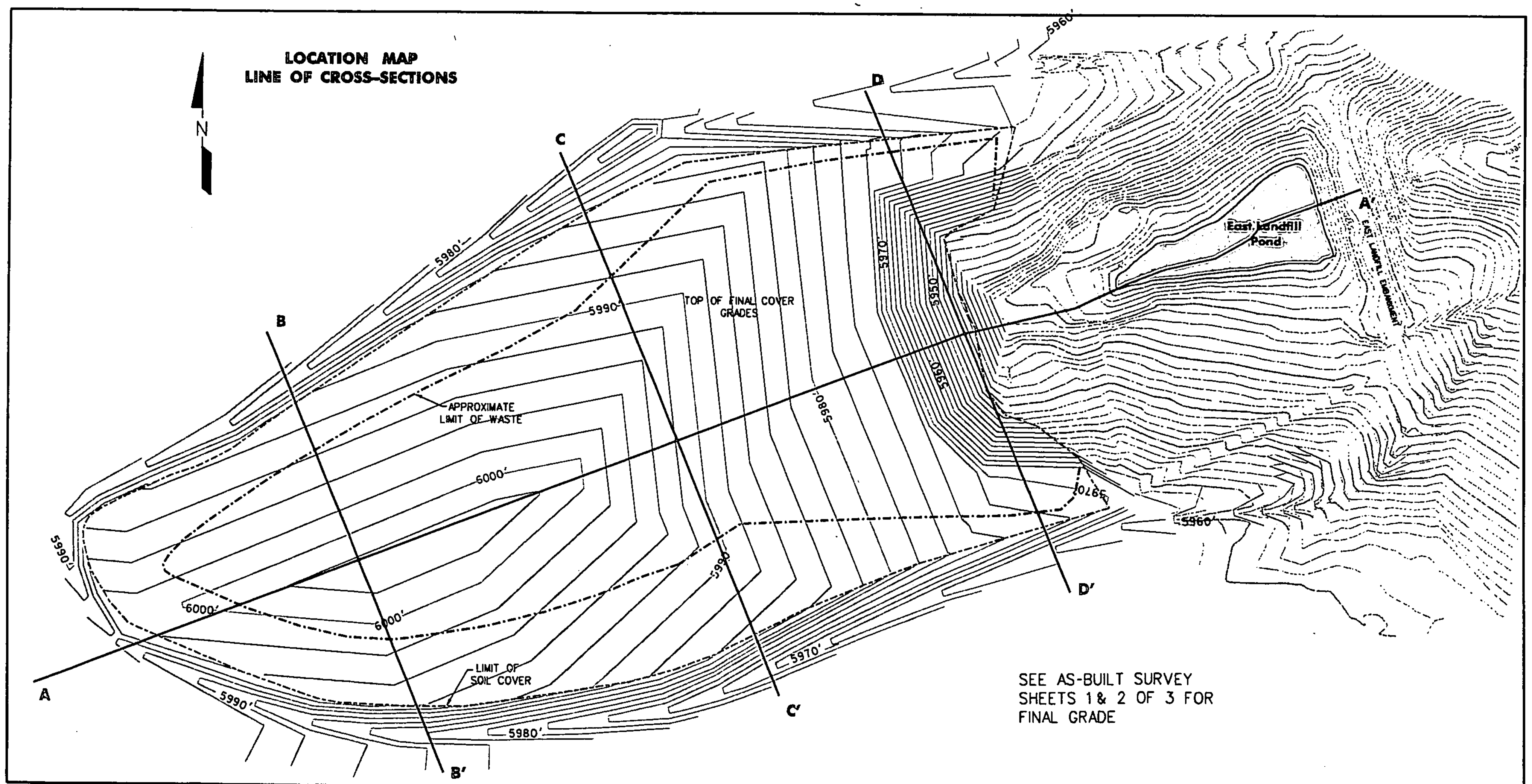
LEGEND

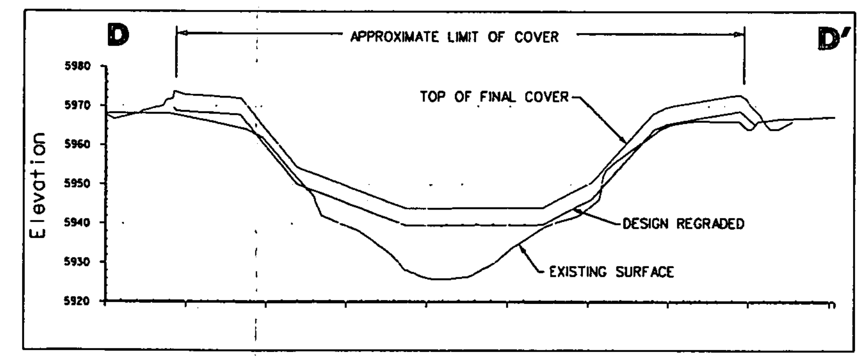
———	EXISTING SURFACE
———	TOP OF SURFACE
———	DESIGN REGRADE
Scaled 5.00 Times Ver. Scaled 1.00 Times Hor.	

COLORADO REGISTERED PROFESSIONAL ENGINEER — RANDALL C. THOMPSON — 30638 — 8/26/05







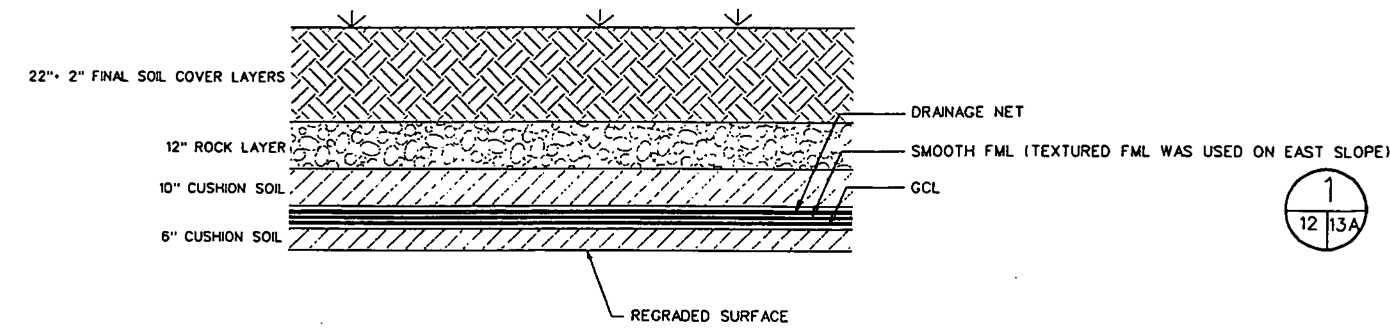


AS-BUILT DRAWING

ISSUE		REVISION DESCRIPTION	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
3	EARTH TECH DESIGN COMPANY		8/26/05									
0	ORIGINAL ISSUE											

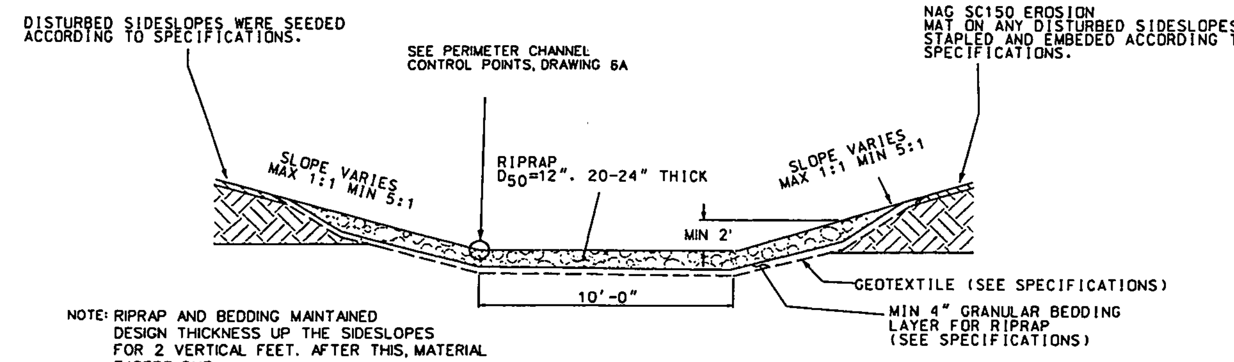
KEYWORDS	TOLERANCES FRACT. : ANGLE : DEC. : UNLESS NOTED OTHERWISE	DESIGN COMPANY: EARTH TECH			PROJECT/WCF NO. 020525
1.		DESIGNED BY R. THOMPSON	RT	8/9/04	U.S. DEPARTMENT OF ENERGY ROCKY FLATS OFFICE GOLDEN, COLORADO
2.		DRAWN BY A. SHOTNIK	AS	8/10/04	Rocky Flats Environmental Technology Site GOLDEN, COLORADO
3.		CHECKED BY R. ARCHIBALD	RA	8/10/04	LANDFILL CROSS SECTIONS
4.		INDEPENDENT VERIFIER S. LAWRENCE	SL	11/10/04	PRESENT LANDFILL ACCELERATED ACTION AS-BUILT
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY R. THOMPSON	RT	8/11/04	
BLDG./FACILITY SITE	NEXT ASSEMBLY NA	CLASSIFIER			SIZE B
ROOM/AREA NA					DRAWING NUMBER 51781-011
GRID COORD./COL NO. NA	SCALE: AS SHOWN	LANDLORD			ISSUE 2

GROUP\CAD\ROCKY_FLATS\New Design_2004\XSEC_100%\XSECTS100.dgn Date: 1-2005



GEOSYNTHETIC COMPOSITE FINAL COVER (1 — 9 | 12)

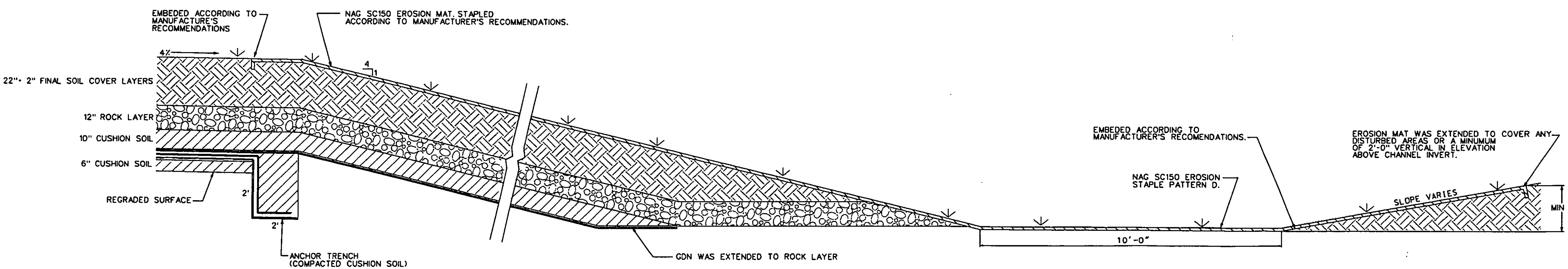
NTS



NOTE: RIPRAP AND BEDDING MAINTAINED DESIGN THICKNESS UP THE SIDESLOPES FOR 2 VERTICAL FEET. AFTER THIS, MATERIAL TAPERS-OUT.

RIPRAP LINED CHANNEL DETAIL (3 — 9 | 12)

NTS



ANCHOR TRENCH * (2 — 9 | 12)

NTS

* NOTE: WHEREVER WASTE WAS ENCOUNTERED DURING THE EXCAVATION OF THE ANCHOR TRENCH, WASTE MATERIAL WAS OVER EXCAVATED AN ADDITIONAL 1-FOOT. OVER EXCAVATIONS WERE FILLED WITH CUSHION LAYER SOIL TO THE DESIGN DIMENSIONS OF ANCHOR TRENCH.

COLORADO REGISTERED PROFESSIONAL ENGINEER — RANDALL C. THOMPSON — 30638 — 8/26/05

3 ISSUE	AS-BUILT DRAWING / EARTH TECH DESIGN COMPANY	6/22/05 DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION										PROJECT/WCF NO. 020525

KEYWORDS	TOLERANCES	DESIGN COMPANY		
1.	FRACT. :	DESIGNED BY: R. ARCHIBALD	RA	8/9/04
2.	ANGLE :	DRAWN BY: A. SHOTNIK	AS	8/10/04
3.	DEC. :	CHECKED BY: R. THOMPSON	RT	8/10/04
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER: S. LAWRENCE	SL	11/10/04
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY: R. THOMPSON	RT	8/11/04
BLDG./FACILITY: SITE	NEXT ASSEMBLY: NA	CLASSIFIER		
ROOM/AREA: NA	SCALE: AS SHOWN	LANDLORD		
GRID COORD./COL NO.: NA				

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

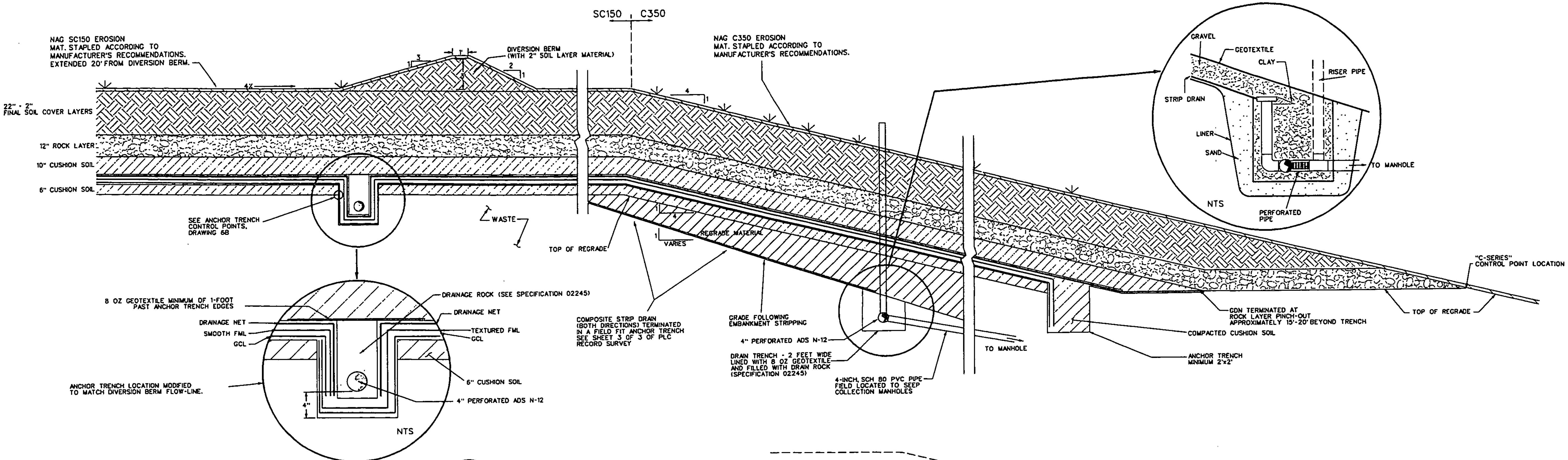
Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

LANDFILL COVER AND SURFACE WATER DETAIL

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

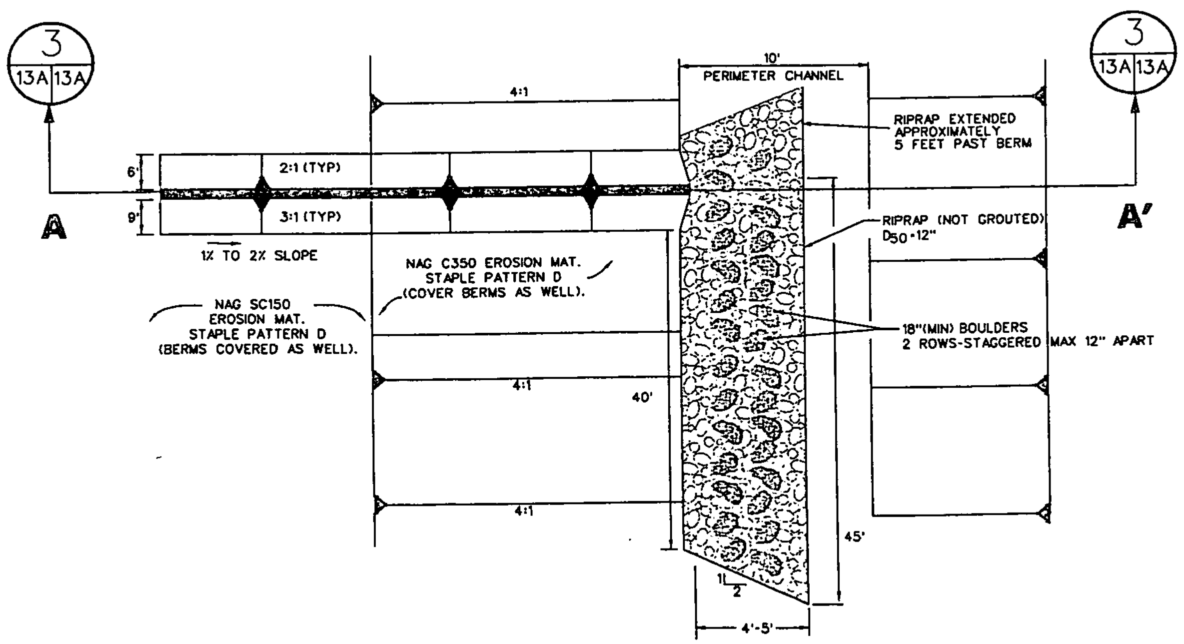
SIZE	DRAWING NUMBER	ISSUE
B	51781-012	3

L:\GROUP\CAD\ROCKY_FLATS\NEW DESIGN 2004 \DETAILS\LNDFILLCVR.DGN 1/23/04



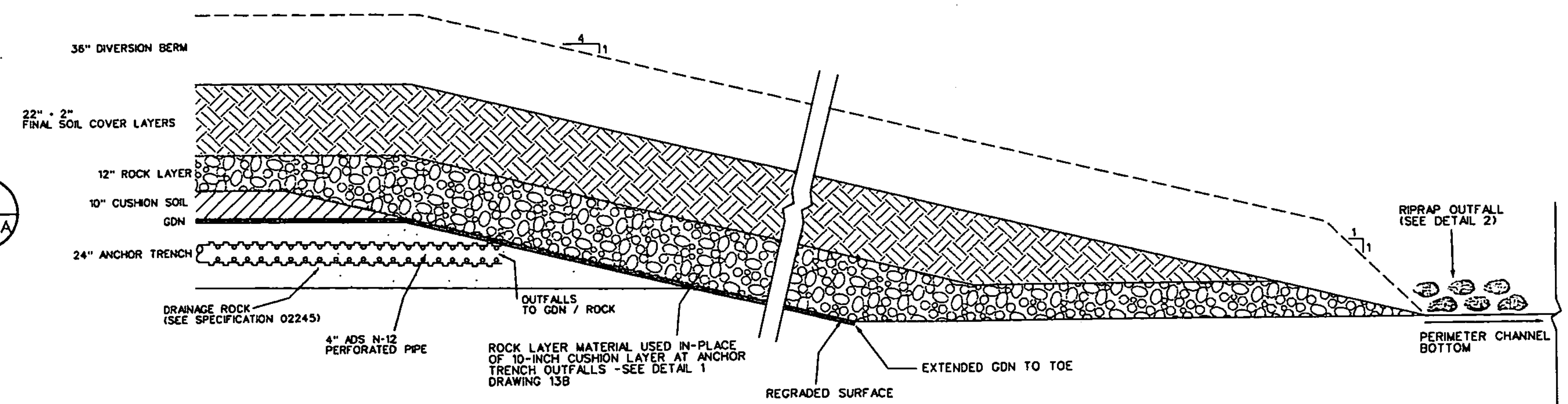
EAST SLOPE COVER BREAK AND DIVERSION BERM (1 — 9 | 13A)

NTS



DOWNSLOPE CHANNEL TRANSITION FROM EAST SLOPE BERM TO PERIMETER CHANNEL (2 — 9 | 13A)

NTS



CROSS-SECTION A - A' (3 — 13A | 13A)

NTS

COLORADO REGISTERED PROFESSIONAL ENGINEER — RANDALL C. THOMPSON — 30638 — 8/26/05

5 ISSUE	AS-BUILT DRAWING — EARTH TECH DESIGN COMPANY	8/26/05 DATE	DSGN	DWN	CHKD	IV	APVD		CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE									

REVISION DESCRIPTION / DESCRIPTION

KEYWORDS	TOLERANCES FRACT. ANGLE DEC. UNLESS NOTED OTHERWISE	DESIGN COMPANY: EARTH TECH		
1.		DESIGNED BY R. ARCHIBALD	RA	8/9/04
2.		DRAWN BY A. SHOTNIK	AS	8/10/04
3.		CHECKED BY R. THOMPSON	RT	8/10/04
4.	REMOVE BURRS AND SHARP EDGES	INDEPENDENT VERIFIER S. LAWRENCE	SL	11/10/04
5.		APPROVED BY R. THOMPSON	RT	8/11/04
BLDG./FACILITY SITE	NEXT ASSEMBLY NA			
ROOM/AREA NA		CLASSIFIER		
GRID COORD./COL NO. NA	SCALE: AS SHOWN	LANDLORD		

PROJECT/WCF NO. 020525

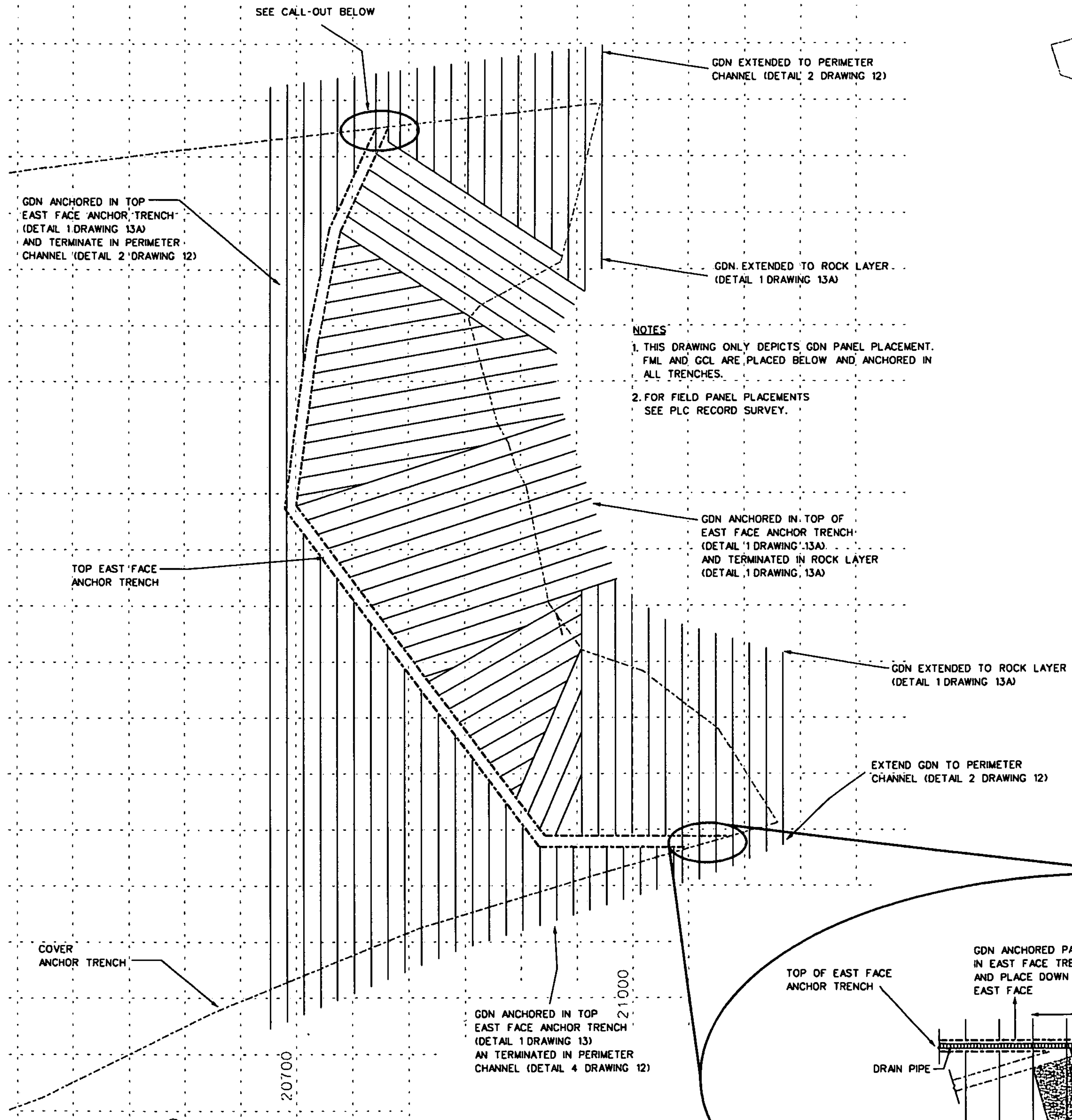
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

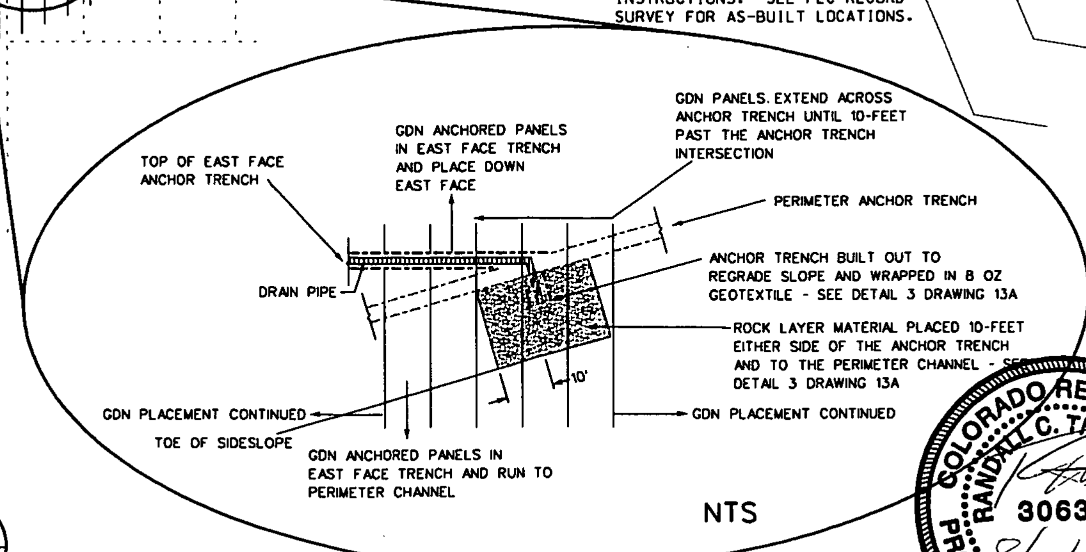
LANDFILL COVER DETAILS EAST FACE

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

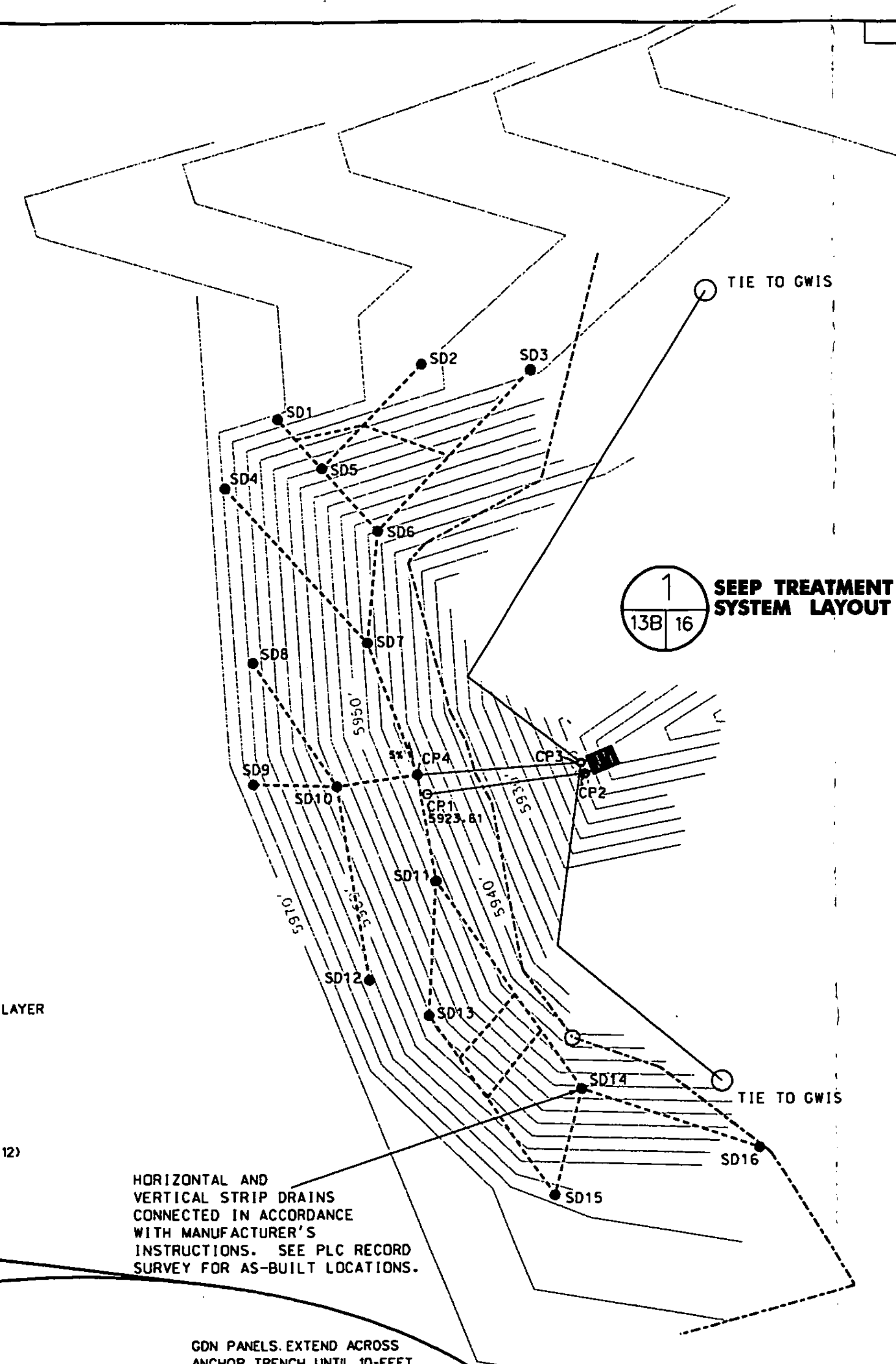
SIZE	DRAWING NUMBER	ISSUE
B	51781-013A	5



NOTES
1. THIS DRAWING ONLY DEPICTS GDN PANEL PLACEMENT. FML AND GCL ARE PLACED BELOW AND ANCHORED IN ALL TRENCHES.
2. FOR FIELD PANEL PLACEMENTS SEE PLC RECORD SURVEY.



ANCHOR TRENCH - GDN PLACEMENT (1 / 6B 13B)



SEEP TREATMENT SYSTEM LAYOUT (1 / 13B 16)

NOTES
AMERICAN WICK DRAIN CORPORATION'S 12-INCH AKWADRAIN SOIL STRIP DRAINS WERE INSTALLED. ANCHORED TO SOIL WITH EROSION MAT STAPLES OR NAILS AFFIXED WITH A WASHER TO PREVENT BREAKTHROUGH.

SEE PLC RECORD SURVEY FOR FINAL STRIP DRAIN AT SEEP SYSTEM LOCATIONS.

SEEP CAPTURE (2 / 13A 13B)

QUAN.	DESCRIPTION	MATERIAL

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 8/2/05

ISSUE	REVISION DESCRIPTION / DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD	CLASS	PROJECT/CHARGE NO.
1	AS-BUILT DRAWING / EARTH TECH	6/22/05							57378
0	ORIGINAL ISSUE								

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS: 1. 2. 3. 4. 5.
BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
TOLERANCES: FRACT. ANGLE DEC. UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

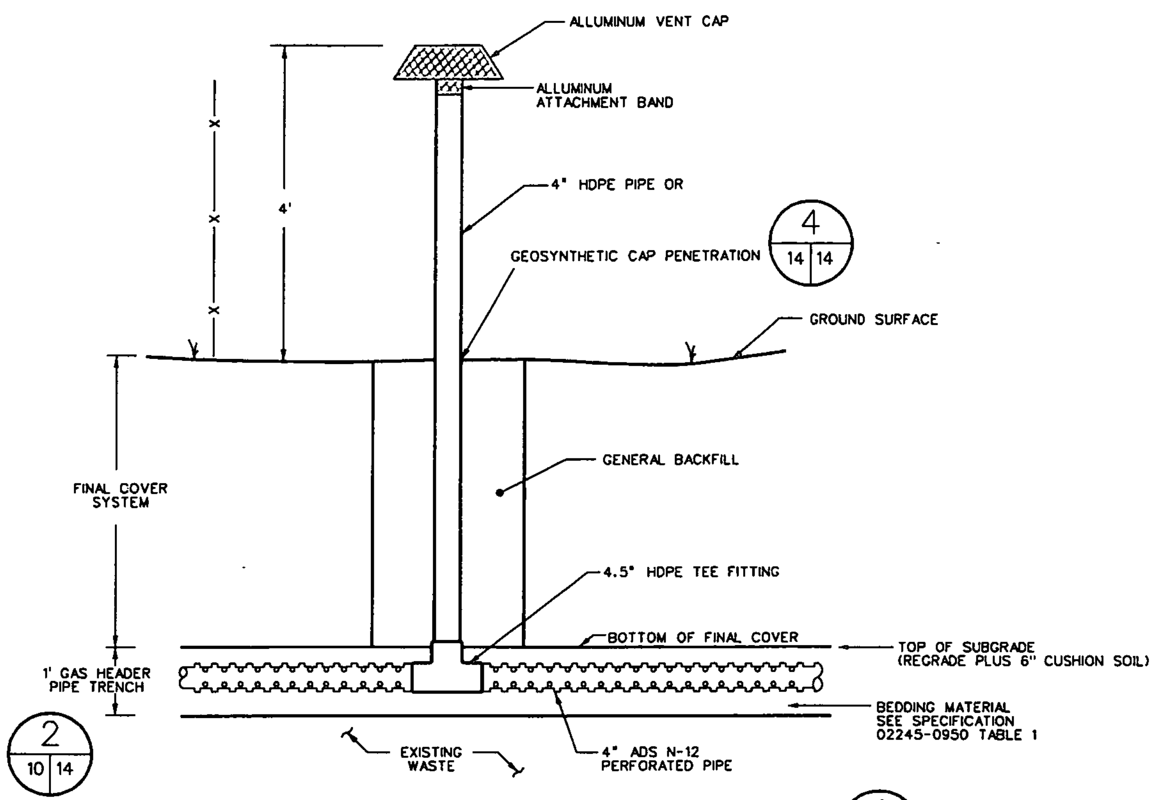
DESIGN COMPANY: EARTH TECH

Role	Name	Initials	Date
DESIGNED BY	R. ARCHIBALD	RA	1/14/05
DRAWN BY	A. SHOTNIK	AS	1/14/05
CHECKED BY	R. THOMPSON	RT	1/14/05
INDEPENDENT VERIFIER	S. LAWRENCE	SL	1/14/05
APPROVED BY	R. THOMPSON	RRT	1/14/05
CLASSIFIER			
LANDLORD			

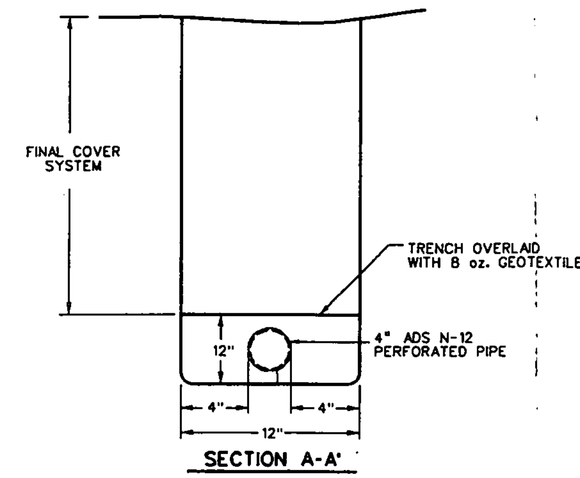
ANCHOR TRENCH EAST FACE
PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-013B	1

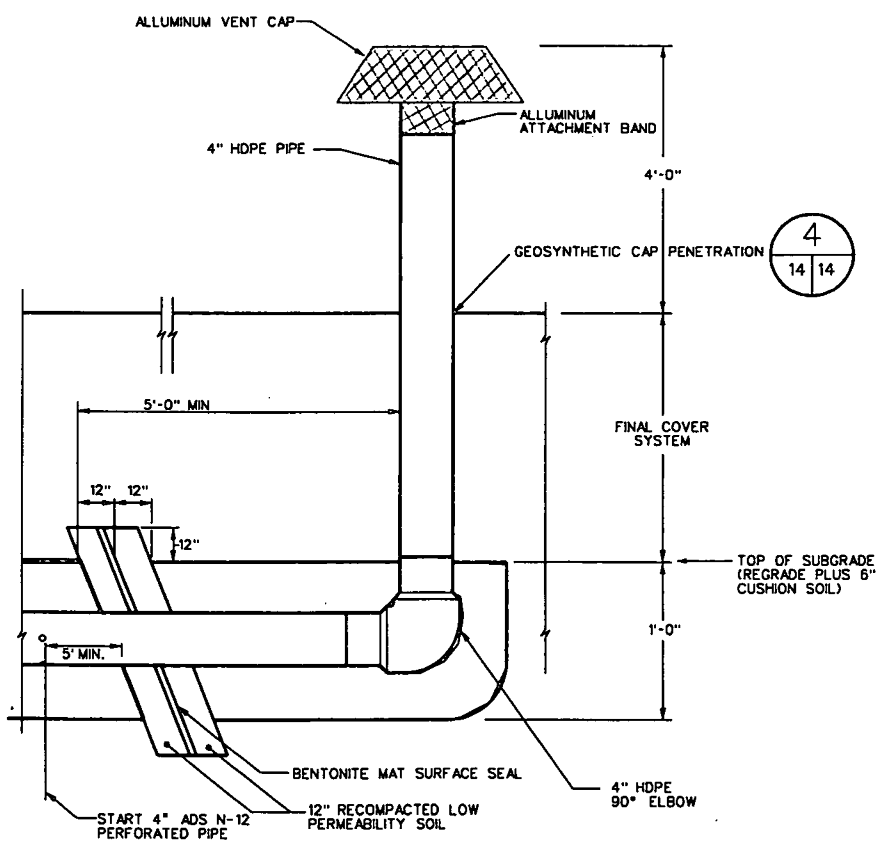
L:\GROUP\CAD\ROCKY_FLATS\NEW DESIGN 2004 \DETAILS\AT3D.DGN 1/12/05



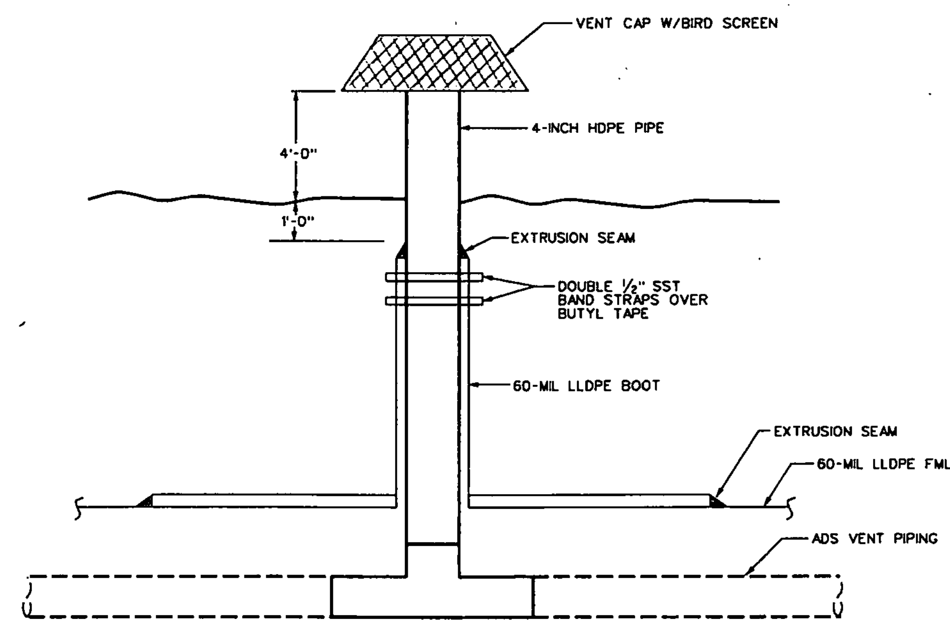
VENTILATOR (1 — 10 | 14)



VENT TRENCH (2 — 10 | 14)



HEADER ACCESS RISER (3 — 10 | 14)
NTS



TYPICAL GEOSYNTHETIC CAP PENETRATION (4 — 14 | 14)
NTS

NOTES

1. ALL HDPE PIPE IS SDR-11 AND ALL HDPE FITTINGS ARE SDR-11 EXCEPT AS NOTED.
2. CLEAN SAND BEDDING AND BACKFILL WERE COMPACTED IN MAXIMUM LIFTS OF 9".

QUAN.	DESCRIPTION	MATERIAL

AS-BUILT DRAWING

ISSUE	REVISION DESCRIPTION	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
3	EARTH TECH DESIGN COMPANY	8/26/05									57378
0	ORIGINAL ISSUE										

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

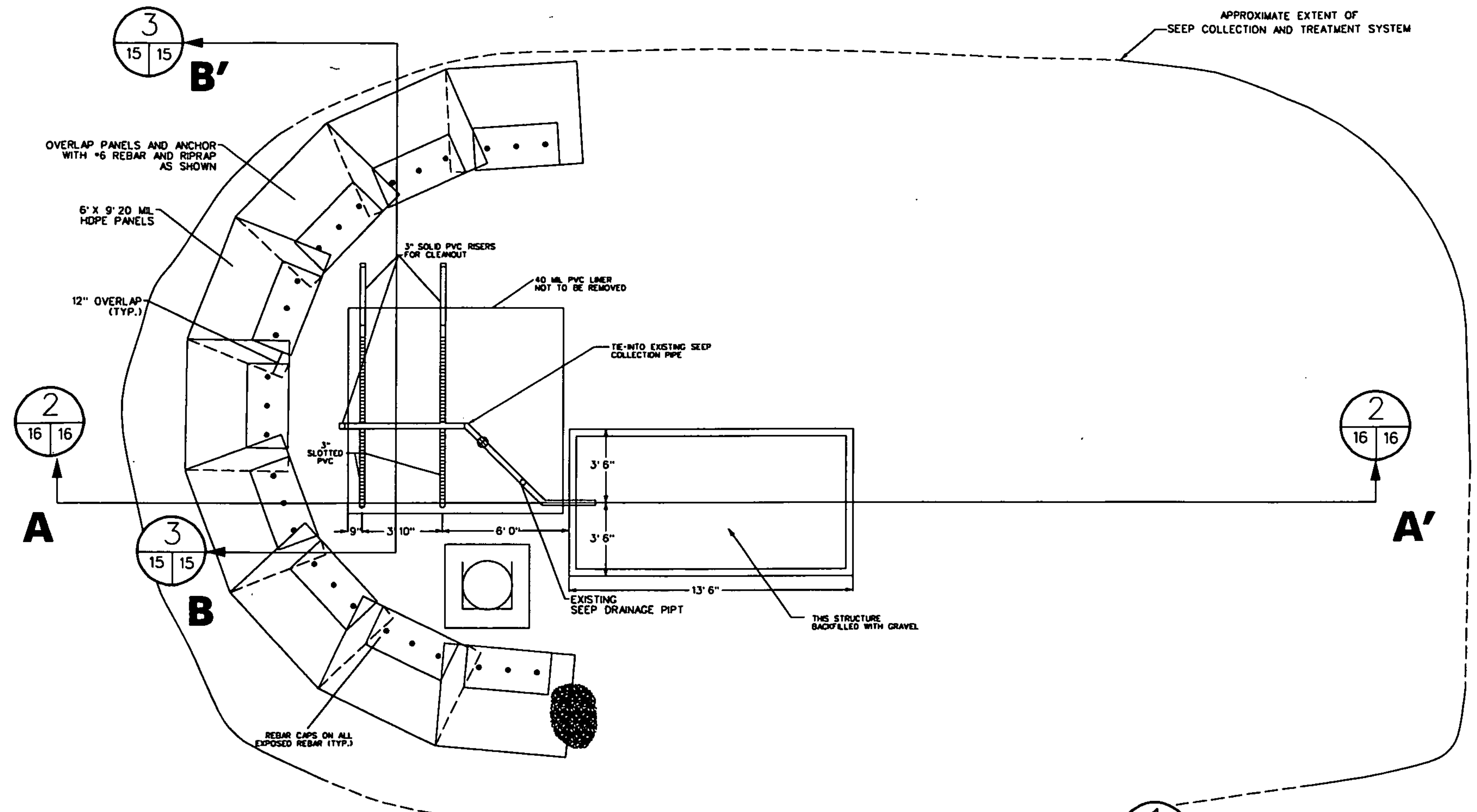
KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. :	DESIGNED BY R. THOMPSON	RT	8/9/04
2.	ANGLE :	DRAWN BY A. SHOTNIK	AS	8/10/04
3.	DEC. :	CHECKED BY R. ARCHIBALD	RA	8/10/04
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER S. LAWRENCE	SL	11/10/04
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY R. THOMPSON	RT	8/11/04
BLDG./FACILITY SITE	NEXT ASSEMBLY NA	CLASSIFIER		
ROOM/AREA NA				
GRID COORD./COL NO. NA	SCALE: AS SHOWN	LANDLORD		

VENT SYSTEM DETAILS

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

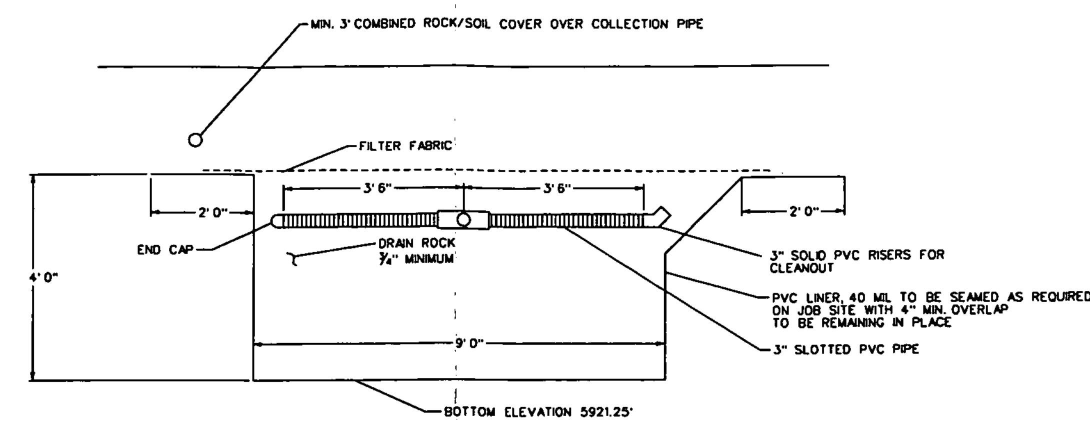
SIZE	DRAWING NUMBER	ISSUE
B	51781-014	2

GROUP\CAD\ROCKY_FLATS\New Design 2004/Details/rock_det2.DGN 1/26/04



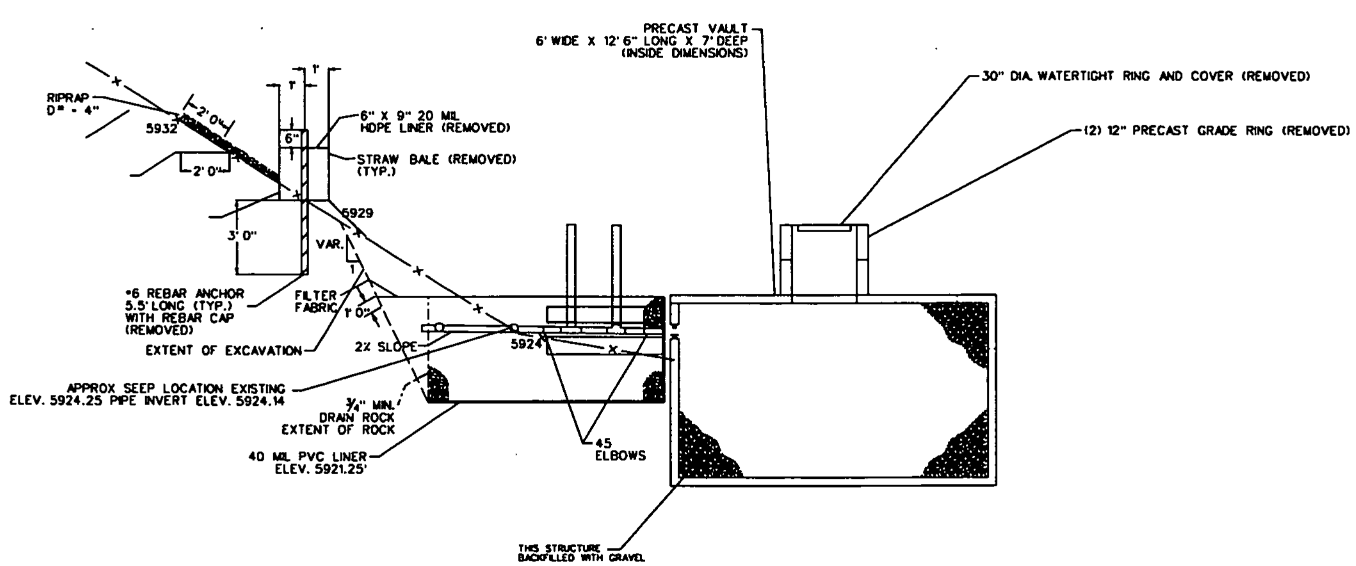
PLAN VIEW, FORMER PASSIVE TREATMENT SYSTEM (1 / 15 15)

SCALE 0 2 4
Scale in feet



ALL 3" PVC PIPE IS SCHEDULE 40. SEE SPECIFICATION SECTION 03100

CROSS – SECTION B – B' (3 / 15 15)



CROSS – SECTION A – A' (2 / 15 15)

SCALE 0 2 4
Scale in feet

NOTE: PORTIONS OF PREVIOUS SEEP SYSTEM WERE REMOVED AND REPLACED BY NEW SEEP COLLECTION AND TREATMENT SYSTEM. SEE DRAWING 016-018.

COLORADO REGISTERED PROFESSIONAL ENGINEER — RANDALL C. THOMPSON — 30638 — 8/2/05

ISSUE	DESCRIPTION	DATE	DSGN	DWN	CHKD	IV	APVD
1	AS-BUILT DRAWING / DESIGN COMPANY	6/22/05					
0	ORIGINAL ISSUE						

Role	Name	Initials	Date
DESIGNED BY	R. THOMPSON	RJ	8/9/04
DRAWN BY	A. SHOTNIK	AS	8/10/04
CHECKED BY	R. ARCHIBALD	RA	8/10/04
INDEPENDENT VERIFIER	S. LAWRENCE	SL	11/10/04
APPROVED BY	R. THOMPSON	RJ	8/11/04

KEYWORDS: 1. 2. 3. 4. 5.
BLDG/FACILITY: SITE — ROOM/AREA: NA — GRID COORD/COL NO.: NA — NEXT ASSEMBLY: NA — SCALE: AS SHOWN
TOLERANCES FRACT. : ANGLE : DEC. : UNLESS NOTED OTHERWISE — REMOVE BURRS AND SHARP EDGES
CLASSIFIER — LANDLORD

PROJECT/WCF NO. 020525

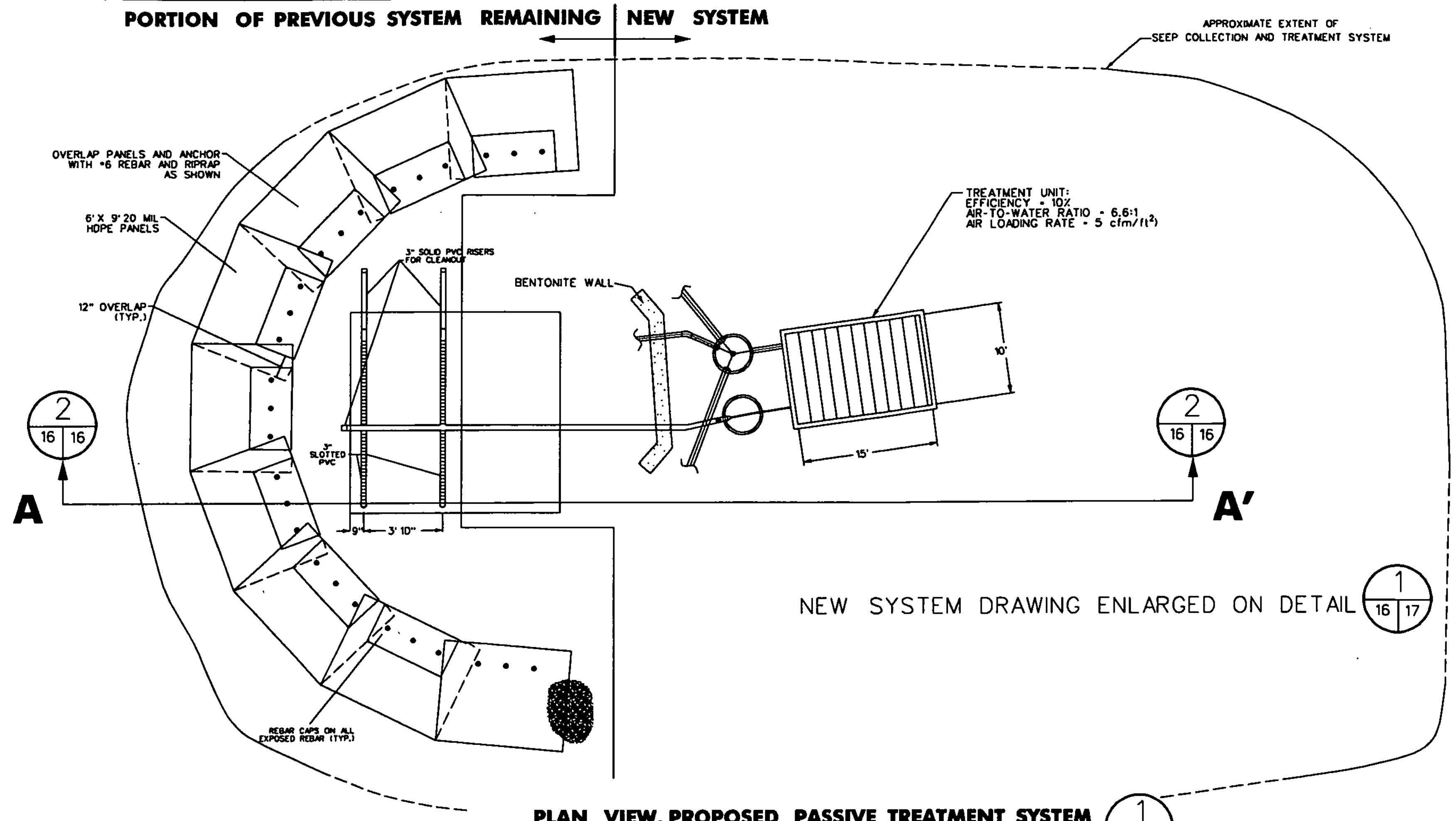
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

FORMER SEEP PASSIVE TREATMENT SYSTEM
PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

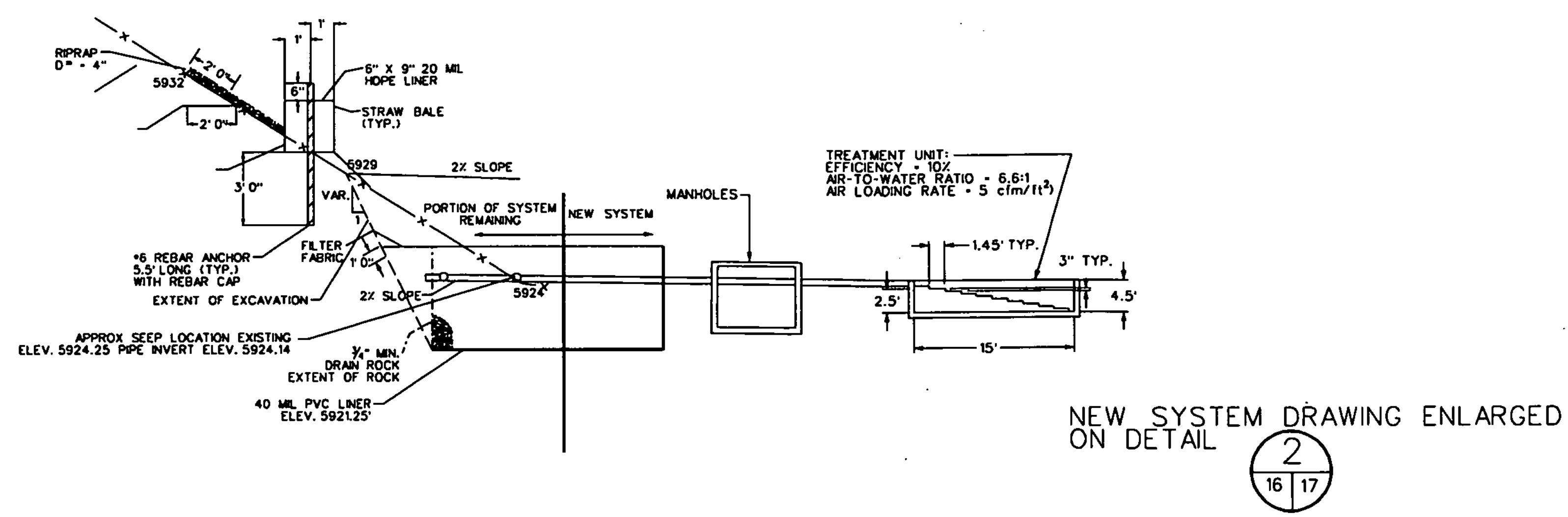
SIZE: B — DRAWING NUMBER: 51781-015 — ISSUE: 1

GROUP\CAD\ROCKY_FLATS\NEW-DESIGN2003\DETAILS\SEEPDET.DGN 10/11/02



PLAN VIEW, PROPOSED PASSIVE TREATMENT SYSTEM (1 / 13B 16)

SCALE 0 2 4
Scale in feet



CROSS - SECTION A - A ' (PROPOSED) (2 / 16 16)

SCALE 0 2 4
Scale in feet

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 8/2/05

QUAN.	DESCRIPTION	MATERIAL

ISSUE	DESCRIPTION	DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
2	AS-BUILT DRAWING (REVISION DESCRIPTION)	EARTH TECH	6/22/05									
0	ORIGINAL ISSUE											

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

NEW SEEP PASSIVE TREATMENT SYSTEM LAYOUT

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

KEYWORDS
1.
2.
3.
4.
5.

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA

TOLERANCES
FRACT. :
ANGLE :
DEC. :
UNLESS NOTED OTHERWISE

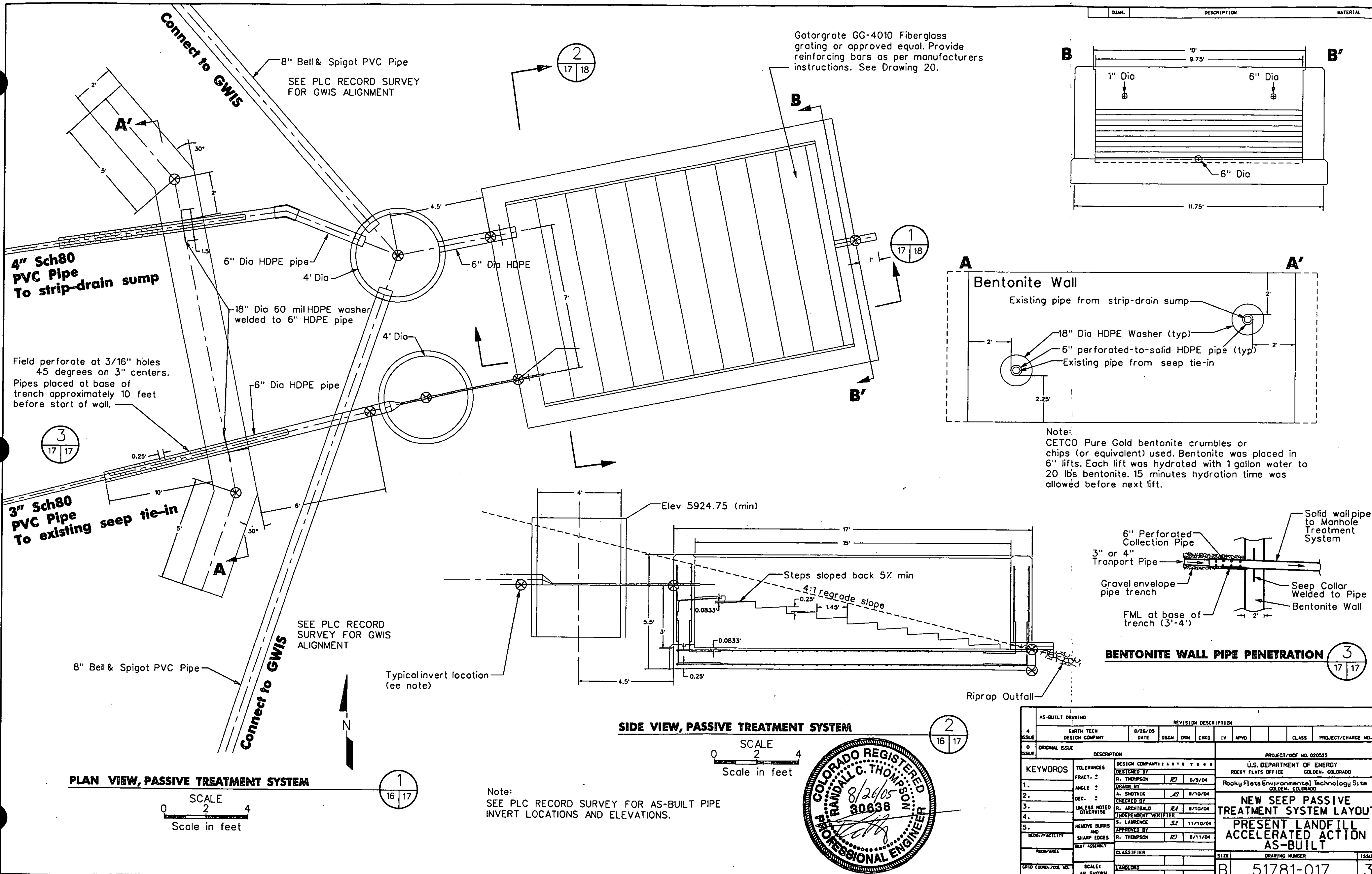
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

DESIGN COMPANY: EARTH TECH

Role	Name	Initials	Date
DESIGNED BY	R. THOMPSON	RT	8/9/04
DRAWN BY	A. SHOTNIK	AS	8/10/04
CHECKED BY	R. ARCHIBALD	RA	8/10/04
INDEPENDENT VERIFIER	S. LAWRENCE	SL	11/10/04
APPROVED BY	R. THOMPSON	RT	8/11/04
CLASSIFIER			
LANDLORD			

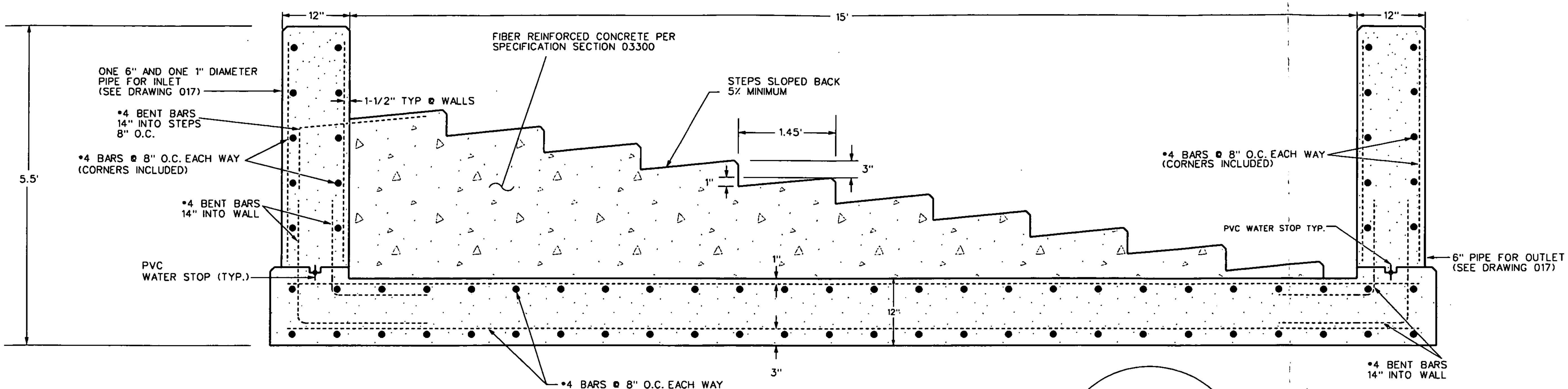
SIZE	DRAWING NUMBER	ISSUE
B	51781-016	2

L:\GROUP\CAD\ROCKY FLATS\NEW DESIGN 2003\DETAILS\WTRBUNKERDTL.DGN

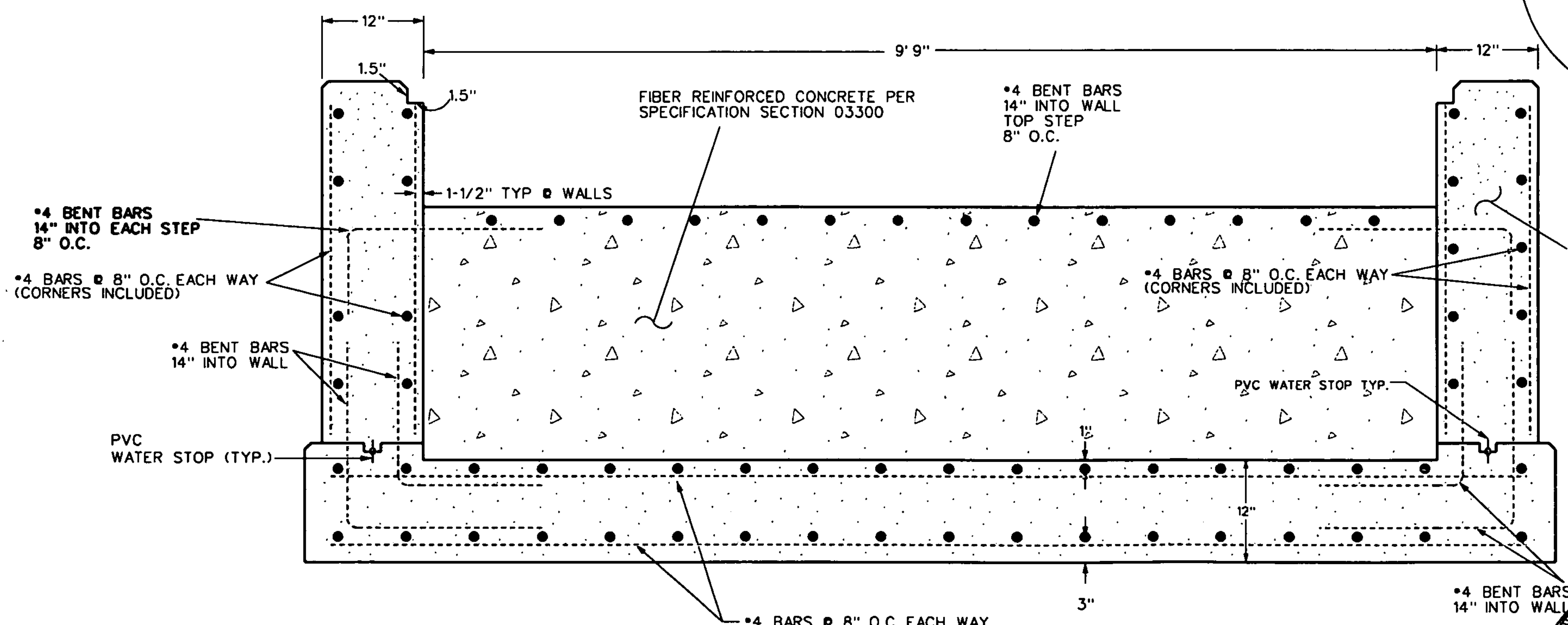


GROUP\CAD\ROCKY_FLATS\New_Design2005\Details\Seep0405.dgn Date: 4-2005

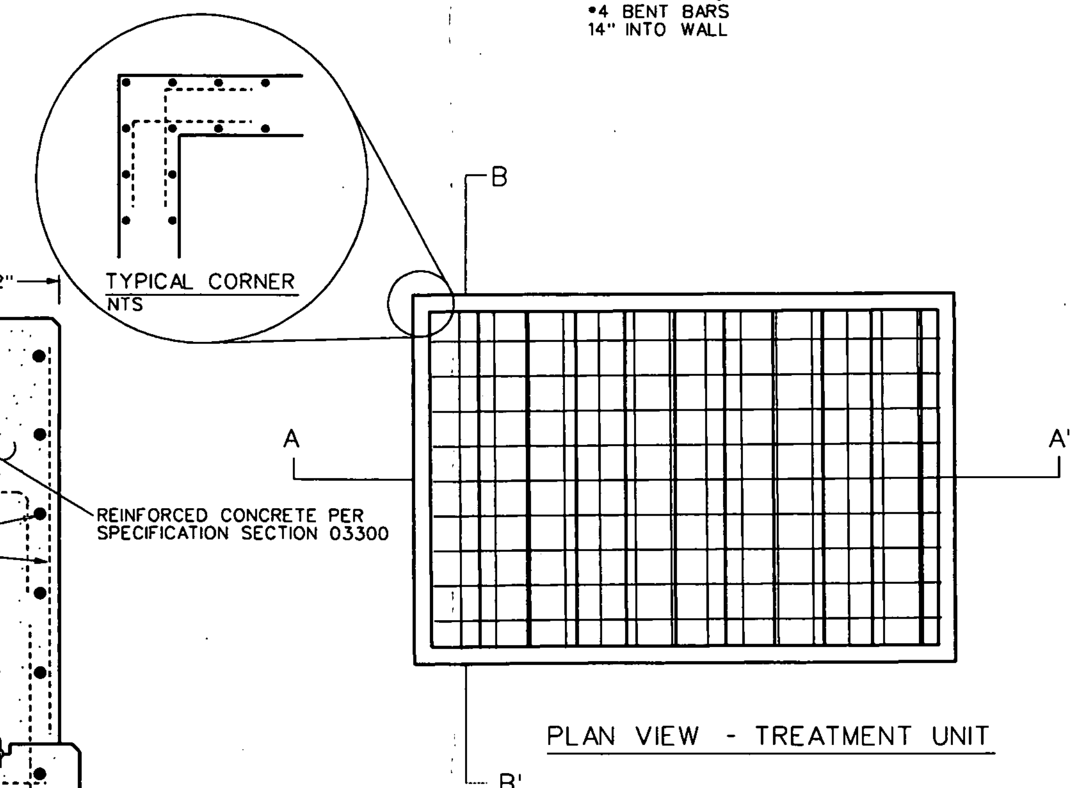
QUAN.	DESCRIPTION	MATERIAL



CROSS - SECTION A - A ' (1, 17 | 18)



CROSS - SECTION B - B ' (TYPICAL STEP SECTION) (2, 17 | 18)



PLAN VIEW - TREATMENT UNIT

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 8/2/05

ISSUE											
2	AS-BUILT DRAWING — REVISION DESCRIPTION										
ISSUE	EARTH TECH DESIGN COMPANY	6/22/05 DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE — DESCRIPTION										

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS

TOLERANCES FRACT. : ANGLE DEC. : UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

DESIGN COMPANY: EARTH TECH		
DESIGNED BY		
S. KEITH	SK	1/13/05
DRAWN BY		
R. ARCHIBALD	RA	1/14/05
CHECKED BY		
R. ARCHIBALD	RA	1/14/05
INDEPENDENT VERIFIER		
S. LAWRENCE	SL	1/14/05
APPROVED BY		
R. THOMPSON	RT	1/14/05
CLASSIFIER		
LANDLORD		

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

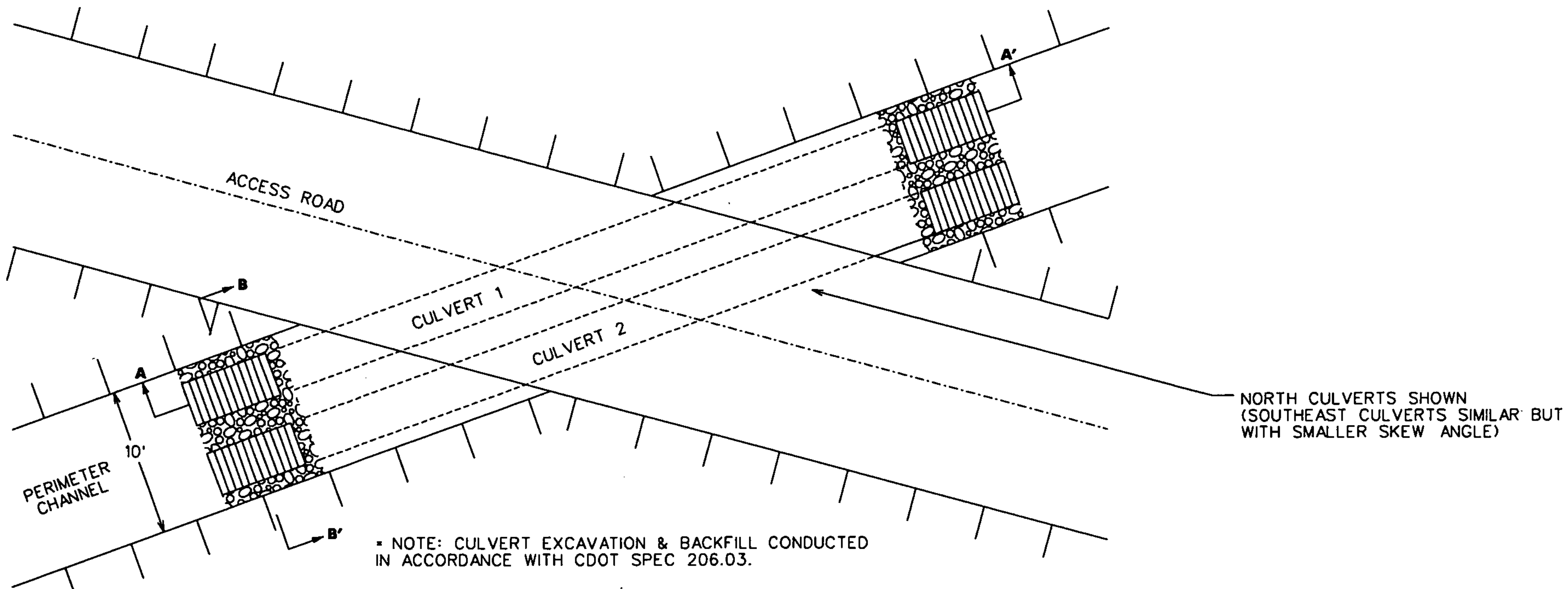
NEW SEEP PASSIVE TREATMENT SYSTEM DETAIL

PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-018	2

L:\GROUP\CAD\ROCKY FLATS\NEW DESIGN 2004\DETAILS\Seep2005r.DGN 4/13/05

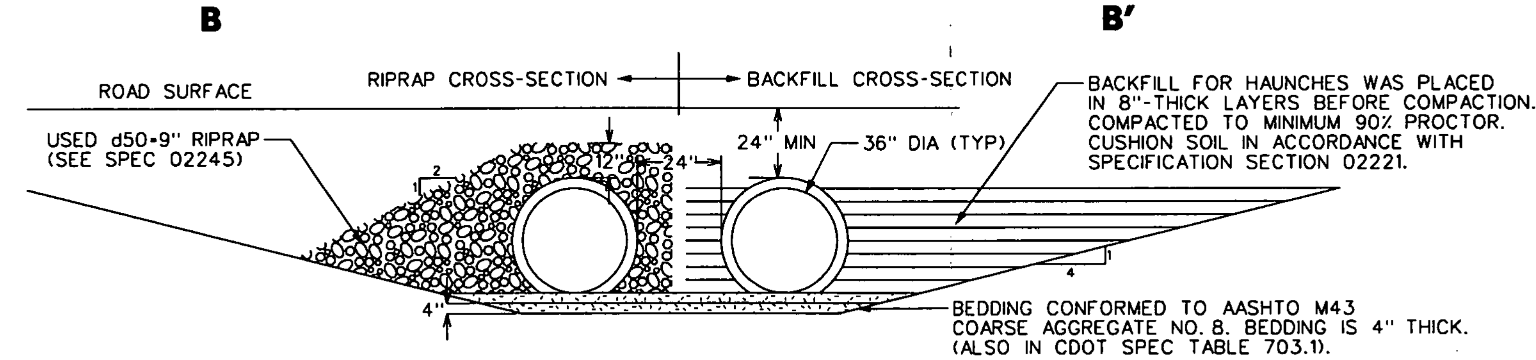
QUAN.	DESCRIPTION	MATERIAL



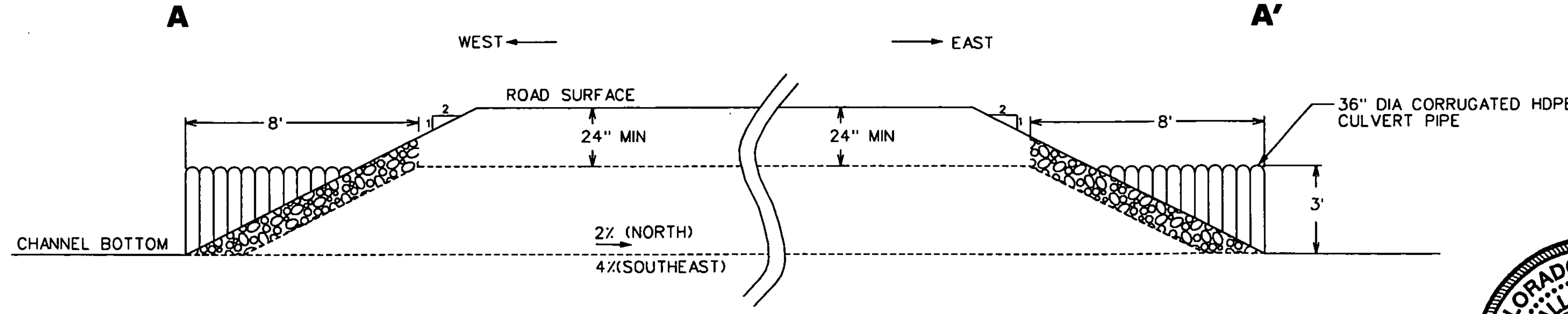
PERIMETER CHANNEL CULVERT DESIGN (2 / 9 | 19)

SCALE
0 5' 10'
Scale in feet

NOTE: SEE PLC RECORD DRAWINGS



SCALE
0 $2\frac{1}{2}$' 5'
Scale in feet



SCALE
0 $2\frac{1}{2}$' 5'
Scale in feet

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 8/2/05

1 ISSUE	AS-BUILT DRAWING / EARTH TECH DESIGN COMPANY	6/22/05 DATE	DSGN	DWN	CHKD	IV	APVD		CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE									

REVISION DESCRIPTION / DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

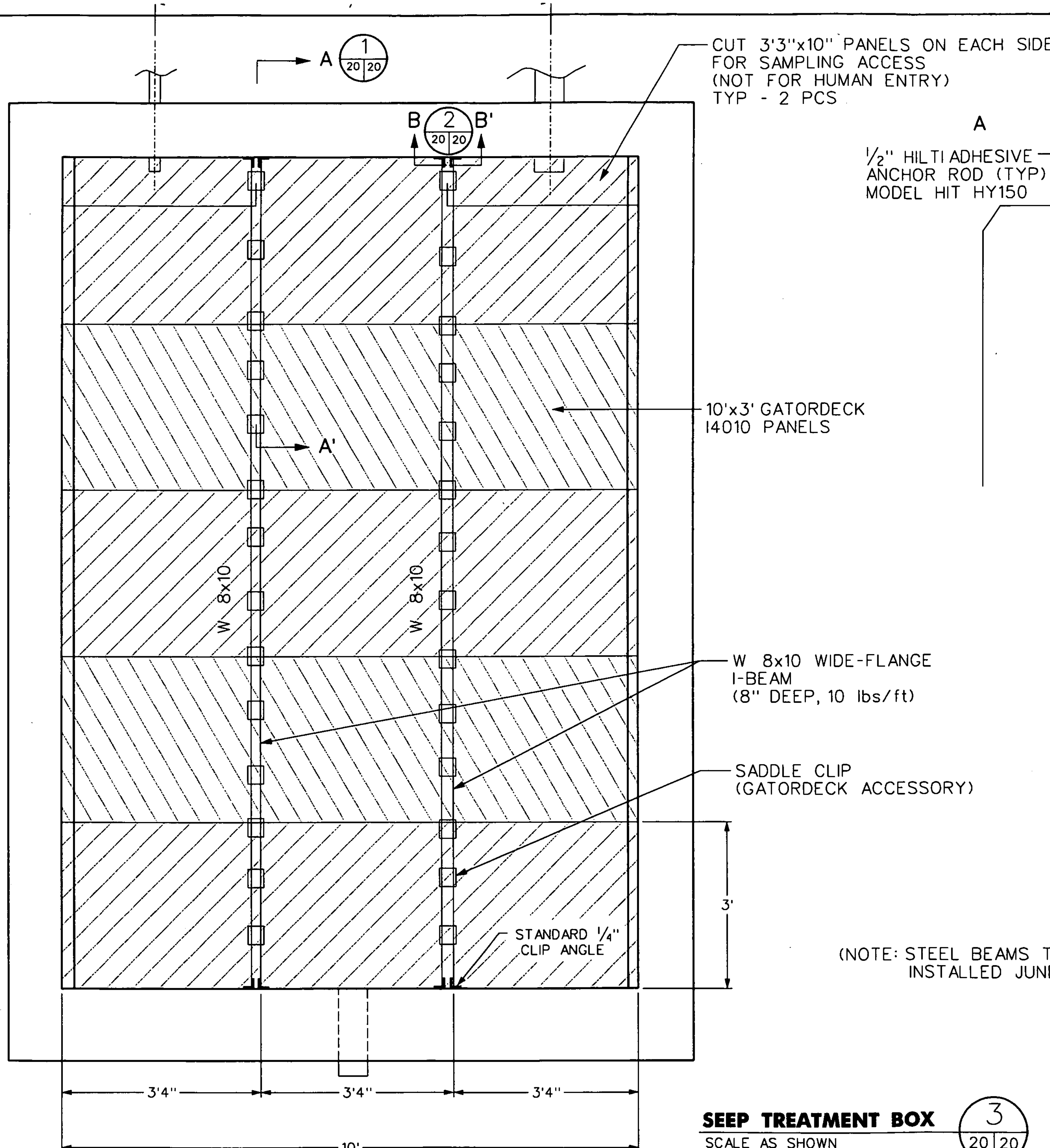
KEYWORDS	TOLERANCES	DESIGN COMPANY		
1.	FRACT. :	DESIGNED BY		
2.	ANGLE	S. POWELL	SP	4/29/05
3.	DEC. :	DRAWN BY		
4.	UNLESS NOTED OTHERWISE	D. BAXTER	DB	4/29/05
5.	REMOVE BURRS AND SHARP EDGES	CHECKED BY		
BLDG./FACILITY SITE		R. ARCHIBALD	RA	4/29/05
ROOM/AREA NA	NEXT ASSEMBLY NA	INDEPENDENT VERIFIER		
GRID COORD./COL NO. NA	SCALE: AS SHOWN	S. LAWRENCE	SL	4/29/05
		APPROVED BY		
		R. THOMPSON	RT	4/29/05
		CLASSIFIER		
		LANDLORD		

PERIMETER CHANNEL CULVERT

PRESENT LANDFILL CLOSURE PROJECT AS-BUILT

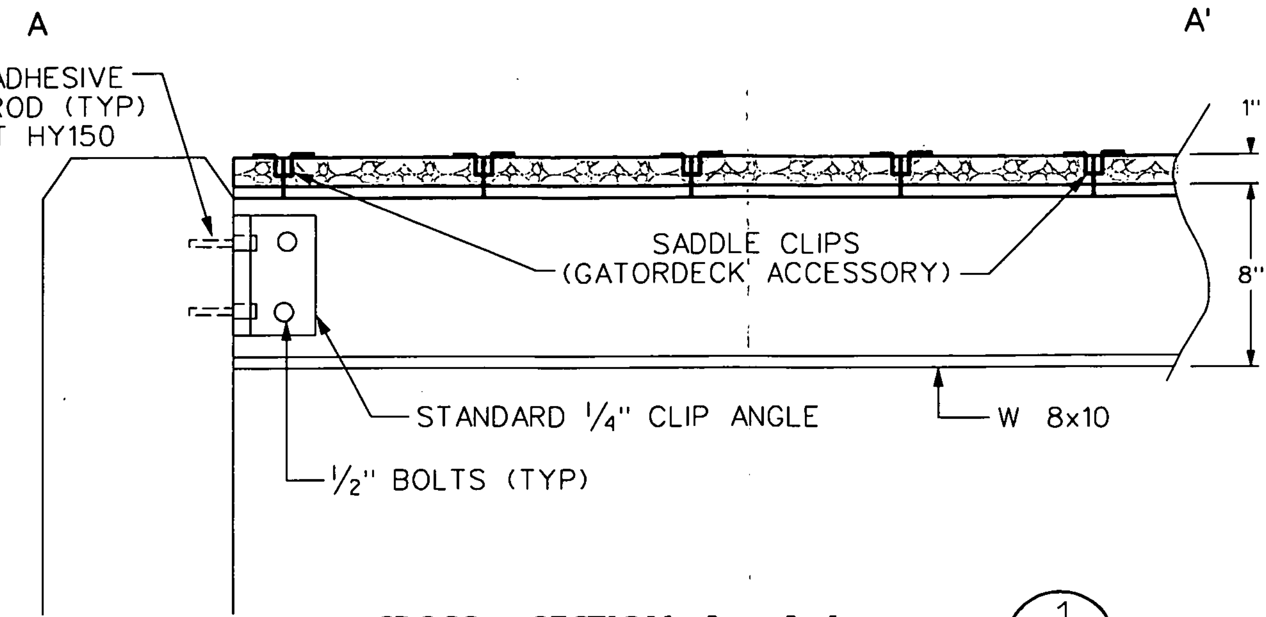
SIZE	DRAWING NUMBER	ISSUE
B	51781-019	1

C:\GROUP\CAD\ROCKY FLATS\NEW DESIGN 2005\DETAILS\PerChann.DGN



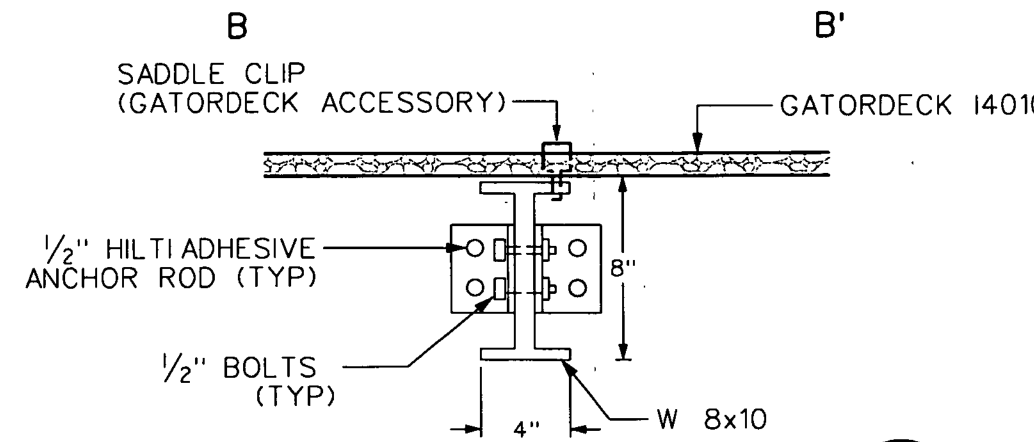
SEEP TREATMENT BOX

SCALE AS SHOWN (3 / 20 20)



CROSS - SECTION A - A'

SCALE AS SHOWN (1 / 20 20)



CROSS - SECTION B - B'

SCALE AS SHOWN (2 / 20 20)

(NOTE: STEEL BEAMS TO BE INSTALLED JUNE 20)

COLORADO REGISTERED PROFESSIONAL ENGINEER
RANDALL C. THOMPSON
30638
8/2/05

ISSUE	DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
0	ORIGINAL ISSUE										

REVISION DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

DESIGNED BY		
S. POWELL	SP	6/22/05
DRAWN BY		
A. SHOTNIK	AS	6/22/05
CHECKED BY		
R. ARCHIBALD	RA	6/22/05
INDEPENDENT VERIFIER		
S. LAWRENCE	SL	6/22/05
APPROVED BY		
R. THOMPSON	RT	6/22/05
CLASSIFIER		
LANDLORD		

KEYWORDS
1.
2.
3.
4.
5.

TOLERANCES FRACT. : ANGLE : DEC. : UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

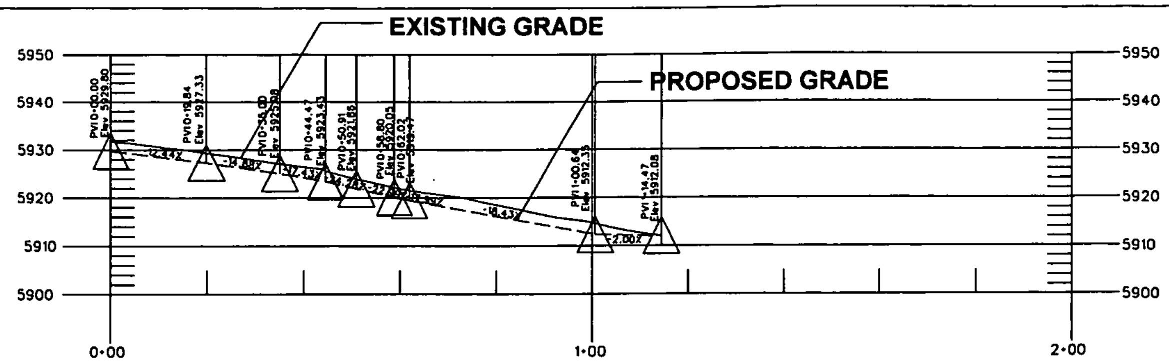
BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

NEW SEEP PASSIVE TREATMENT SYSTEM DETAIL

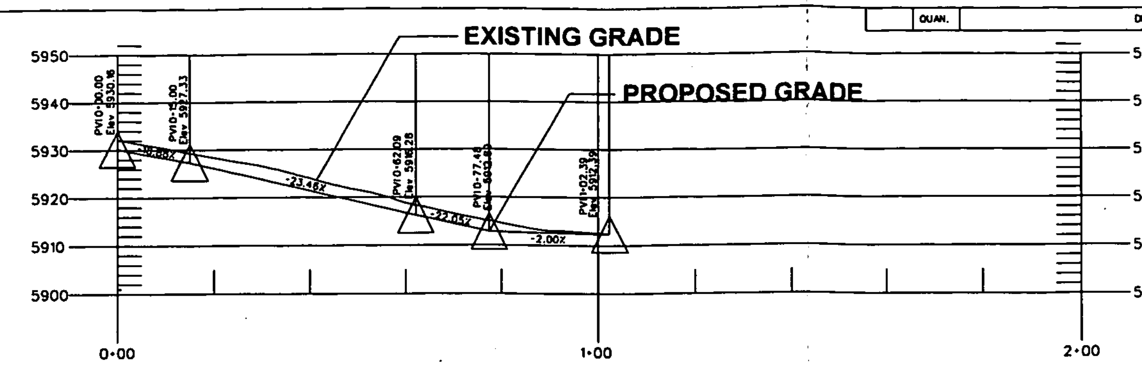
PRESENT LANDFILL ACCELERATED ACTION AS-BUILT

SIZE	DRAWING NUMBER	ISSUE
B	51781-020	0

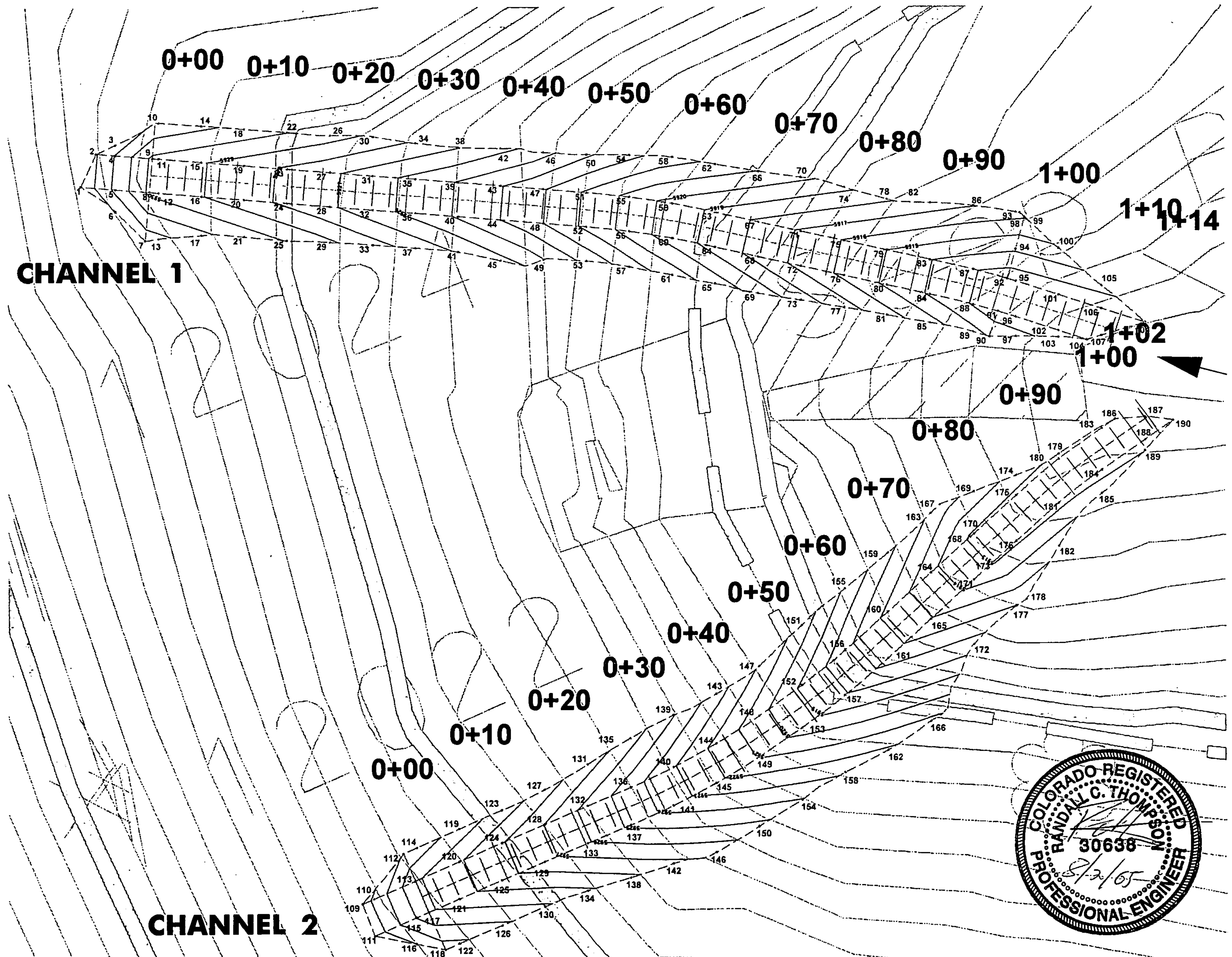
L:\GROUP\CAD\ROCKY FLATS\NEW DESIGN 2005\DETAILS\SeepBox.DGN 5/16/05



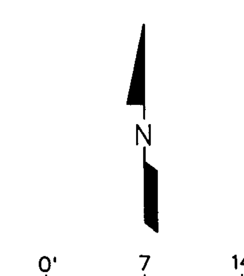
CHANNEL 1
CUT: 76 CY



CHANNEL 2
CUT: 71 CY



OUTFALL BOTH TO EXISTING GRADES



QUAN.	DESCRIPTION	MATERIAL

FINAL COPY

AS-BUILT DRAWING
REVISION DESCRIPTION

ISSUE	DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION										

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS	TOLERANCES FRACT. ANGLE DEC. UNLESS NOTED OTHERWISE	DESIGN COMPANY:		
1.		DESIGNED BY S. POWELL	SP	7/7/05
2.		DRAWN BY A. SHOTNIK	AS	8/2/05
3.		CHECKED BY R. THOMPSON	RT	8/2/05
4.		INDEPENDENT VERIFIER R. ARCHIBALD	RA	7/27/05
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY R. THOMPSON	RT	8/2/05
BLDG./FACILITY SITE	NEXT ASSEMBLY NA			
ROOM/AREA NA		CLASSIFIER		
GRID COORD./COL. NO. NA	SCALE: AS SHOWN			

EAST FACE RIPRAP-LINED CHANNELS

PRESENT LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51781-021	0

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 8/2/05

L:\Work\57378\Work\Geosynthetic Composite cover\Post-Construction\East Face Drainage\Channel_2_7.dgn 7/2005

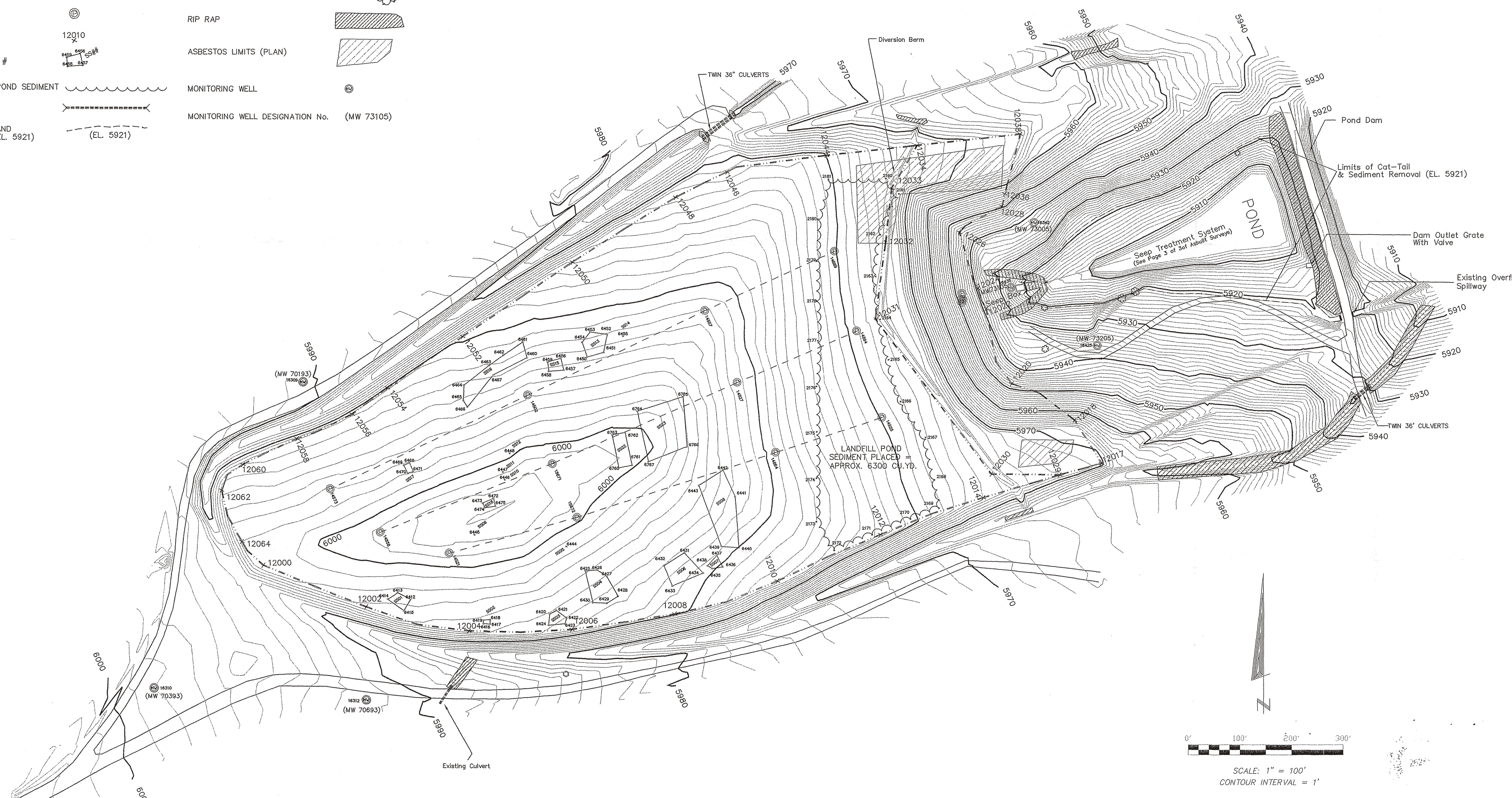
FINAL AS-BUILT DRAWINGS
(PARAGON LAND CONSULTANTS, INC.)

Rocky Flats Environmental Technology Site

ASBUILT SURVEYS

LEGEND

NORTHING GRID LINE	39100	CONTOUR ELEVATION FINAL GRADE	6000
EASTING GRID LINE	19300	VENT SUBSURFACE PIPING	
ANCHOR TRENCH		TREE	
RISER PIPE OR VENT		RIP RAP	
POINT NO.	12010	ASBESTOS LIMITS (PLAN)	
REPAIRED SOFTSPOTS #		MONITORING WELL	
APPROX. BOUNDARY POND SEDIMENT		MONITORING WELL DESIGNATION No.	(MW 73105)
CULVERT			
LIMITS OF CAT-TAIL AND SEDIMENT REMOVAL (EL. 5921)	(EL. 5921)		



U.S. Department of Energy Rocky Flats Environmental Technology Site Golden, Colorado

ASBUILT SURVEY

MAP OF PRESENT LANDFILL ACCELERATED ACTION

No.	Date	Description
Revisions		

Drawing File: FINAL-AZB2
Issue Date: 08/29/2005
Drawn By: PEG
Checked By: MJG
Sheet Number: 2 of 4

PARAGON LAND CONSULTANTS, INC.
Norfolk Park Centre II
416 Norfolk Street
Aurora, Colorado 80011
(720) 857-8800 Fax: (720) 857-8900

BZ-A-000950

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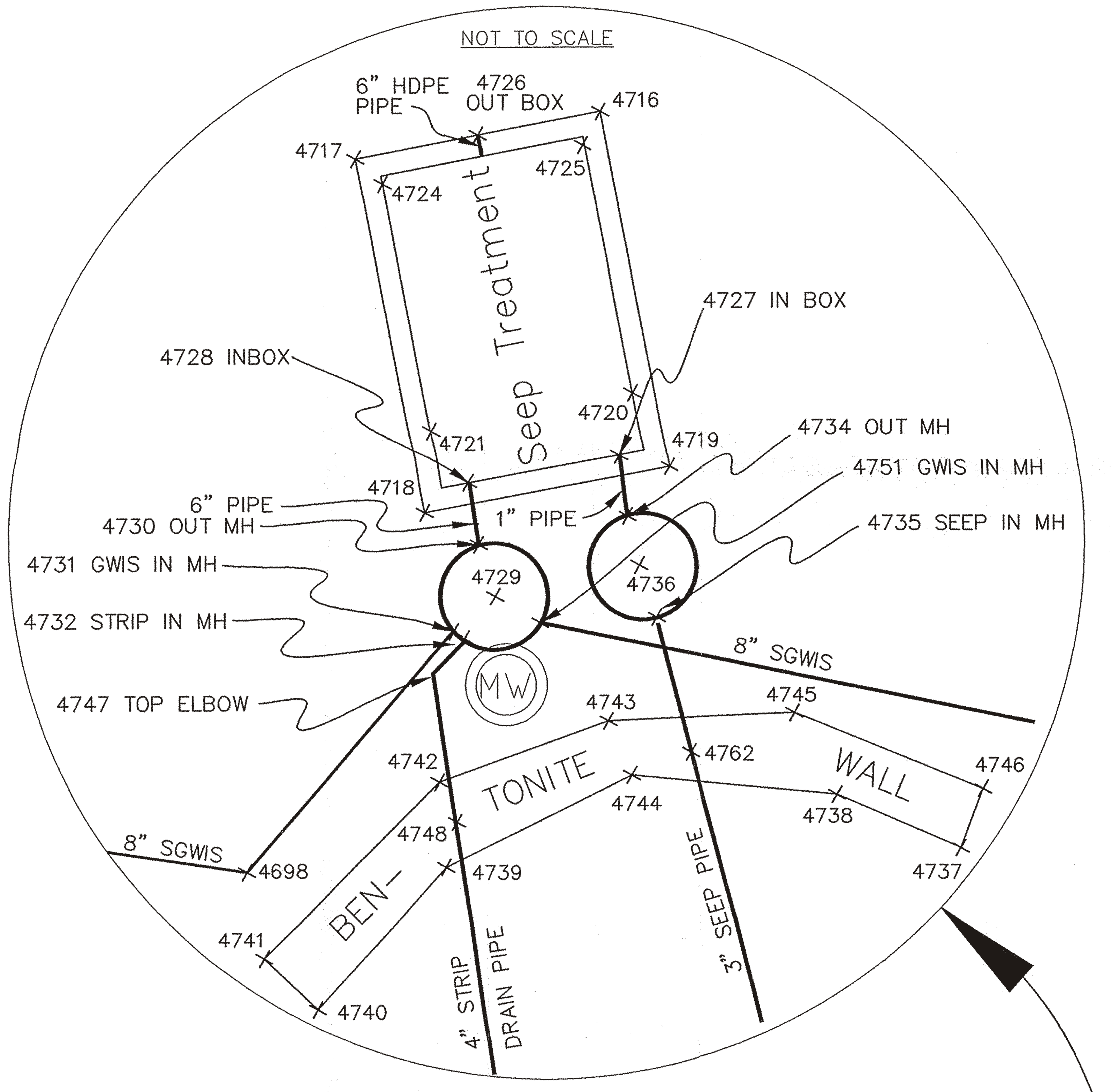
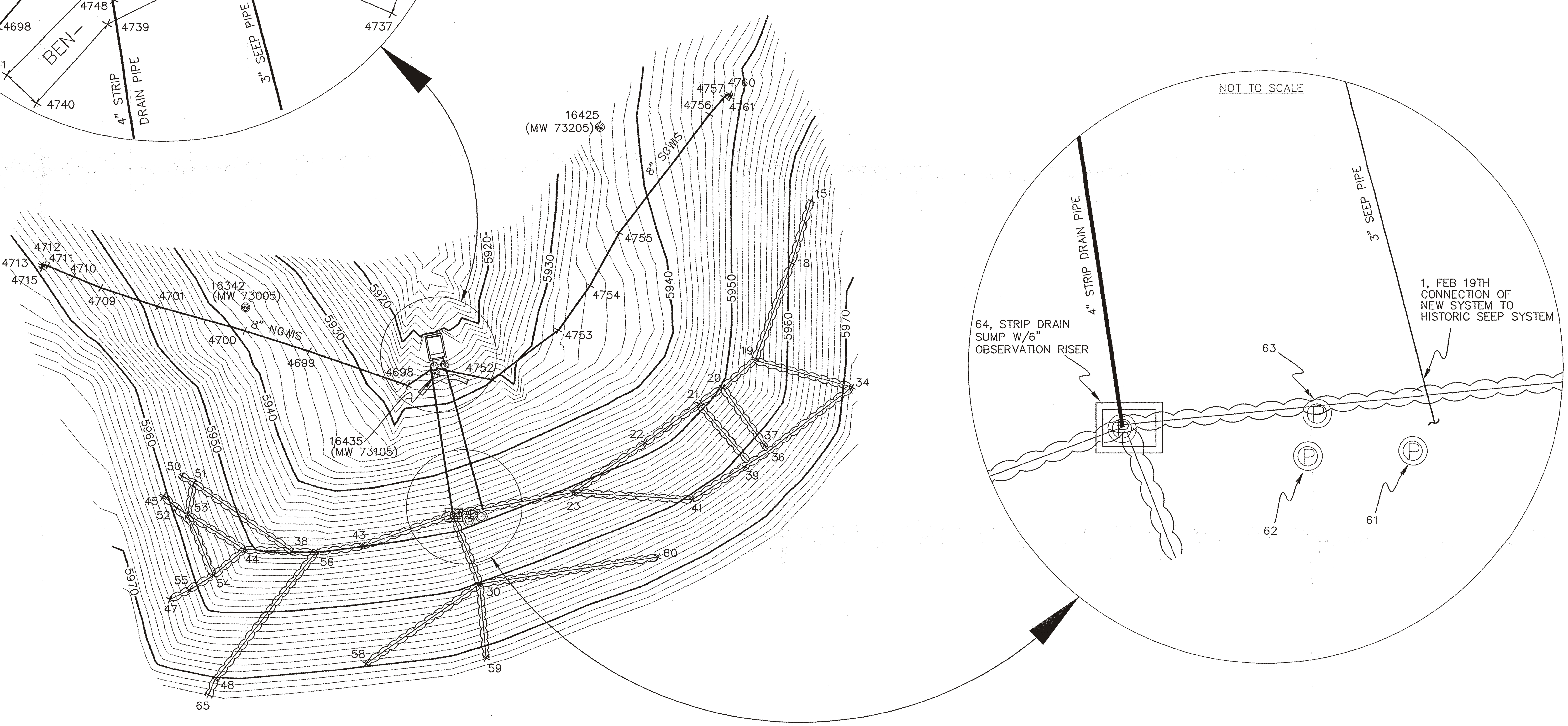
BZ-A-000950 #121

Rocky Flats Environmental Technology Site

ASBUILT SURVEYS





0' 40' 80' 120'

SCALE: 1" = 40'

LEGEND

RISER PIPE OR VENT (P)

MONITORING WELL (MW) (MW)

POINT NO. 12010

MONITORING WELL DESIGANATION No. (MW 73105)

STRIP DRAIN

UNDERGROUND PIPING

NGWIS = NORTH GROUNDWATER INTERCEPTOR SYSTEM

SGWIS = SOUTH GROUNDWATER INTERCEPTOR SYSTEM

PARAGON
LAND CONSULTANTS, INC.
Norfolk Park Centre II
416 Norfolk Street
Aurora, Colorado 80011
(720) 857-8800 Fax: (720) 857-8900

U.S. Department of Energy Rocky Flats Environmental Technology Site Golden, Colorado

ASBUILT SURVEYS
ASBUILT NEW SEEP SYSTEM

No.	Date	Revisions Description

Drawing File:	FINAL-AZB3
Issue Date:	08/29/2005
Drawn By:	PEG
Checked By:	MJG
Sheet Number:	3 OF 4

Rocky Flats Environmental Technology Site

ASBUILT SURVEYS

SOFTSPOTS POINTS (SHEET 2)

POINT	COORDINATE SYSTEM				ELEVATION
	ROCKY FLATS		STATE PLANE		
	NORTHING	EASTING	NORTHING	EASTING	
6412	39288.01	19786.05	752266.27	2082884.92	5990.29
6413	39301.01	19760.97	752279.18	2082859.80	5991.03
6414	39288.11	19742.16	752266.22	2082841.05	5990.56
6415	39266.34	19773.00	752244.56	2082871.95	5989.78
6416	39241.11	19928.11	752219.85	2083027.10	5987.99
6417	39240.65	19941.04	752219.43	2083040.02	5987.65
6418	39249.36	19941.01	752228.14	2083039.96	5987.92
6419	39248.08	19927.54	752226.81	2083026.51	5988.03
6420	39260.74	20056.93	752239.90	2083155.83	5986.77
6421	39267.63	20069.78	752246.83	2083168.64	5986.79
6422	39253.35	20089.71	752232.62	2083188.62	5985.69
6423	39241.58	20086.65	752220.84	2083185.60	5985.58
6424	39238.63	20054.63	752217.78	2083153.60	5986.10
6425	39344.42	20125.42	752323.79	2083224.02	5988.19
6426	39346.31	20148.50	752325.75	2083247.08	5987.33
6427	39334.22	20167.50	752313.73	2083266.12	5986.37
6428	39295.24	20189.41	752274.83	2083288.15	5983.71
6429	39281.80	20167.39	752261.32	2083266.19	5984.20
6430	39282.98	20140.72	752262.41	2083239.51	5985.63
6431	39381.00	20318.32	752360.99	2083416.75	5985.35
6432	39355.30	20278.31	752335.16	2083376.83	5984.97
6433	39315.58	20294.82	752295.51	2083393.46	5982.79
6434	39341.21	20354.61	752321.33	2083453.16	5982.26
6435	39349.84	20372.46	752330.02	2083470.97	5982.04
6436	39353.21	20392.74	752333.45	2083491.24	5981.61
6437	39375.76	20381.09	752355.96	2083479.51	5982.73
6438	39355.55	20363.21	752335.69	2083461.71	5982.33
6439	39393.77	20390.17	752373.99	2083488.54	5982.94
6440	39391.77	20424.72	752372.11	2083523.08	5980.87
6441	39489.91	20417.45	752470.20	2083515.49	5984.27
6442	39541.67	20392.73	752521.87	2083490.61	5987.40
6443	39511.55	20345.85	752491.59	2083443.84	5989.75
6444	39392.41	20089.03	752371.65	2083187.48	5991.72
6445	39414.92	19909.83	752393.56	2083008.25	5998.10
6446	39521.37	19968.78	752500.17	2083066.84	5998.33
6447	39536.56	19964.57	752515.35	2083062.58	5997.48
6448	39573.20	19977.84	752552.02	2083075.72	5995.15
6450	39761.19	20128.55	752740.46	2083225.77	5987.56
6451	39770.11	20160.24	752749.48	2083257.42	5987.66
6452	39804.69	20167.08	752784.07	2083264.15	5985.68
6453	39809.70	20133.97	752788.97	2083231.03	5984.89
6454	39789.58	20118.69	752768.80	2083215.82	5985.73
6455	39801.40	20197.95	752780.88	2083295.02	5986.23
6456	39758.31	20077.45	752737.41	2083174.69	5987.22
6457	39735.39	20083.21	752714.52	2083180.53	5988.72
6458	39733.02	20053.69	752712.05	2083151.03	5988.65
6459	39751.21	20051.81	752730.22	2083149.09	5987.70
6460	39758.89	20011.31	752737.77	2083108.57	5986.62
6461	39789.83	20002.81	752768.67	2083099.97	5985.32
6462	39763.62	19964.75	752742.34	2083062.01	5985.82
6463	39743.85	19936.88	752722.49	2083034.21	5986.17
6464	39705.93	19888.81	752684.42	2082986.28	5986.73
6465	39675.87	19887.92	752654.36	2082985.49	5988.69
6466	39663.42	19895.72	752641.95	2082993.33	5989.67
6467	39725.94	19945.85	752704.61	2083043.23	5987.00
6468	39554.05	19783.26	752532.23	2082881.26	5991.48
6469	39549.12	19771.86	752527.27	2082869.88	5991.35
6470	39533.30	19779.90	752511.48	2082877.97	5992.47
6471	39536.95	19790.38	752515.16	2082888.43	5992.53
6472	39485.65	19946.73	752464.39	2083044.90	5999.64
6473	39475.99	19925.72	752454.66	2083023.94	5999.48
6474	39466.99	19929.42	752445.68	2083027.67	5999.35
6475	39470.40	19950.25	752449.16	2083048.47	5999.36

ANCHOR TRENCH POINTS (SHEET2)

POINT	COORDINATE SYSTEM				ELEVATION
	ROCKY FLATS		STATE PLANE		
	NORTHING	EASTING	NORTHING	EASTING	
12000	39353.50	19499.90	752330.80	2082598.63	5994.10
12001	39312.40	19600.00	752290.04	2082698.84	5992.90
12002	39273.20	19700.00	752251.18	2082798.95	5991.80
12003	39239.30	19800.00	752217.61	2082899.03	5991.20
12004	39227.50	19900.00	752206.15	2082999.05	5991.10
12005	39225.00	20000.00	752203.98	2083099.02	5989.50
12006	39230.80	20100.00	752210.11	2083198.97	5988.20
12007	39245.20	20200.00	752224.83	2083298.91	5987.20
12008	39261.80	20300.00	752241.76	2083398.82	5985.00
12009	39285.50	20400.00	752265.78	2083498.72	5983.00
12010	39326.00	20500.00	752306.60	2083598.56	5981.40
12011	39374.60	20600.00	752355.52	2083698.38	5980.20
12012	39417.30	20700.00	752398.54	2083798.21	5978.60
12013	39457.90	20800.00	752439.46	2083898.05	5974.30
12014	39489.30	20900.00	752471.18	2083997.92	5970.30
12015	39518.90	21000.00	752501.10	2084097.79	5968.90
12016	39547.70	21100.00	752530.22	2084197.67	5967.10
12017	39555.90	21129.40	752538.52	2084227.04	5966.60
12018	39639.40	21077.10	752621.83	2084174.47	5959.60
12019	39691.60	21009.50	752673.79	2084106.72	5946.90
12020	39710.40	20955.20	752692.40	2084052.38	5942.50
12021	39752.30	20924.70	752734.19	2084021.74	5940.00
12022	39855.90	20905.30	752837.71	2084002.01	5934.60
12023	39873.60	20895.60	752855.37	2083992.25	5935.10
12024	39894.40	20889.40	752876.15	2083985.98	5934.60
12025	39912.40	20879.50	752894.10	2083976.03	5935.10
12026	40006.10	20853.40	752987.70	2083949.62	5940.60
12027	40017.80	20864.10	752999.42	2083960.28	5942.00
12028	40056.80	20936.00	753038.65	2084032.03	5946.10
12029	39533.60	21048.00	752515.96	2084145.73	5968.00
12030	39534.60	20916.00	752516.53	2084013.77	5968.80
12031	39836.50	20689.70	752817.60	2083786.52	5972.60
12032	39988.40	20709.90	752969.52	2083806.22	5971.00
12033	40091.90	20721.20	753073.04	2083817.18	6999.00
12034	40175.00	20770.60	753156.27	2083866.28	5968.00
12035	40075.50	20900.00	753057.23	2083995.98	5963.10
12036	40080.90	20939.00	753062.76	2084034.95	5962.00
12037	40099.80	20946.00	753081.67	2084041.89	5962.00
12038	40197.10	20971.00	753179.03	2084066.56	5963.20
12041	40189.20	20900.00	753170.90	2083995.61	5964.90
12042	40172.70	20750.00	753153.90	2083845.70	5968.30
12044	40155.60	20594.10	753136.30	2083689.90	5975.50
12045	40132.60	20418.20	753112.73	2083514.12	5976.90
12046	40123.50	20400.00	753103.57	2083495.96	5977.10
12047	40100.00	20352.20	753079.91	2083448.24	5977.70
12048	40073.30	20300.00	753053.05	2083396.14	5978.30
12049	40011.20	20200.00	752990.64	2083296.38	5979.90
12050	39945.40	20100.00	752924.52	2083196.62	5981.70
12051	39876.90	20000.00	752855.71	2083096.87	5983.60
12052	39800.00	19886.30	752778.46	2082983.46	5984.80
12053	39741.40	19800.00	752719.59	2082897.37	5985.70
12054	39700.00	19740.50	752678.00	2082838.03	5986.30
12055	39670.20	19700.00	752648.07	2082797.64	5986.80
12056	39648.60	19672.00	752626.39	2082769.71	5987.20
12057	39612.90	19600.30	752590.46	2082698.15	5987.40
12058	39600.40	19565.40	752577.85	2082663.30	5987.30
12059	39570.70	19500.30	752547.94	2082598.32	5987.40
12060	39549.80	19459.90	752526.92	2082558.00	5988.00
12061	39529.20	19429.20	752506.22	2082527.37	5988.90
12062	39499.90	19418.70	752476.89	2082516.97	5990.10
12063	39449.90	19430.20	752426.94	2082528.64	5992.20
12064	39400.00	19457.80	752377.14	2082556.39	5994.00
12065	39382.20	19467.60	752359.39	2082566.25	5994.00

SEEP SYSTEM (SHEET 3)

POINT	COORDINATE SYSTEM				ELEVATION	DESCRIPTION
	ROCKY FLATS		STATE PLANE			
	NORTHING	EASTING	NORTHING	EASTING		
1	39865.00	20861.31	752846.65	2083958.00	5922.85	CP1BD-CONNECT EXIST SEEP
15	39642.21	21070.61	752624.62	2084167.98	5960.31	TOP OF STRIP DRAIN
18	39655.56	21028.44	752637.83	2084125.78	5954.79	TOP OF STRIP DRAIN
19	39680.90	20962.42	752662.94	2084059.68	5946.98	TOP OF STRIP DRAIN
20	39702.75	20944.02	752684.72	2084041.22	5943.28	TOP OF STRIP DRAIN
21	39718.67	20932.87	752700.60	2084030.02	5941.84	TOP OF STRIP DRAIN
22	39755.40	20906.84	752737.23	2084003.88	5939.63	TOP OF STRIP DRAIN
23	39803.92	20873.26	752785.63	2083970.15	5936.16	TOP OF STRIP DRAIN
30	39867.26	20810.83	752848.75	2083907.52	5946.52	TOP OF STRIP DRAIN
34	39614.74	20944.32	752596.74	2084041.81	5965.06	TOP OF STRIP DRAIN
36	39672.28	20900.74	752654.12	2083998.05	5957.19	TOP OF STRIP DRAIN
37	39674.72	20905.39	752656.57	2084002.69	5955.60	TOP OF STRIP DRAIN
38	39994.11	20832.98	752975.64	2083929.25	5942.40	TOP OF STRIP DRAIN
39	39695.08	20905.47	752676.93	2084002.71	5950.52	TOP OF STRIP DRAIN
41	39723.69	20868.35	752705.41	2083965.50	5954.86	TOP OF STRIP DRAIN
43	39946.39	20836.31	752927.94	2083932.74	5939.16	TOP OF STRIP DRAIN
44	40026.16	20834.29	753007.68	2083930.45	5944.95	TOP OF STRIP DRAIN
45	40080.41	20871.33	753062.05	2083967.31	5947.77	TOP OF STRIP DRAIN
47	40076.28	20800.73	753057.68	2083896.74	5952.89	TOP OF STRIP DRAIN
48	40045.65	20746.72	753026.88	2083842.84	5963.49	TOP OF STRIP DRAIN
50	40068.18	20884.69	753049.86	2083980.70	5947.62	TOP OF STRIP DRAIN
51	40059.97	20880.11	753041.63	2083976.15	5946.73	TOP OF STRIP DRAIN
52	40071.42	20862.91	753053.03	2083958.92	5948.19	TOP OF STRIP DRAIN
53	40064.39	20858.53	753045.98	2083954.56	5948.06	TOP OF STRIP DRAIN
54	40047.08	20816.84	753028.55	2083912.94	5948.19	TOP OF STRIP DRAIN
55	40063.22	20807.24	753044.64	2083903.28	5951.30	TOP OF STRIP DRAIN
56	39978.12	20832.33	752959.65	2083928.65	5941.13	TOP OF STRIP DRAIN
58	39943.83	20757.27	752925.12	2083853.73	5960.19	TOP OF STRIP DRAIN
59	39862.90	20761.18	752844.22	2083857.90	5963.50	TOP OF STRIP DRAIN
60	39746.90	20828.86	752728.48	2083925.95	5960.99	TOP OF STRIP DRAIN
61	39867.50	20858.36	752849.14	2083955.04	5948.59	TOP OF GRADE AT 4" RISER/VENT
62	39873.62	20857.70	752855.26	2083954.36	5948.15	TOP OF GRADE AT 4" RISER/VENT
63	39873.06	20860.53	752854.71	2083957.19	5947.73	TOP OF GRADE AT 4" RISER/VENT
64	39884.88	20858.50	752866.52	2083955.12	5946.59	6" RISER/VENT
65	40050.25	20736.52	753031.45	2083832.63	5965.08	TOP OF STRIP DRAIN
4698	39915.70	20945.61	752897.62	2084042.11	5924.70	TOP 8"PIPE NGWIS
4699	39981.77	20968.77	752963.75	2084065.04	5931.56	TOP 8"PIPE NGWIS
4700	40025.36	20982.87	753007.37	2084079.00	5935.76	TOP 8"PIPE NGWIS
4701	40084.40	20999.37	753066.46	2084095.29	5943.77	TOP 8"PIPE NGWIS
4709	40122.65	21012.15	753104.74	2084107.95	5951.13	TOP 8"PIPE NGWIS
4710	40141.02	21019.64	753123.13	2084115.37	5952.97	TOP 8"PIPE NGWIS
4711	40158.40	21027.10	753140.53	2084122.78	5953.55	TOP 8"PIPE NGWIS
4712	40160.91	21027.79	753143.04	2084123.46	5953.61	TOP 8"PIPE NGWIS
4713	40162.50	21027.47	753144.63	2084123.13	5953.78	TOP 8"PIPE NGWIS
4714	40162.57	21026.58	753144.70	2084122.24	5953.87	TOP 8"PIPE NGWIS
4715	40162.30	21025.47	753144.42	2084121.13	5953.93	TOP 8"PIPE NGWIS
4716	39892.49	20981.03	752874.54	2084077.60	5923.01	TOP OF WALL BOX
4717	39903.90	20978.84	752885.93	2084075.37	5923.02	TOP OF WALL
4718	39900.73	20962.26	752882.71	2084058.80	5923.02	TOP OF WALL
4719	39889.35	20964.44	752871.34	2084061.02	5923.00	TOP OF WALL
4720	39891.03	20967.91	752873.04	2084064.48	5920.77	LIP OF STEP BOX
4721	39900.42	20966.11	752882.41	2084062.65	5920.72	LIP OF STEP
4724	39902.57	20977.60	752884.60	2084074.13	5918.76	LIP OF STEP
4725	39893.26	20979.39	752875.30	2084075.95	5918.80	LIP OF STEP
4726	39898.35	20980.23	752880.39	2084076.78	5918.88	TOP 6" PIPE OUTLET OF BOX
4727	39891.85	20965.07	752873.85	2084061.64	5921.62	TOP 1" PIPE SOUTH INLET
4728	39898.71	20963.71	752880.69	2084060.25	5922.05	TOP 6" PIPE NORTH INLET
4729	39897.94	20958.13	752879.91	2084054.69	5921.54	MANHOLE FLOOR NORTH
4730	39898.07	20959.90	752880.04	2084056.45	5922.09	TOP 6" PIPE NORTH MANHOLE
4731	39899.26	20957.11	752881.22	2084053.66	5924.42	TOP 8" PIPE
4732	39898.68	20956.84	752880.64	2084053.40	5924.24	TOP 6" PIPE
4734	39890.82	20961.09	752872.80	2084057.66	5921.59	TOP 1" PIPE SOUTH MANHOLE
4735	39890.45	20957.78	752872.42	2084054.36	5921.76	TOP 6" PIPE
4736	39890.55	20959.62	752872.53	2084056.19	5919.04	MANHOLE FLOOR, SOUTH
4737	39875.78	20946.55	752857.72	2084043.18	5926.80	TOP CLAY WALL , 19.0 BOTTOM
4738	39881.55	20949.05	752863.49	2084045.66	5925.90	TOP CLAY WALL , 19.0 BOTTOM
4739	39899.79	20945.67	752881.71	2084042.22	5925.70	TOP CLAY WALL , 19.0 BOTTOM
4740	39905.79	20939.03	752887.69	2084035.56	5925.40	TOP CLAY WALL , 19.0 BOTTOM
4741	39908.30	20941.41	752890.21	2084037.93	5925.30	TOP CLAY WALL , 19.0 BOTTOM
4742	39900.08	20949.66	752882.02	2084046.21	5925.90	TOP CLAY WALL , 19.0 BOTTOM
4743	39892.19	20952.48	752874.14	2084049.06	5925.90	TOP CLAY WALL , 19.0 BOTTOM
4744	39891.10	20949.97	752873.05	2084046.55	5925.90	TOP CLAY WALL , 19.0 BOTTOM
4745	39883.52	20952.86	752865.48	2084049.47	5926.00	TOP CLAY WALL , 19.0 BOTTOM
4746	39874.75	20949.32	752856.69	2084045.95	5926.80	TOP CLAY WALL , 19.0 BOTTOM
4747	39899.41	20955.58	752881.37	2084052.13	5924.32	TOP 6" PIPE AT ELBOW
4748	39898.21	20948.27	752880.14	2084044.83	5924.59	TOP 8" PIPE AT BENTONITE WALL
4751	39896.18	20957.35	752878.15	2084053.91	5924.50	TOP 8"PIPE NORTH MANHOLE
4752	39858.67	20949.38	752840.62	2084046.07	5926.64	TOP 8"PIPE SGWIS
4753	39813.67	20983.18	752795.75	2084080.01	5927.99	TOP 8"PIPE SGWIS
4754	39792.12	21013.16	752774.30	2084110.05	5930.16	TOP 8"PIPE SGWIS
4755	39772.27	21048.94	752754.57	2084145.88	5934.17	TOP 8"PIPE SGWIS
4756	39711.27	21129.34	752693.85	2084226.46	5943.70	TOP 8"PIPE SGWIS
4757	39701.65	21140.50	752684.28	2084237.65	5940.23	TOP 8"PIPE SGWIS
4758	39701.29	21140.91	752683.92	2084238.07	5940.24	TOP 8"PIPE SGWIS
4759	39698.93	21142.74	752681.56	2084239.90	5940.42	TOP 8"PIPE SGWIS
4760	39697.34	21142.95	752679.97	2084240.12	5940.56	TOP 8"PIPE SGWIS
4761	39696.72	21140.89	752679.35	2084238.06	5940.69	TOP 8"PIPE SGWIS
4762	39888.00	20951.00	752869.95	2084047.59	5922.06	TOP 6" PIPE AT BENTONITE WALL

LANDFILL POND SEDIMENT PLACEMENT POINTS (SHEET 2)

POINT	COORDINATE SYSTEM				ELEVATION
	ROCKY FLATS		STATE PLANE		
	NORTHING	EASTING	NORTHING	EASTING	
2160	40110.54	20709.83	753091.63	2083805.75	5967.77
2161	40080.40	20735.30	753061.59	2083831.31	5966.42
2162	40000.65	20699.26	752981.74	2083795.54	5967.01
2163	39917.67	20690.48	752898.75	2083787.03	5970.15
2164	39834.57	20698.97	752815.70	2083795.80	5971.85
2165	39756.99	20716.01	752738.19	2083813.09	5971.61
2166	39675.15	20739.29	752656.45	2083836.63	5972.44
2167	39605.76	20787.70	752587.24	2083885.26	5970.88
2168	39523.12	20805.07	752504.68	2083902.90	5971.02
2169	39453.34	20822.25	752452.26	2083917.08	5970.88
2170	39424.86	20755.64	752426.72	2083850.29	5973.43
2171	39416.78	20683.73	752396.15	2083776.44	5975.03
2172	39386.14	20610.46	752364.11	2083702.01	5975.12
2173	39442.08	20575.44	752422.90	2083673.59	5979.81
2174	39526.57	20575.66	752507.37	2083673.54	5979.89
2175	39616.54	20575.97	752597.32	2083673.55	5979.18
2176	39704.74	20575.25	752685.49	2083672.54	5978.60
2177	39793.43	20578.21	752774.17	2083675.20	5978.15
2178	39870.89	20575.77	752851.60	2083672.51	5977.27
2179	39947.94	20575.53	752928.63	2083672.01	5976.81
2180	40030.84	20577.82	753011.52	2083674.03	5976.52
2181	40108.97	20598.29	753089.69	2083694.24	5974.20

VENT SYSTEM POINTS (SHEET 2)

POINT	COORDINATE SYSTEM				ELEVATION
	ROCKY FLATS		STATE PLANE		
	NORTHING	EASTING	NORTHING	EASTING	
14502	39686.57	20013.25	752665.48	2083110.75	5996.02
14521	39378.40	19861.15	752356.88	2082959.71	6001.51
14558	39418.73	19726.38	752396.76	2082824.84	6001.35
14573	39502.51	19629.83	752480.20	2082728.03	5997.27
14827	39712.18	20421.24	752692.42	2083518.54	5991.45
14857	39851.15	20356.99	752831.15	2083453.86	5992.31
14864	39576.04	20496.08	752556.57	2083593.81	5989.31
14889	39967.39	20610.32	752948.19	2083706.73	5980.16
14894	39812.29	20653.71	752793.28	2083750.62	5979.16
14925	39644.11	20702.71	752625.30	2083800.17	5979.85
15671	39553.30	20061.18	752532.39	2083159.10	6001.97
15672	39449.17	20108.98	752428.45	2083207.23	6000.47

MONITORING WELLS (SHEET 3)

POINT	COORDINATE SYSTEM				ELEVATION	DESCRIPTION
	ROCKY FLATS		STATE PLANE			
	NORTHING	EASTING	NORTHING	EASTING		
16309	39710.51	19576.16	752687.96	2082673.69	5990.62	MONITORING WELL No. 70193
16310	39114.70	19290.46	752091.37	2082390.03	5998.08	MONITORING WELL No. 70393
16312	39092.14	19700.45	752070.17	2082799.99	5991.38	MONITORING WELL No. 70693
16342	40024.78	20998.76	753006.84	2084094.88	5937.71	MONITORING WELL No. 73005
16425	39785.21	21121.00	752767.74	2084217.88	5937.36	MONITORING WELL No. 73205
16435	39896.74	20953.72	752878.70	2084050.28	5926.10	MONITORING WELL No. 73105

PARAGON
LAND CONSULTANTS, INC.
Norfolk Park Centre II
416 Norfolk Street
Aurora, Colorado 80011
(720) 857-8800 Fax: (720) 857-8900

U.S. Department of Energy Rocky Flats Environmental Technology Site Golden, Colorado

ASBUILT SURVEY

ASBUILT POINT TABLES

Revisions		
No.	Date	Description

Drawing File:	FINAL-AZB4
Issue Date:	08/29/2005
Drawn By:	PEG
Checked By:	MJG
Sheet Number:	4 of 4

Rocky Flats Environmental Technology Site

ASBUILT SURVEYS

AS OF 08/11/2005

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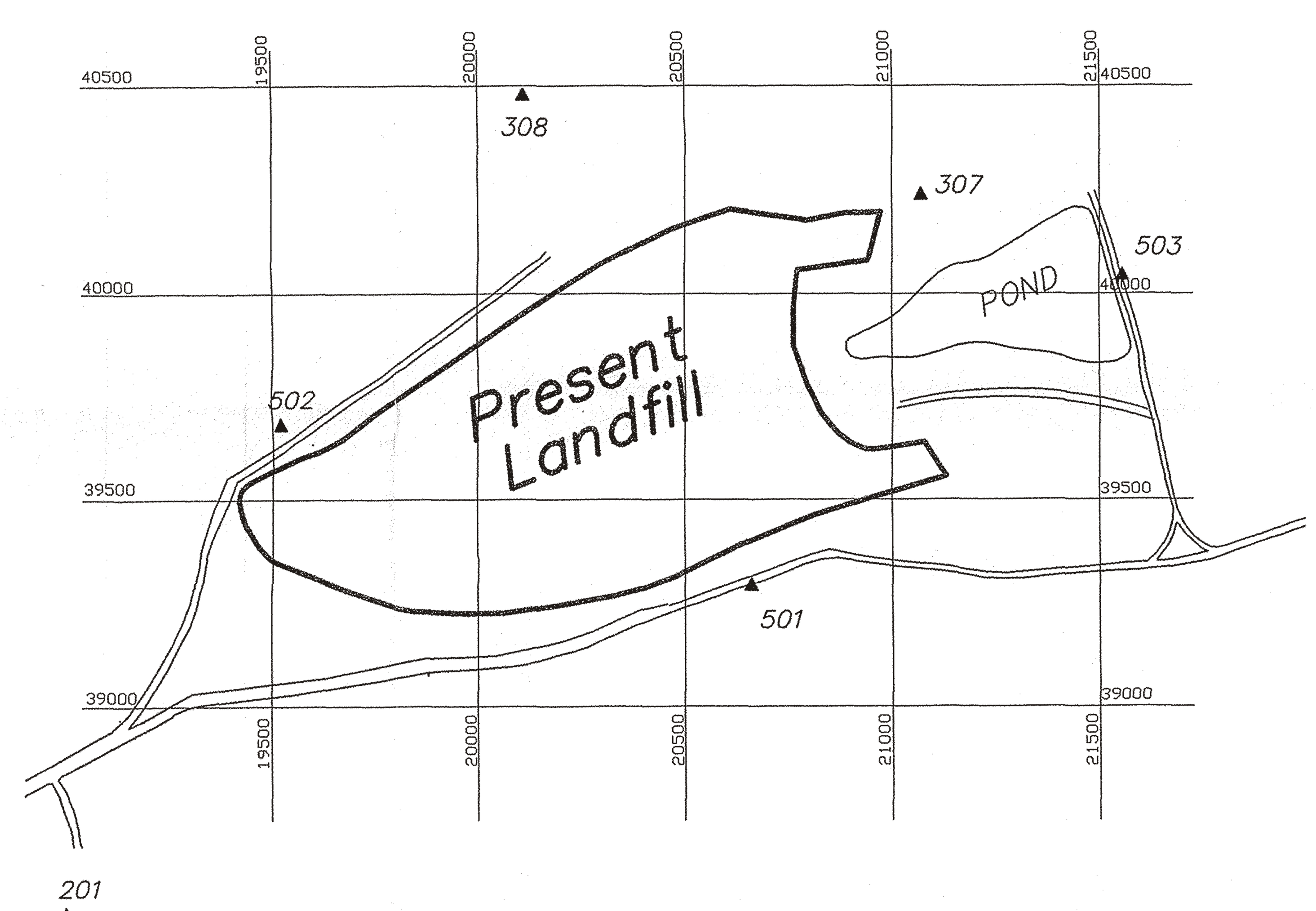

PROJECT CONTROL POINTS

	COORDINATE SYSTEM					
	ROCKY FLATS		STATE PLANE			
POINT	NORTHING	EASTING	NORTHING	EASTING	ELEVATION	DESCRIPTION
200	37500.00	17700.00	750471.8406	2080805.3185	6039.20	RECOVERED 1.5" ALUM CAP
201	38500.00	19000.00	751475.8703	2082101.6792	6007.73	RECOVERED 1.5" ALUM CAP
202	36500.00	23500.00	749491.2460	2086607.1040	–	RECOVERED 1.5" ALUM CAP
307	40239.02	21069.24	753221.27	2084164.64	5961.86	RECOVERED 1.5" ALUM CAP
308	40478.50	20108.70	753457.52	2083203.56	5986.15	RECOVERED 1.5" ALUM CAP
501	39289.78	20658.87	752270.92	2083757.51	5974.00	SET #4 REBAR
502	39678.87	19517.26	752656.14	2082614.91	5992.16	SET #4 REBAR
503	40043.79	21556.16	753027.70	2084652.07	5927.01	SET #4 REBAR

Paragon used the following conversion as required and provided by Kaiser-Hill Company to determine State Plane Coordinates.

State Plane to Rocky Flats Coordinate System:

1. (ACAD: Turn on all layers) Insert the following points into the State Plane Coordinate System drawing:

State Plane Coordinates

Point	Northing	Easting	Elevation	Description
3	747633.2251	2078764.6108	6093.5700	LEV=FB2/61
200	750471.8406	2080805.3185	6039.2000	
201	751475.8703	2082101.6792	6007.7300	
202	749491.2460	2086607.1040	0.0000	
208	749979.3939	2088943.9068	0.0000	

2. Scale the entire drawing around base point 0,0,6000 (x,y,z) by the factor 1.00025586417. The coordinate results from this action result in Modified State Plane coordinates, with the inserted points having coordinates as follows:

Modified State Plane Coordinates

Point	Northing	Easting	Elevation	Description
3	747824.519	2079296.493	6093.5700	LEV=FB2/61
200	750663.859	2081337.722	6039.2000	
201	751668.146	2082634.414	6007.7300	
202	749683.014	2087140.992	0.0000	
208	750171.288	2089478.391	0.0000	

3. Move the entire drawing, using Point 202 (2087140.992,749683.014 (x,y))as the base point and moving it to 23500,36500 (x,y).

4. Rotate the entire drawing around base point Point 202 (23500, 36500 (x,y)) -0.1891666 degrees. The resulting drawing is in Rocky Flats Coordinate System, and should be verified by checking that the coordinates of the inserted points are as follows (ACAD: Check Points, modify project):

Rocky Flats Coordinate System

Point	Northing	Easting	Elevation	Description
3	34667.4130	15649.4070	6093.5700	LEV=FB2/61
200	37500.0000	17700.0000	6039.2000	
201	38500.0000	19000.0010	6007.7300	
202	36500.0000	23500.0000	0.0000	
208	36980.5530	25839.0000	0.0000	

Rocky Flats to State Plane Coordinate System:

1. Insert the points from Step 4 under State Plane to Rocky Flats Coordinate System above into the Rocky Flats Coordinate System drawing.

2. Rotate the entire drawing around base point Point 202 (23500, 36500 (x,y)) +0.1891666 degrees.

3. Move the entire drawing, using Point 202 (23500,36500 (x,y)) as the base point and moving it to 2087140.992,749683.014 (x,y). This results in Modified State Plane Coordinates that can be cross-checked with the coordinates in Step 2 under State Plane to Rocky Flats Coordinate System above.

4. Scale the entire drawing around base point 0,0,6000 (x,y,z) by the factor 0.999744201298. The resulting drawing is in the State Plane Coordinate System, and should be verified by checking that the coordinates of the inserted points are as listed in Step 1 under State Plane to Rocky Flats Coordinate System above.

Michael J. Gregory, PLS N... Date:
For And On The Behalf O...
Paragon Land Consultants, ...c.

PARAGON
LAND CONSULTANTS, INC.
Norfolk Park Centre II
416 Norfolk Street
Aurora, Colorado 80011
(720) 857-8800 Fax: (720) 857-8900

U.S. Department of Energy Rocky Flats Environmental Technology Site Golden, Colorado

ASBUILT SURVEYS

FOR THE PRESENT LANDFILL ACCELERATED ACTION

Revisions		
No.	Date	Description

Drawing File:	FINAL-AZB1
Issue Date:	08/24/2005
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Checked By:	MJG
Sheet Number:	1 of 4