03

Los Alamos
NATIONAL LABORATORY
EST. 1943

Associate Director for ESH
Environment, Safety, and Health
P.O. Box 1663, MS K491
Los Alamos, New Mexico 87545
505-667-4218/Fax 505-665-3811

RECEIVED

OCT 6 2014

NMED
Hazardous Waste Bureau

ENTERED

National Nuclear Security Administration
Los Alamos Field Office, MS A316
Environmental Projects Office
Los Alamos, New Mexico 87544
(505) 667-4255/FAX (505) 606-2132

Date: OCT 06 2014
Refer To: ADESH-14-094

John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the Response to Comments and Replacement Pages – Completion Report for the Sandia Canyon Grade-Control Structure

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the Response to comments and replacement pages – Completion Report for Sandia Canyon Grade-Control Structure. Also enclosed is an electronic copy of a redline strikeout version of the report that includes all changes made in response to the New Mexico Environment Department's approval with modifications dated September 5, 2014.

If you have any questions, please contact Steve Veenis at (505) 667-0013 (veenis@lanl.gov) or Ramoncita Massey at (505) 665-7771 (ramoncita.massey@nnsa.doe.gov).

Sincerely,

Michael T. Brandt, DrPH, CIH, Associate Director
Environment, Safety, and Health
Los Alamos National Laboratory

Sincerely,

Peter Maggiore, Assistant Manager
Environmental Projects Office
Los Alamos Field Office

MB/PM/DM/SV:sm

Enclosures: Two hard copies with electronic files:

(1) Response to the Approval with Modification for the Completion Report for Sandia Canyon Grade-Control Structure (LA-UR-14-27523)

(2) Replacement Pages for the Completion Report – Sandia Canyon Grade-Control Structure Revision 1 (LA-UR-14-27522)

(3) An electronic copy of the redline-strikeout version of the plan that includes all changes and edits to the document

Cy: (w/enc.)
Hai Shen, DOE-NA-LA, MS A316
Ramoncita Massey, DOE-NA-LA, MS A316
John McCann, EP-CAP, MS M992
Public Reading Room (EPRR)
RPF (electronic copy)

Cy: (Letter and CD and/or DVD)
Laurie King, EPA Region 6, Dallas, TX
Steve Yanicak, NMED-DOE-OB, MS M894
Tim Goering, EP-CAP, MS M992 (w/ MS Word files on CD)
PRS Database with ER ID

Cy: (w/o enc.)
Tom Skibitski, NMED-DOE-OB (date-stamped letter emailed)
lasomailbox@nnsa.doe.gov
Annette Russell, DOE-NA-LA (date-stamped letter emailed)
David Rhodes, DOE-NA-LA (date-stamped letter emailed)
Kimberly Davis Lebak, DOE-NA-LA (date-stamped letter emailed)
Dave McInroy, EP-CAP (date-stamped letter emailed)
Michael Brandt, ADESH (date-stamped letter emailed)

Response to the Approval with Modifications for the Completion Report for Sandia Canyon Grade-Control Structure, Los Alamos National Laboratory, EPA ID No. NM0890010515, HWB-LANL-13-069, Dated September 5, 2014

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. The comments are divided into general and specific categories, as presented in the approval with modifications. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment.

NMED Comment

1. *NMED notes that a stockpile of sediment (estimated volume of approximately 150 cubic) located in a small south-entering ravine, had not been characterized and addressed in the Report. NMED is concerned with both the characterization and final disposition of the material. The Permittees appear to have relocated the excavated material to an area both sloped and upstream of the sediment retention basin above the Sandia grade-control structure. The Permittees must document in the Report the erosion controls implemented to prevent the sediment from continuing to be eroded and mobilized downstream. The Permittees must also specify for what type of flood event the fill site can withstand and describe procedures that will be implemented in the event of a significant rainfall event.*

LANL Response

1. During the week of September 10, 2013, the site was inundated with unprecedented rainfall, exceeding 7 in. in a 1-wk time period in some areas of the Laboratory, with much of it falling during an extremely intense event that occurred between September 12 and 13, 2013. Roughly 600 yd^3 of material was eroded from the site of the closed Los Alamos County (the County) landfill and deposited between the first and second steel-sheet piles. During the construction phase, the sediment was removed from that area by the contractor and stockpiled to construct a large run-on control north of the valley floor west of sheet piles one and two to retain additional materials that may erode from the landfill area. Los Alamos County (the County) has installed temporary controls above the project area and is working towards a final solution in the near future.

   The remaining sediment was then placed in a small south-entering swale measuring approximately 50 by 120 ft southwest of the grade-control structure, and erosion controls were put in place to stabilize the area. The swale and fill area are above the canyon 100-yr floodplain and are not susceptible to significant upgradient run-on. The 100-year flood plain levels have been calculated and plotted for the Sandia Canyon drainage basin by LANL (LANL Engineering Standards Manual ISD 341-2). The established vegetation will resist potential erosion caused by rainfall falling directly on the fill area. Erosion controls for this area included lining the ravine with a polypropylene liner, track-walking the sediment to match existing contours, and hydroseeding. Four rows of wattles were also placed perpendicular to the slope of the swale. An earthen berm measuring approximately 30 ft was also constructed below the swale and hydroseeded to prevent any potential run-on from entering the wetlands area (Appendix D). The sediments in the stockpile were not sampled because much of it either came from the County landfill cover or was imported clean fill material and not material from the wetlands.

The wetland area and fill area has since withstood four additional flow events during the summer of 2014 over 50 cubic feet per second (cfs), with the largest storm being a 25-yr, 30-min event that generated an estimated peak discharge of 110 cfs. No significant erosion occurred after these events. The south-entering ravine and fill area as well as the entire project area have been inspected under the current construction general permit Storm Water Pollution Prevention Plan (SWPPP). The grade-control structure will continue to be inspected following rain events with discharges greater than 50 cfs and quarterly. If erosion or any indications of instability are observed, appropriate actions will be taken to ensure continued stability and functionality and will be documented in the annual performance report.

The text in section 3.4.2 of the report has been revised.

NMED Comment

2. *The Permittees report that a significant amount of rainfall (seven inches) occurred September 10 – 13th, 2013. NMED notes that this amount is greater than the 25-year, two-hour storm event that the grade-control structure was designed to withstand. Should regular storm events of this magnitude continue, the structure design may be inadequate.*

LANL Response

2. The September 2013 rain event has a 1000-year return period based on information provided by NOAA. The grade-control structure was designed to withstand a 25-yr 2-h peak flow event of 500 cfs. NMED approved and accepted the design parameters in the “Approval with Modification, Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland” (NMED 2011, 208094). The overall project goals and objectives were to arrest the headcut in the lower portion of the wetland and to maintain hydrologic and geochemical conditions to minimize contaminant migration. The September 2013 rain event occurred after sheet piles two and three had already been constructed. Estimates vary on the return-interval magnitude of the event, but it was significantly greater than a 25-yr return interval. With the exception of the loss of newly planted vegetation and the displacement of some boulders in the cascade pool, no unusual erosion was noted above or below the sheet piles. Since that time, significant additional vegetation has been established (Appendix D). The wetland area has since had four additional flow events during the summer of 2014 over 50 cfs with the largest storm being a 25-yr, 30-min event that generated an estimated peak discharge of 110 cfs. No significant erosion occurred after these events. The south-entering swale as well as the entire project area is currently being inspected under the construction general permit SWPPP. The grade-control structure will also be inspected after every runoff event greater than 50 cfs and quarterly. If erosion or any indications of instability are observed, appropriate actions will be taken to ensure continued stability and function and will be documented in the annual performance report.

The text in section 3.4.2 of the report has been revised.

REFERENCES

NMED (New Mexico Environment Department), November 15, 2011. “Approval with Modification, Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland,” New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 208094)

CONTENTS

Figures

Tables

Appendixes

Acronyms and Abbreviations

BMP	best management practice
DOE	Department of Energy (U.S.)
DRO	diesel-range organics
EPA	Environmental Protection Agency (U.S.)
ES&H	environment, safety, and health
ET	evapotranspiration
gpd	gallons per day
HEC-RAS	Hydrologic Engineering Center River Analysis System (U.S. Army Corps of Engineers surface model)
IWD	integrated work document
LANL	Los Alamos National Laboratory
NMED	New Mexico Environment Department
NWP	nationwide permit
PAH	polycyclic aromatic hydrocarbon
RPF	Records Processing Facility
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers

2. During the week of September 10, 2013, the site was inundated with unprecedented rainfall. Rainfall totals in some areas of the Laboratory exceeded 7 in. in a 1-wk time period, and much of the rain fell during an extremely intense event that occurred between September 12 and 13, 2013. These storm events were accompanied by record run-on, flooding, and erosion at the site.

   On the morning of September 17, 2013, damage to the site was summarized as follows:

   - The cascade pool lost roughly 25% of its boulders downstream.
   - Roughly 75% of recently planted site-restoration plants were lost.
   - The diversion pond overflowed, and some plastic lining was lost.

Cobbles rolled downstream from the rock aprons. Roughly 600 cubic yards of material from the Los Alamos County landfill was deposited between the first and second steel-sheet piles. During the construction phase, the sediment was removed from that area by the contractor and stockpiled to construct a large run-on control north of the valley floor west of sheet piles one and two to retain additional materials that may erode from the landfill area. Los Alamos County has installed temporary controls above the project area and is working towards a final solution in the near future.

The remaining sediment was then placed in a small south-entering swale measuring approximately 50 ft by 120 ft southwest of the grade-control structure and erosion controls were put in place for stabilization of the area. The swale and fill area are above the 100-year floodplain and are not susceptible to significant upgradient run-on. The 100-year flood plain levels have been calculated and plotted for the Sandia Canyon drainage basin by LANL (LANL Engineering Standards Manual). The established vegetation will resist potential erosion caused by rainfall falling directly on the fill area. Erosion controls for this area included lining the ravine with a polypropylene liner, track-walking the sediment to match existing contours, and hydroseeding. Four rows of wattles were also placed perpendicular to the slope of the swale. An earthen berm measuring approximately 30 ft was also constructed below the swale and hydroseeded to prevent any potential run-on from entering the wetlands area (Appendix D). The sediments in the stockpile were not sampled because much of it either came from the County landfill cover or was imported clean fill material and not material from the wetlands.

The wetland area and fill area has since withstood four additional flow events during the summer of 2014 over 50 cubic feet per second (cfs), with the largest storm being a 25-yr, 30-min event that generated an estimated peak discharge of 110 cfs. No significant erosion occurred after these events. The south-entering ravine and fill area as well as the entire project area have been inspected under the current construction general permit Storm Water Pollution Prevention Plan (SWPPP). The grade-control structure will continue to be inspected following rain events with discharges greater than 50 cfs and quarterly. If erosion or any indications of instability are observed, appropriate actions will be taken to ensure continued stability and functionality and will be documented in the annual performance report.

The second event resulted in significant delays to completing construction. Extensive repairs were required, including the design and construction of best management practice (BMP) run-on control structures (see Appendix E), repair of the sump pond and diversion system, replacement of boulders and repair of the cascade pool liner, removal of deposited sediments and regrading, and replanting of the lost plants. One month of work was required to recover from this event.

The September 2013 rain event has a 1000-year return period based on information provided by NOAA. The grade-control structure was designed to withstand a 25-yr 2-h peak flow event of 500 cfs. NMED approved and accepted the design parameters in the “Approval with Modification, Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland.” (NMED 2011, 208094) The overall project goals and objectives were to arrest the headcut in the lower portion of the wetland and to maintain hydrologic and geochemical conditions to minimize contaminant migration. The September 2013 rain event occurred after sheet piles two and three had already been constructed. Estimates vary on the return-interval magnitude of the event, but it was significantly greater than a 25-yr return interval. With the exception of the loss of newly planted vegetation and the displacement of some boulders in the cascade pool, no unusual erosion was noted above or below the sheet piles. Since that time, significant additional vegetation has been established (Appendix D). The wetland area has since had four additional flow events during the summer of 2014 over 50 cfs with the largest storm being a 25 yr, 30-min event that generated an estimated peak discharge of 110 cfs. No significant erosion occurred after these events. The south-entering swale as well as the entire project area is currently being inspected under the construction general permit SWPPP. The grade-control structure will also be inspected after every runoff event greater than 50 cfs and quarterly. If erosion or any indications of instability are observed, appropriate actions will be taken to ensure continued stability and function and will be documented in the annual performance report.

3.5 As-Built Drawings

A set of as-built drawings after construction for the grade-control structure can be found in Appendix C.

3.6 Photo Documentation

Photos of the grade-control structure can be found in Appendix D as well as photos of the run-on BMPs.

3.7 Deviations

The following deviation from the work plan occurred. NMED's approval with modification of the interim measures work plan required that "In the final design, the Permittees must propose to remove all post-1942 alluvial sediments that are present within reach S-2 of Sandia Canyon below the grade-control structure, and to place these sediments as fill behind the grade-control structure" (NMED 2011, 203806).

As previously discussed, the Sandia Wetland grade-control structure project was permitted under the USACE Nationwide Permit (NWP) 38 for Cleanup of Hazardous and Toxic Waste (USACE 2013, 251704). The Laboratory pursued permission from the USACE to fulfill the NMED requirement (LANL 2013, 251705), but it was concluded that NWP 38 General Condition 6 would be violated by the placement of sediments that contain toxic pollutants in toxic amounts into jurisdictional waters (USACE 2013, 251706). Thus, the Laboratory did not remove post-1942 alluvial sediments within reach S-2 of Sandia Canyon and use them as fill behind the grade-control structure.

4.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), May 2011. "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," Los Alamos National Laboratory document LA-UR-11-2186, Los Alamos, New Mexico. (LANL 2011, 203454)

LANL (Los Alamos National Laboratory), September 2011. "Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland," Los Alamos National Laboratory document LA-UR-11-5337, Los Alamos, New Mexico. (LANL 2011, 207053)

LANL (Los Alamos National Laboratory), September 4, 2013. "Action No. SPA-2012-00050-ABQ Potential Removal and Placement of Sediments at Sandia Canyon Wetland," Los Alamos National Laboratory letter (ENV-DO-13-0073) to W. Oberle (USACE) from A.R. Grieggs (LANL) and G.E. Turner (DOE-NA-00-LA), Los Alamos, New Mexico. (LANL 2013, 251705)

NMED (New Mexico Environment Department), January 4, 2011. "Approval with Modification, Phase II Investigation Work Plan for Sandia Canyon," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 111518)

NMED (New Mexico Environment Department), June 9, 2011. "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 203806)

NMED (New Mexico Environment Department), November 15, 2011. "Approval with Modification, Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 208094)

USACE (U.S. Army Corps of Engineers), March 27, 2013. "Action No. SPA-2012-00050-ABQ, McCann, LANL, Sandia Canyon, Wetland, Los Alamos County, NM," USACE letter to J. McCann (LANL) from W. Oberle (USACE), Albuquerque, New Mexico. (USACE 2013, 251704)

USACE (U.S. Army Corps of Engineers), September 5, 2013. "Potential Violation - Action No. SPA-2012-00050-ABQ, McCann, LANL, Sandia Canyon, Wetland, Los Alamos County, NM," USACE letter to G. Turner (DOE-NA-00-LA) and A.R. Grieggs (LANL) from W. Oberle (USACE), Albuquerque, New Mexico. (USACE 2013, 251706)

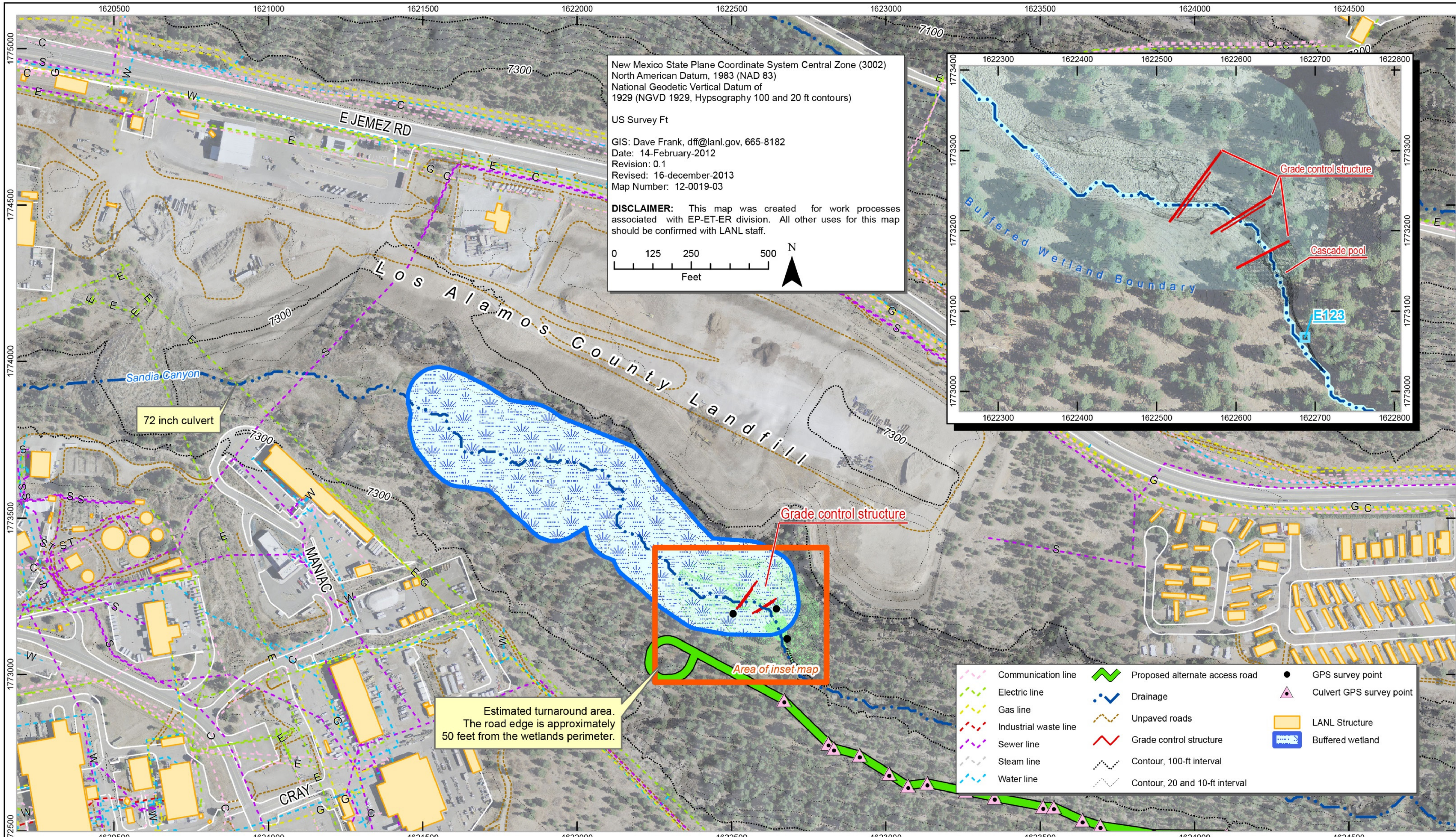


Figure 1 Location of Sandia Canyon grade-control structure

Table 1
Permits and Permissions Obtained

Permit	Agency
National Environmental Policy Act Assessment	U.S. Department of Energy
Section 7 Biological Assessment Consultation under the Endangered Species Act	U.S. Department of Interior Fish and Wildlife Service
National Pollutant Discharge Elimination System Construction General Permit	EPA
Section 404 NWP 38 for Cleanup of Hazardous and Toxic Waste under the Clean Water Act	USACE
Section 401 Water Quality Certification Permit under the Clean Water Act	NMED Surface Water Quality Bureau

Table 2
Analytical Results for Sample CASA-13-34678
Using SW-846 EPA Method 8270

Analyte Name	Result	Units
Anthracene	18,000	µg/kg
Carbazole	3400	µg/kg
Dibenzofuran	21,000	µg/kg
Fluorene	9200	µg/kg
2-Methylnaphthalene	38,000	µg/kg
Naphthalene	8800	µg/kg
Phenanthrene	8300	µg/kg
Pyrene	5500	µg/kg
TPH-DRO	11,000	mg/kg

Sandia wetland run-on control and grade-control structure looking southeast, December 5, 2013

Sheet-pile wall 1 looking upstream, September 23, 2014

Sheet-pile wall 2 looking upstream, September 23, 2014

Cascade structure looking downstream, September 23, 2014

Erosion controls at south-entering swale looking southeast with established vegetation and no signs of erosion or rilling taking place, September 23, 2014

Earthen berm erosion control below south-entering swale looking south with established vegetation and no signs of erosion or rilling taking place, September 23, 2014

LA-UR-13-29285
December 2013
EP2013-0291

Completion Report for Sandia Canyon Grade-Control Structure

Los Alamos
NATIONAL LABORATORY

Prepared by the Environmental Programs Directorate

EP2013-0291

Completion Report for Sandia Canyon Grade-Control Structure

December 2013

Responsible project manager:

John McCann	[signature]	Project Manager	Environmental Programs	12-17-2013
Printed Name	Signature	Title	Organization	Date

Responsible LANS representative:

Jeff Mousseau	[signature]	Associate Director	Environmental Programs	12-17-13
Printed Name	Signature	Title	Organization	Date

Responsible DOE representative:

Peter Maggiore	[signature]	Assistant Manager	DOE-NA-00-LA	12-18-13
Printed Name	Signature	Title	Organization	Date

CONTENTS

Figures

Tables

Appendixes

Acronyms and Abbreviations

BMP	best management practice
DOE	Department of Energy (U.S.)
DRO	diesel-range organics
EPA	Environmental Protection Agency (U.S.)
ES&H	environment, safety, and health
ET	evapotranspiration
gpd	gallons per day
HEC-RAS	Hydrologic Engineering Center River Analysis System (U.S. Army Corps of Engineers surface model)
IWD	integrated work document
LANL	Los Alamos National Laboratory
NMED	New Mexico Environment Department
NWP	nationwide permit
PAH	polycyclic aromatic hydrocarbon
RPF	Records Processing Facility
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) has prepared this completion report in response to the New Mexico Environment Department's (NMED's) approval of the "Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland" (LANL 2011, 207053; NMED 2011, 208094) and in response to requirements set forth originally in NMED's "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland" (NMED 2011, 203806). The "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland" (LANL 2011, 203454) was prepared in response to NMED's "Approval with Modification, Phase II Investigation Work Plan for Sandia Canyon" (NMED 2011, 111518). This completion report provides project goals and objectives, design and performance criteria, and as-built drawings of the Sandia Canyon wetland grade-control structure. The grade-control structure consists of three stepped sheet-pile walls that were constructed as a measure to physically stabilize the Sandia Canyon wetland.

The overall project goals and objectives were to arrest the headcut in the lower portion of the wetland and to maintain hydrologic and geochemical conditions to minimize contaminant migration. The project consisted of installing three stepped sheet-pile walls to form a grade-control structure to stabilize the headcut and allow a grade transition from the wetland surface upstream of the grade-control structure to the stream grade near stream gage E123 (Figure 1). Design features should also allow reduction of effluent in the canyon without compromising physical and geochemical function of the wetland. The area behind the grade-control structure was backfilled and wetland vegetation was planted to allow expansion of the wetland area. These measures will physically stabilize the wetland by reducing sediment and associated contaminant transport into the lower sections of the canyon and should also maintain reducing conditions within the wetland sediments, thus contributing to the goal of reducing potential contaminant transport.

The wetland is located in reach S-2 of Sandia Canyon. The largest drainage contributing to the wetland flows through a 72-in. corrugated metal pipe culvert a short distance upstream of the wetland. A single stream channel is present within the upper one-third of the wetland, and wetland vegetation is established on floodplains inset relative to older wetland surfaces. In the lower two-thirds of the wetland, surface water is generally present across much of the width of the wetland. Prior to construction of the grade-control structure, the terminus of the wetland had an active headcut. Willows had been planted in and around the headcut but failed to stabilize it. Downstream of the wetland, the stream system enters a narrow canyon reach and is stable, with bedrock exposed along much of the stream bed. Stream gage E123 is located a short distance below the wetland.

2.0 ENGINEERING

2.1 Design Objectives

The grade-control structure was designed to meet the following objectives:

- Provide an even grade to allow wetland expansion and further stabilization
- Be sufficiently impervious to prevent the draining of alluvial soils
- Facilitate nonchanneled flow
- Minimize erosion during large flow events
- Support wetland function under reduced effluent conditions

2.2 Design Criteria

2.2.1 Base Flow Hydrology

Stream flow from combined effluent sources in Sandia Canyon has averaged approximately 250,000 to 350,000 gallons per day (gpd). These base flows feed the groundwater within the reach, providing adequate hydrology and soil moisture conditions where the wetland vegetation can flourish.

2.2.2 Storm Flow Hydrology

A 25-yr, 2-h storm event with a peak design flow of 500 cubic feet per second was used for the design of the grade-control structure as required by the Laboratory's design guidance. The primary goal was to reduce the stream velocity in the area of the grade-control structure to less than 6 ft per second. Design parameters were determined using Hydrologic Engineering Center River Analysis System (HEC-RAS) modeling. The hydrologic calculations can be found in Appendix A, and hydraulics calculations can be found in Appendix B.

2.2.3 Water Balance

The wetland currently receives approximately 250,000 to 350,000 gpd of inflow from combined effluent sources. To address the potential for reduced effluent volumes into Sandia Canyon, estimations of the evapotranspiration (ET) across the wetland footprint was performed using Penman-Monteith equations. Modeling indicates that the maximum 30-day ET is approximately 11 in. This results in an estimated minimum effluent volume to maintain wetland vegetation in Sandia Canyon of approximately 30,000 gpd.

2.2.4 Design Features

The grade-control structure, as shown in the as-built drawings (Appendix C), transitions the grade approximately 11 vertical feet from the elevation of the current wetland just upgradient of the former headcut location to the natural stream bed just upstream of stream gage E123. To maintain grade and to reduce the overall fill and size of a single structure, a set of three steel-sheet-pile walls was installed with smaller elevation drops. Downstream of the third sheet-pile wall, a cascade pool was constructed of boulders and cobbles to transition to the final grade.

Three sheet-pile walls were installed with the following design elements:

- The sheet piles were installed into 2-ft-deep trenches into bedrock. Trenches were backfilled to the elevation of the bedrock with bentonite.
- Seep holes were cut into the sheet piles at consistent elevations across each sheet pile to encourage smaller, braided channels through the restored sections of wetland to establish vegetation.
- Stone splash pools were installed just downgradient of each sheet pile to prevent scour holes and to slow the water.
- Sheet piles were capped with reinforced concrete curbs to provide a spillway to establish even flows.
- A stone cascade and pool structure was installed downstream of the third sheet-pile wall to complete the final transition into the native channel just upgradient of gage station E123.

The walls are seated in bedrock to prevent groundwater from seeping through the structure as noted above. The transition from the wetland above the grade-control structure to the stream channel below is gradual, smooth, and in a stepped fashion to prevent erosive flows that could scour and destabilize the stream reach below the structure. In addition, the stepped nature of the design reduces the risk of catastrophic failure of the grade-control structure in the event of a localized failure. Engineered fill was placed behind each wall to replace the area of the wetland that had been eroded. These areas were filled to match the elevation of the surrounding wetland area to prevent the formation of pools behind the grade-control walls. A variety of wetland species was planted in 18-in. of native top soil to stabilize the wetland and expand the footprint.

2.3 Permitting

2.3.1 General

The Laboratory's Design Engineering and Environmental Compliance groups performed a review of the design model and the construction documents. Table 1 lists the permits and permissions that were obtained to meet state and federal requirements.

2.3.2 Reporting

All monitoring data collected during the previous year will be submitted to NMED annually for up to 5 yr in a Sandia Canyon performance monitoring report to be submitted by April 30 of each year. The report will summarize alluvial, water level, and storm water monitoring data collected above and below the grade-control structure. A series of repeat cross-section locations will be established in the upper portion of reach S-2 and in the vicinity of the head location to document geomorphic changes. In addition, the Laboratory will submit a yearly vegetation monitoring report to the U.S. Army Corps of Engineers (USACE) for up to 3 yr by December 1 of each year. This is in support of the 401/404 Clean Water Act Permit, which required annual vegetation transects, photographs from certain locations, and delineation of wetland boundaries.

3.0 CONSTRUCTION

3.1 General

The Laboratory placed Portage, Inc., under contract in November 2012 to build the Sandia Canyon grade-control structure. Construction of the Sandia Canyon grade-control structure began on April 22, 2013, and the structure was substantially complete and functional on September 9, 2013. Site stabilization activities were completed November 22, 2013, with demobilization completed November 27, 2013. Appendix D presents photo documentation of the grade-control structures.

3.2 Safety and Health

Under the guidance and approval of the Laboratory, Portage developed and implemented an environment, safety, and health (ES&H) plan to ensure the project met safety and health goals. In addition to the ES&H plan, all site activities were analyzed and addressed within task-specific integrated work documents (IWDs). Site personnel were subsequently trained to these IWDs prior to commencing field activities. As a result of safe construction practices, there were no lost-time accidents or incidents during the entire project.

3.3 Quality Control

Under the guidance and approval of the Laboratory, Portage developed and implemented a quality assurance plan to ensure the project met quality construction goals. In addition to the quality assurance plan, Portage was also contractually obligated to develop and adhere to a project-specific test and inspection plan that captured all project tests, inspections, and hold points. Finally, Portage assigned a quality control inspector to oversee field activities and ensure project requirements were achieved.

3.4 Occurrences

Two major categories of events occurred during construction of the grade-control structure that impacted the construction schedule. These events are the discovery of a tar-like substance during initial excavations and significant flooding.

3.4.1 Tar-Like Substance

On May 16, 2013, the field crew notified Laboratory management that a black tar-like substance was observed oozing out of the initial side cut of the second grade-control wall. Regulatory and technical personnel visited the site, and the event was reported to Dave Cobrain at the NMED – Hazardous Waste Bureau on May 16, 2013. A sample of the material was collected and analyzed for diesel-range organics (DRO), total petroleum hydrocarbon (TPH), and semivolatile organic compounds (SW-846 U.S. Environmental Protection Agency [EPA] Method 8270).

The personnel who received sample CASA-13-34678 at the Laboratory's Sample Management Office described it as wet, ground asphalt. Table 2 lists the analytes detected using SW-846 EPA Method 8270.

The analytes listed in Table 2 are all polycyclic aromatic hydrocarbons (PAHs) that are created from the production of coal tar. Coal tar is a ready source of asphaltenes necessary for the production of asphalt. Based on the description of this sample and the PAHs detected, this sample was almost certainly asphalt. This sample was also analyzed for TPH-DRO. TPH-DRO measures total petroleum hydrocarbons with a carbon range from C-10 through C-38, which includes the PAHs listed above. The TPH-DRO detection of 11,000 mg/kg for sample CASA-13-34678 further verifies that this sample is coal tar–based asphalt.

Because the tar material was limited in extent, nonmobile, and within the boundaries of the grade-control structure, the material was left in place and construction was continued. This event resulted in a 2-day delay to the project schedule.

3.4.2 Rainfall and Flooding

Two significant rainfall events occurred during the construction phase and impacted the project schedule. These events are described as follows:

1. On June 30, 2013, approximately 0.5 in. of rain fell on and around the construction site; water traveled down Sandia Canyon and overcame the diversion pond but was stopped by the earthen fill run-on control above the first sheet-pile wall of the grade-control structure. The site also received heavy run-on from the Los Alamos County landfill diversion channel northeast of the construction site. This run-on flooded all three grade-control structure trenches. No damage to the structures occurred during this flooding, but significant efforts were required to dewater the site and remove sediments received as a result of the run-on from the landfill. It took 1 wk to reestablish the site and resume construction.

2. During the week of September 10, 2013, the site was inundated with unprecedented rainfall. Rainfall totals in some areas of the Laboratory exceeded 7 in. in a 1-wk time period, and much of the rain fell during an extremely intense event that occurred between September 12 and 13, 2013. These storm events were accompanied by record run-on, flooding, and erosion at the site.

   On the morning of September 17, 2013, damage to the site was summarized as follows:

   - The cascade pool lost roughly 25% of its boulders downstream.
   - Roughly 75% of recently planted site-restoration plants were lost.
   - The diversion pond overflowed, and some plastic lining was lost.

Cobbles rolled downstream from the rock aprons. Roughly 600 cubic yards of material from the Los Alamos County landfill was deposited between the first and second steel-sheet piles. During the construction phase, the sediment was removed from that area by the contractor and stockpiled to construct a large run-on control north of the valley floor west of sheet piles one and two to retain additional materials that may erode from the landfill area. Los Alamos County has installed temporary controls above the project area and is working towards a final solution in the near future.

The remaining sediment was then placed in a small south-entering swale measuring approximately 50 ft by 120 ft southwest of the grade-control structure and erosion controls were put in place for stabilization of the area. The swale and fill area are above the 100-year floodplain and are not susceptible to significant upgradient run-on. The 100-year flood plain levels have been calculated and plotted for the Sandia Canyon drainage basin by LANL (LANL Engineering Standards Manual). The established vegetation will resist potential erosion caused by rainfall falling directly on the fill area. Erosion controls for this area included lining the ravine with a polypropylene liner, track-walking the sediment to match existing contours, and hydroseeding. Four rows of wattles were also placed perpendicular to the slope of the swale. An earthen berm measuring approximately 30 ft was also constructed below the swale and hydroseeded to prevent any potential run-on from entering the wetlands area (Appendix D). The sediments in the stockpile were not sampled because much of it either came from the County landfill cover or was imported clean fill material and not material from the wetlands.

The wetland area and fill area has since withstood four additional flow events during the summer of 2014 over 50 cubic feet per second (cfs), with the largest storm being a 25-yr, 30-min event that generated an estimated peak discharge of 110 cfs. No significant erosion occurred after these events. The south-entering ravine and fill area as well as the entire project area have been inspected under the current construction general permit Storm Water Pollution Prevention Plan (SWPPP). The grade-control structure will continue to be inspected following rain events with discharges greater than 50 cfs and quarterly. If erosion or any indications of instability are observed, appropriate actions will be taken to ensure continued stability and functionality and will be documented in the annual performance report.

The second event resulted in significant delays to completing construction. Extensive repairs were required, including the design and construction of best management practice (BMP) run-on control structures (see Appendix E), repair of the sump pond and diversion system, replacement of boulders and repair of the cascade pool liner, removal of deposited sediments and regrading, and replanting of the lost plants. One month of work was required to recover from this event.

The September 2013 rain event has a 1000-year return period based on information provided by NOAA. The grade-control structure was designed to withstand a 25-yr 2-h peak flow event of 500 cfs. NMED approved and accepted the design parameters in the "Approval with Modification, Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland." (NMED 2011, 208094) The overall project goals and objectives were to arrest the headcut in the lower portion of the wetland and to maintain hydrologic and geochemical conditions to minimize contaminant migration. The September 2013 rain event occurred after sheet piles two and three had already been constructed. Estimates vary on the return-interval magnitude of the event, but it was significantly greater than a 25-yr return interval. With the exception of the loss of newly planted vegetation and the displacement of some boulders in the cascade pool, no unusual erosion was noted above or below the sheet piles. Since that time, significant additional vegetation has been established (Appendix D). The wetland area has since had four additional flow events during the summer of 2014 over 50 cfs with the largest storm being a 25 yr, 30-min event that generated an estimated peak discharge of 110 cfs. No significant erosion occurred after these events. The south-entering swale as well as the entire project area is currently being inspected under the construction general permit SWPPP. The grade-control structure will also be inspected after every runoff event greater than 50 cfs and quarterly. If erosion or any indications of instability are observed, appropriate actions will be taken to ensure continued stability and function and will be documented in the annual performance report.

3.5 As-Built Drawings

A set of as-built drawings after construction for the grade-control structure can be found in Appendix C.

3.6 Photo Documentation

Photos of the grade-control structure can be found in Appendix D as well as photos of the run-on BMPs.

3.7 Deviations

The following deviation from the work plan occurred. NMED's approval with modification of the interim measures work plan required that "In the final design, the Permittees must propose to remove all post-1942 alluvial sediments that are present within reach S-2 of Sandia Canyon below the grade-control structure, and to place these sediments as fill behind the grade-control structure" (NMED 2011, 203806).

As previously discussed, the Sandia Wetland grade-control structure project was permitted under the USACE Nationwide Permit (NWP) 38 for Cleanup of Hazardous and Toxic Waste (USACE 2013, 251704). The Laboratory pursued permission from the USACE to fulfill the NMED requirement (LANL 2013, 251705), but it was concluded that NWP 38 General Condition 6 would be violated by the placement of sediments that contain toxic pollutants in toxic amounts into jurisdictional waters (USACE 2013, 251706). Thus, the Laboratory did not remove post-1942 alluvial sediments within reach S-2 of Sandia Canyon and use them as fill behind the grade-control structure.

4.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), May 2011. "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," Los Alamos National Laboratory document LA-UR-11-2186, Los Alamos, New Mexico. (LANL 2011, 203454)

LANL (Los Alamos National Laboratory), September 2011. "Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland," Los Alamos National Laboratory document LA-UR-11-5337, Los Alamos, New Mexico. (LANL 2011, 207053)

LANL (Los Alamos National Laboratory), September 4, 2013. "Action No. SPA-2012-00050-ABQ Potential Removal and Placement of Sediments at Sandia Canyon Wetland," Los Alamos National Laboratory letter (ENV-DO-13-0073) to W. Oberle (USACE) from A.R. Grieggs (LANL) and G.E. Turner (DOE-NA-00-LA), Los Alamos, New Mexico. (LANL 2013, 251705)

NMED (New Mexico Environment Department), January 4, 2011. "Approval with Modification, Phase II Investigation Work Plan for Sandia Canyon," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 111518)

NMED (New Mexico Environment Department), June 9, 2011. "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 203806)

NMED (New Mexico Environment Department), November 15, 2011. "Approval with Modification, Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 208094)

USACE (U.S. Army Corps of Engineers), March 27, 2013. "Action No. SPA-2012-00050-ABQ, McCann, LANL, Sandia Canyon, Wetland, Los Alamos County, NM," USACE letter to J. McCann (LANL) from W. Oberle (USACE), Albuquerque, New Mexico. (USACE 2013, 251704)

USACE (U.S. Army Corps of Engineers), September 5, 2013. "Potential Violation - Action No. SPA-2012-00050-ABQ, McCann, LANL, Sandia Canyon, Wetland, Los Alamos County, NM," USACE letter to G. Turner (DOE-NA-00-LA) and A.R. Grieggs (LANL) from W. Oberle (USACE), Albuquerque, New Mexico. (USACE 2013, 251706)

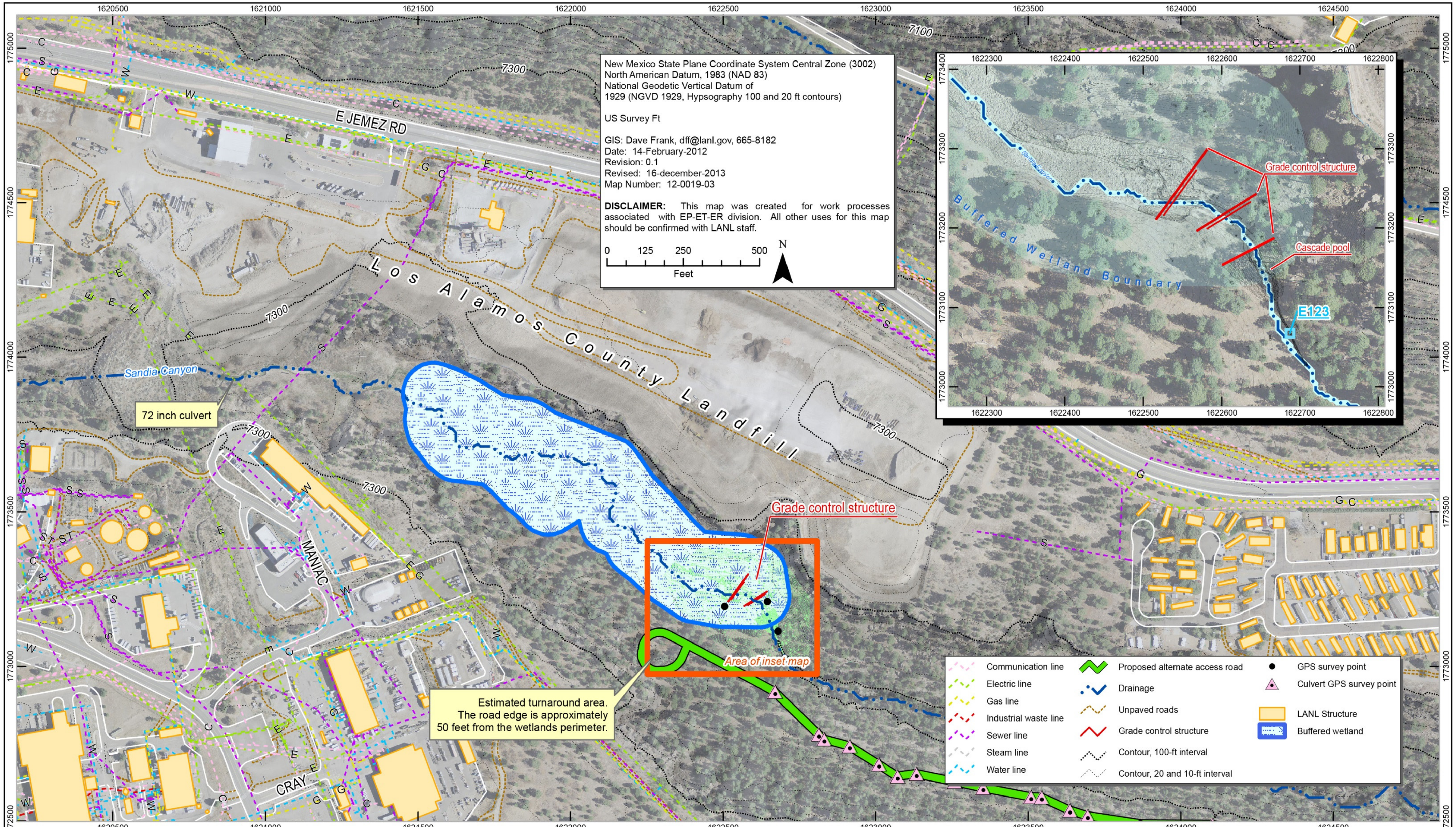


Figure 1 Location of Sandia Canyon grade-control structure

Table 1
Permits and Permissions Obtained

Permit	Agency
National Environmental Policy Act Assessment	U.S. Department of Energy
Section 7 Biological Assessment Consultation under the Endangered Species Act	U.S. Department of Interior Fish and Wildlife Service
National Pollutant Discharge Elimination System Construction General Permit	EPA
Section 404 NWP 38 for Cleanup of Hazardous and Toxic Waste under the Clean Water Act	USACE
Section 401 Water Quality Certification Permit under the Clean Water Act	NMED Surface Water Quality Bureau

Table 2
Analytical Results for Sample CASA-13-34678
Using SW-846 EPA Method 8270

Analyte Name	Result	Units
Anthracene	18,000	µg/kg
Carbazole	3400	µg/kg
Dibenzofuran	21,000	µg/kg
Fluorene	9200	µg/kg
2-Methylnaphthalene	38,000	µg/kg
Naphthalene	8800	µg/kg
Phenanthrene	8300	µg/kg
Pyrene	5500	µg/kg
TPH-DRO	11,000	mg/kg

Appendix A

Sandia Canyon Wetland Hydrology

Los Alamos NATIONAL LABORATORY EST. 1943

Conduct of Engineering
Calculations
Calculation Cover Sheet

Calc No.: CALC-000512 Rev. No.: ~~1~~ 0 DAP 3/20/13 JAO 3/21/13

Calc Title: Sandia Canyon Wetland Hydrology

Calculation Cover Sheet

1.0 IDENTIFICATION

1.1 Calculation Status: ☐ Preliminary ☒ Final

1.2 DP/DCP/DCF/ECN No.: NA

1.3 Project ID No: 102698

1.4 Superseded Calc No.:

1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Canyon Wetland Hydrology	1.8 Structure/ System Number: Sandia Canyon Wetland Hydrology
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SS Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No

2.0 SECURITY CLASSIFICATION REVIEW

2.1 Security Classification: Unclassified

2.2 DC RO: *(Name, Z Number, Organization, Signature, Date)*

William R. Turney, 112765, ADEP, [signature] 01/25/13

3.0 CHECKING

3.1 Checker (Note 1): *(Name, Z Number (if applicable), Organization, Signature, Date)*

Carl J. McDonald, Brown + Caldwell, [signature] 2/14/2013

4.0 INDEPENDENT REVIEW

4.1 Independent Review: ☐ Required ☐ Not Required

4.2 Independent Reviewer: *(Name, Z Number (if applicable), Organization, Signature, Date)*

Carl J. McDonald, Brown + Caldwell, [signature] 2/14/2013

5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW

5.1 Design Authority Representative Review: ☒ Required ☐ Not Required

5.2 Design Authority Representative: *(Name, Z Number, Organization, Signature, Date)*

Gary Blakely 098713 ES-U1 [signature] 2/21/13

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

Calc No.: CAL - ~~XXXXXX~~ CALC-000512

Calc Title: Sandia Canyon Wetland Hydrology

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES

6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)*

James A O'Neill III, J. A. O'Neill III, 280079, Brown & Caldwell 3/8/2012

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*

NA 3/20/13

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*

ALAN MacGREGOR 112808 ET-ER 3.21.13

7.0 REGISTERED PROFESSIONAL ENGINEER SEAL:

NEW MEXICO 18656 PROFESSIONAL ENGINEER 3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
	3/8/12	
0	~~Aug '11~~	Original issue
~~1~~	~~Oct '11~~	~~90% Design Revision~~ 3/20/13 3/21/13

TABLE OF CONTENTS

1.0 Purpose

To calculate peak discharges and storage volumes associated with the design of the Sandia Canyon Wetland. Peak discharges were determined for the 25-year, 2-hour rainfall event.

2.0 Methodology

Software: The U.S. Army Corps of Engineers HEC-HMS software program was used to determine peak discharges for the Sandia Canyon Wetland. Peak discharges were determined at two design points within the drainage basin: one point located upgradient of the proposed stilling basin and the other located at the existing stream gage E-123. Input into the HEC-HMS model is attached to this form.

Loss Method: The loss method used in the model was the National Resource Conservation Service (NRCS) curve number (CN) method. The majority of the contributing drainage areas are urbanized areas with a high degree of imperviousness. Therefore, a high CN was chosen for the drainage areas.

Time of Concentration: The times of concentration were determined using the TR-55 method for determining sheet flow and shallow concentrated flow. Time of concentration calculations are attached to this form. Supporting equations and tables from TR-55 are also attached to this form.

Precipation Data:

The most widely used public source of rainfall data is published by the National Oceanic and Atmospheric Administration (NOAA). However, LANL has also collected approximately 20 years of rainfall data at various rain gages within the LANL property boundary. LANL rainfall data was used for this analysis rather than NOAA data for the following reasons:

- The U.S. Geological Survey (USGS) recommends a minimum of 10 years of rainfall data for statistical analysis. LANL gage data spans a time period of 1990 to present and includes years of both above and below average precipitation. Therefore, the data set meets the minimum requirements for statistical analysis of rainfall data.
- NOAA data is typically based on regional rainfall values. However, because LANL is located just east of the Jemez mountain range, precipitation values vary greatly within a short distance. In addition, the NOAA precipitation data does not accurately present spatial variations in precipitation data within a large region.
- Site-specific, local data is a better indicator of actual site conditions.

Rainfall depths:

Data was analyzed for the two rain gages closest in location to the Sandia Canyon Wetland, rain gage TA-6 and TA-53. Rainfall gage data were analyzed to estimate a 2-hour rainfall depth for the Sandia Canyon Wetland. Gage TA-6 and TA-53 were analyzed separately using the Gumbel Extreme Value Type 1 statistical distribution. The analysis was done using a spreadsheet with no additional software. The greatest rainfall depth between TA-6 and TA-53 was chosen as the design depth

Storm distributions:

The six largest storm events within the twenty year data record were evaluated for both rain gages, giving a total of twelve actual storm events for the 2-hour storm. From those twelve events, the distribution that produced the greatest peak discharge (the storm event with the greatest intensity) was used as the design distribution.

All relevant back-up materials are attached to this calcualtion form.

3.0 Acceptance Criteria

Per the LANL Engineering Standards Manual (Chapter 3, Section G20), hydrologic analysis for design of drainage features with in the LANL boundaries should use the rational method to computer peak flows from small drainage areas (<5 acres). However, the rational method was not used in this hydrologic analysis because of two reasons: (1.) the drainage area for the Sandia Canyon Wetland is larger than 5 acres and (2.) the use of real LANL precipitation data to generate the hydrograph was deemed more accurate for the analyses.

4.0 Open Items

There are no open items for hydrology.

5.0 Assumptions

- The drainage areas and flow paths were estimated using LANL topographic contour data.
- Assumed the most conservative (highest runoff producing) storm event from LANL rain gage TA-53 as the storm distribution for the HEC-HMS model.
- Assumed the most conservative (highest runoff producing) storm event from LANL rain gage TA-6 as the precipitation amount for the HEC-HMS model.

6.0 Limitations

Due to the uncertain nature of hydrology, all hydrologic analyses are inherent to a certain amount of error. Therefore, the calculations performed as part of the Sandia Canyon Wetland anlysis leaned towards the conservative (highest runoff producing) side when at all possible.

7.0 Calculation Inputs

HEC-HMS inputs are attached to this form.

8.0 Computer Hardware and Software

U.S. Army Corps of Engineers HEC-HMS software, Version 3.3

9.0 Summary and Conclusions

Preliminary hydrologic output is attached to this form.

10.0 References

HEC website: http://www.hec.usace.army.mil/software/hec-hms/

United States Department of Agriculture, Technical Release 55 - Urban Hydrology for Small Watersheds, June 1998.

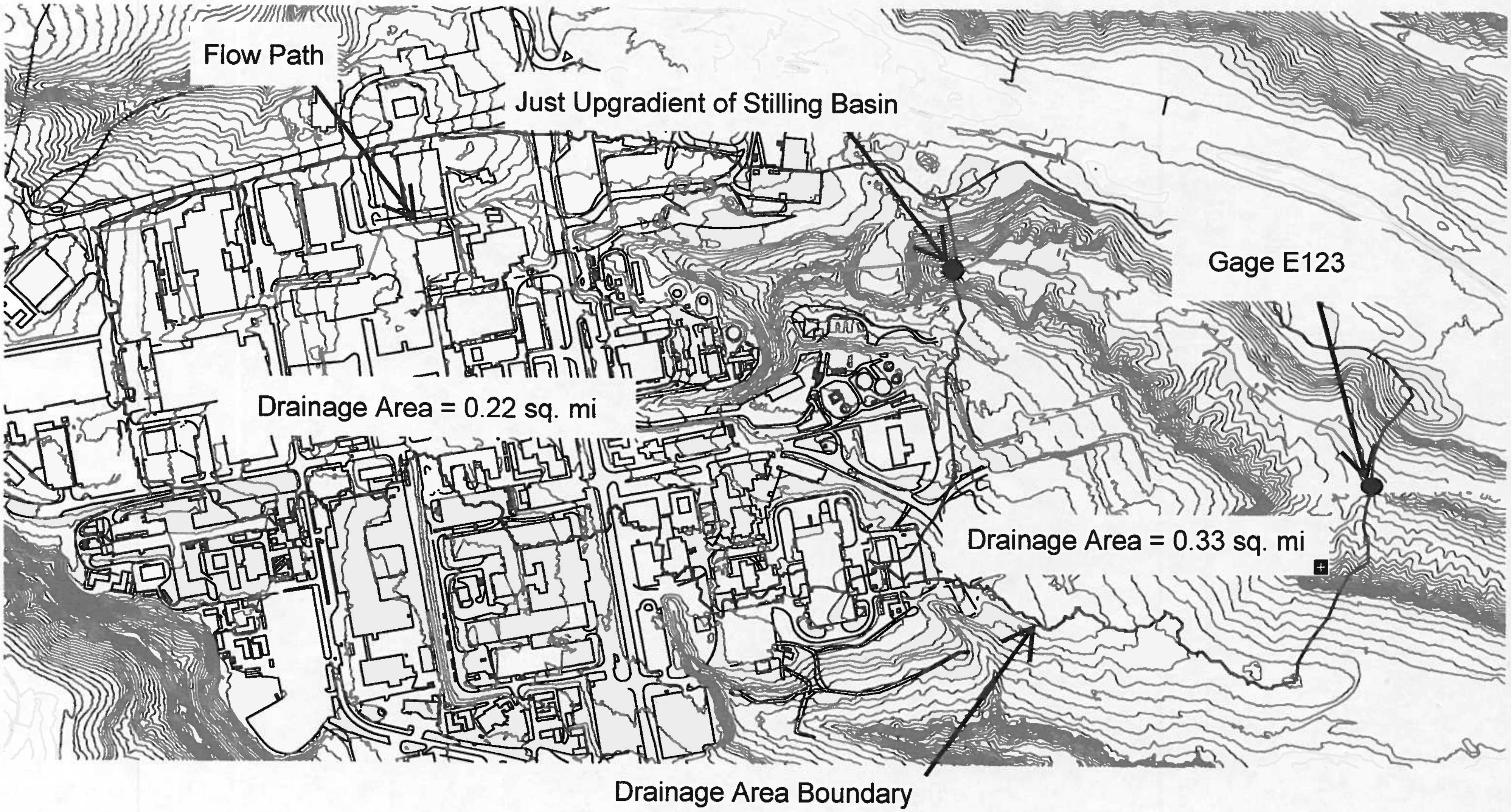
11.0 Calculation

- Calculation 1: HEC-HMS model output (spreadsheet format)

- Appendix – Supporting Information
  - o Drainage Area Map

- HEC-HMS model input (spreadsheet format)
- Applicable TR-55 Equations
- LANL Rainfall data
- Rainfall Distribution

Sandia Canyon Wetland
Drainage Area Map
8/24/2011



Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

HEC-HMS Input

	Soil Type	Descpt.	Soil Group	Cover	CN
DA1	NA	Impervious	NA	asphault/rock	98
DA2	162	Hackroy-Nyjack	D	grass cover	86
DA2	NA	Impervious	NA	asphault/rock	98

	Area (ft^2)	Area (mi^2)
DA1	6038460	0.2166
DA2	9313880	0.3341

	[5] Sheet Flow						[11] Storm Drain Flow			
	[6] n	[7] L (ft)	[8] P2 (in)	[9] S (ft/ft)	[10] Tt (hr)	Tt (min)	[12] L (ft)	[13] elev. (ft)	[14] S (ft/ft)	[15] v (ft/s)
DA1	0.011	300	1.39	0.050	0.051	3.07	3133	na	0.0125	2.5
DA2	0.011	300	1.39	0.050	0.051	3.07	3133	na	0.0125	2.5

Assumptions:

1.) CN generated based on land use and soil types within the drainage areas.
2.) S = (1000/CN) - 10
3.) Ia = 0.2 * S
4.) Drainage areas are mostly impervious (paved and/or gravel) landscape.
5.) Sheet flow travel time determined using TR-55 Sheet flow procedure
6.) Manning's n value for impervious area; n = 0.011 per TR-55, Table 3-1
7.) L = sheet flow travel length
8.) P2 = 2-year, 24-hour rainfall
9.) s = slope of hydraulic grade
10.) Tt = sheet flow travel time (TR-55 equation 3-3)
11.) Estimated Velocity of Storm Water in Storm Drain System
12.) L = shallow concentrated flow length
13.) elev = elevation drop along flow lenth

Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

HEC-HMS Output

Storm	Basin	Peak (cfs)
100-yr, 2-hr	Stilling Basin	436.6
100-yr, 2-hr	Stabilization Structures	609.9
50-yr, 2-hr	Stilling Basin	398.02
50-yr, 2-hr	Stabilization Structures	555.7
25-yr, 2-hr	Stilling Basin	357.3
25-yr, 2-hr	Stabilization Structures	498.4
10-yr, 2-hr	Stilling Basin	303.7
10-yr, 2-hr	Stabilization Structures	422.9

Sandia Canyon Wetlands
Hydrologic Data
8/24/2011

LANL Rainfall Depths

TA-6 (2-hour)

EV1 Precipitation Statistics

Recurrence	Precipitation
2.00	0.93
5.00	1.23
10.00	1.42
25.00	**1.67**
50.00	1.86
100.00	2.04

TA-6 (24-hour)

EV1 Precipitation Statistics

Recurrence	Precipitation
2.00	1.39
5.00	1.84
10.00	2.13
25.00	2.50
50.00	2.78
100.00	**3.05**

TA-53 (2-hour)

EV1 Precipitation Statistics

Recurrence	Precipitation
2.00	0.73
5.00	1.01
10.00	1.20
25.00	**1.43**
50.00	1.60
100.00	1.77

TA-53 (24-hour)

EV1 Precipitation Statistics

Recurrence	Precipitation
2.00	1.20
5.00	1.56
10.00	1.80
25.00	2.10
50.00	2.32
100.00	**2.54**

2-hour Distribution

TA-53 Event #2, Aug. 2007

Month	Day	Year	Hour	Minute	Prcp 15 min (in)	Event Time	Distribution	100-year Storm Cum. Prcp (in)	Inc. Prcp (in)
						0	0	0	0
9	20	2007	8	45	0.23	15	0.167883212	0.342481752	0.34248175
9	20	2007	9	0	0.3	30	0.386861314	0.78919708	0.44671533
9	20	2007	9	15	0.02	45	0.401459854	0.818978102	0.02978102
9	20	2007	9	30	0.82	60	1	2.04	1.2210219
9	20	2007	9	45	0	75	1	2.04	0
9	20	2007	10	0	0	90	1	2.04	0
9	20	2007	10	15	0	105	1	2.04	0
9	20	2007	10	30	0	120	1	2.04	0

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

1 The n values are a composite of information compiled by Engman (1986).

2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

3 When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \qquad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

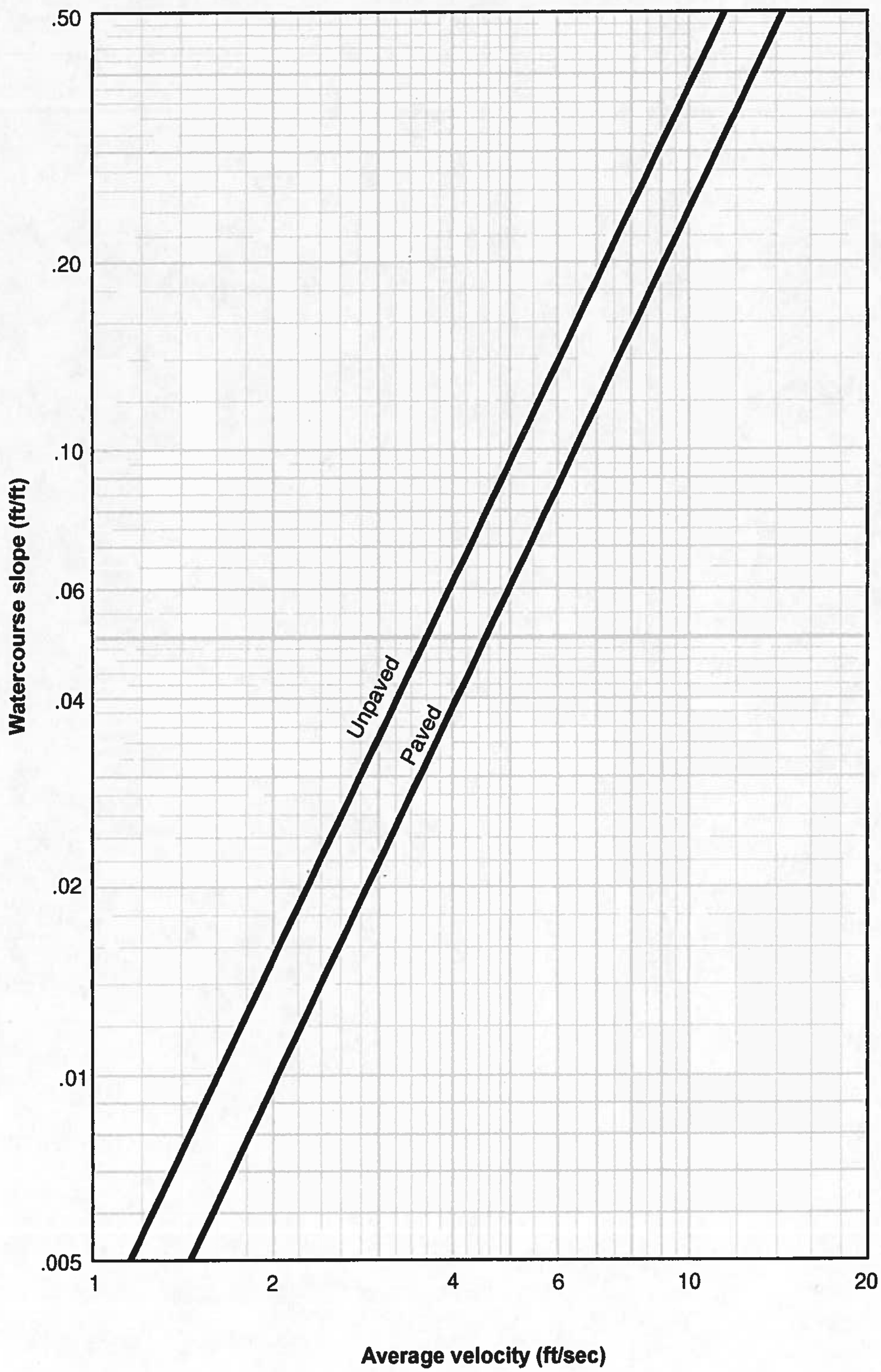
After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bankfull elevation.

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Appendix B

Sandia Canyon Wetland Hydraulics

Calc No.: CALC-000514 | Rev. No.: ~~1~~ 0 GMP 3/20/13 JAO 3/21/13 | Page 1 of 11

Calc Title: Sandia Wetland Hydraulics

Calculation Cover Sheet

1.0 INITIATION

1.1 Calculation Status: ☐ Preliminary ☒ Final

1.2 DP/DCP/DCF/ECN No.: GMP

1.3 Project ID No.: ~~140759~~ → B+C 102698 → LANL

1.4 Superseded Calc No.:

1.5 Facility Name(s): NA	1.6 Organization: Brown and Caldwell
1.7 Structure/ System Name: Sandia Wetland	1.8 Structure/ System Number:
1.9 Management Level: ☐ ML-1 ☐ ML-2 ☒ ML-3 ☐ ML-4 ☐ SB Calculation ☐ N/A ; Explain:	1.10 Associated with Technical Baseline: ☐ Yes ☒ No

2.0 SECURITY CLASSIFICATION REVIEW

2.1 Security Classification: Unclassified

2.2 DC/RO: (Name, Z Number, Organization, Signature, Date)

William R. Turney 112765; ADEP; William R Turney 01/25/13

3.0 CHECKING

3.1 Checker (Note 1): (Name, Z Number (if applicable), Organization, Signature, Date)

CARL J. MCDONALD, BROWN AND CALDWELL [signature] 2/14/2013

4.0 INDEPENDENT REVIEW

4.1 Independent Review: ☒ Required ☐ Not Required

4.2 Independent Reviewer: (Name, Z Number (if applicable), Organization, Signature, Date)

CARL J. MCDONALD, BROWN AND CALDWELL, [signature] 2/14/2013

5.0 DESIGN AUTHORITY REPRESENTATIVE REVIEW

5.1 Design Authority Representative Review: ☒ Required ☐ Not Required

5.2 Design Authority Representative: (Name, Z Number, Organization, Signature, Date)

GARY BLUHAT, 098713 ES-UI [signature] 3/14/13

Note 1: Independent Reviewer can also be the calculation Checker if the scope of the independent review also includes the scope of calculation checking as described in Section 3.0 of the instructions.

Calc No.: CALC-00514

Calc Title: Sandia Wetland Hydraulics

Calculation Cover Sheet

6.0 APPROVAL SIGNATURES

6.1 Preparer: *(Name, Z Number, Organization, Signature, Date)*
James A. O'Neill II , 280079 Brown & Caldwell
J. A. O'Neill II 3/8/2012

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*
NA DAP 2/20/13

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*
ALAN MacGREGOR 112808 ET-ER [signature] 3.21-13

7.0 REGISTERED PROFESSIONAL ENGINEER SEAL:

JAMES A. O'NEILL II
NEW MEXICO
18656
PROFESSIONAL ENGINEER
J. A. O'Neill 3/8/2012

8.0 REVISION LOG

8.1 Rev.	8.2 Date	8.3 Description of Change(s)
	3/8/12 DAP 3/20/13 AMO 3/21/13	
0	~~Aug '11~~	Original Issue
~~1~~	~~Oct '11~~	~~90% Design Revision~~ DAP 3/20/13 AMO 3/21/13

TABLE OF CONTENTS

1.0 Purpose

Calculate hydraulic profile and flow characteristics including velocity and shear for flow in the channel through the wetland area with proposed stilling basin and drop structures.

2.0 Methodology

The hydraulic profile is based on a step-backwater calculation analysis using the HEC-RAS software. The channel configuration and stream channel sections at hydraulic structures are as shown on the Drawings. Calculations include both pre- and post-construction runs to compare water surface elevations, flow velocities and channel shear.

3.0 Acceptance Criteria

The criteria used for evaluating the effectiveness of the design are outlined in Section 2.5 of the Design memorandum, and were developed by the Design Team and LANL staff to meet the goal of reducing sediment transport to the lower portion of Sandia Canyon from the wetland area.

4.0 Open Items

Final design development of the concepts presented in the Design Memorandum still need to be completed, with complete details and final hydraulic analysis to confirm the performance of the system under design flow conditions.

5.0 Assumptions

Tailwater water surface elevation is the primary variable that cannot be measured for design flow conditions, or is not empirically modeled. Tailwater is assumed based on nornal water surface elevation for the existing downstream channel section at design flow.

6.0 Limitations

The hydraulics analysis uses the 25-year design storm. Performance of the drop structures and plunge pool for higher flow rates (longer return periods) is not predicted.

The analysis is a steady state analysis based on the design configuration. The analysis is based on static flow conditions over a period of time, and includes conservative assumptions to minimize under-design. In the field, sediment transport and potentially unstable boundary layer conditions create flow patterns. These conditions may require a much more complex dynamic analysis to increase the accuracy of the model results, but may only result in a minor change in system performance.

7.0 Calculation Inputs

HEC-RAS (Hydraulic profile) - Hydraulic analysis inputs are the channel cross-section, channel slope, Manning's n-value, design discharge and starting water surface elevation at the downstream end where the improvements transition back into the existing channel. Flows are based on the results of the hydrologic analysis of the drainage basin. The design storm is the 25-year, 2-hour storm.

Design Note No. 6 (Plunge pool) – Inputs include the characteristics and configuration of the discharge pipe upstream of the plunge pool, flow discharge, information on the riprap and bedding used, and the side and end slopes of the pool. Again, the design storm is the 25-year, 2-hour storm.

8.0 Computer Hardware and Software

U.S. Army Corps of Engineers HEC-HMS software

Natural Resources Conservation Service, Engineering Division
"Riprap Lined Plunge Pool for Cantilever Outlet" - Design Note No. 6 (2nd Edition), Jan. 23, 1986
Spreadsheet developed by D. Hurtz, Midwest NTC, 1/90, modified by M. Dreischmeier, Eau Claire TC, Wis., 3/98 and 5/2005

9.0 Summary and Conclusions

The calculations show that the grade control structure and stilling basin will be stable and reduce energy and erosive forces locally.

10.0 References

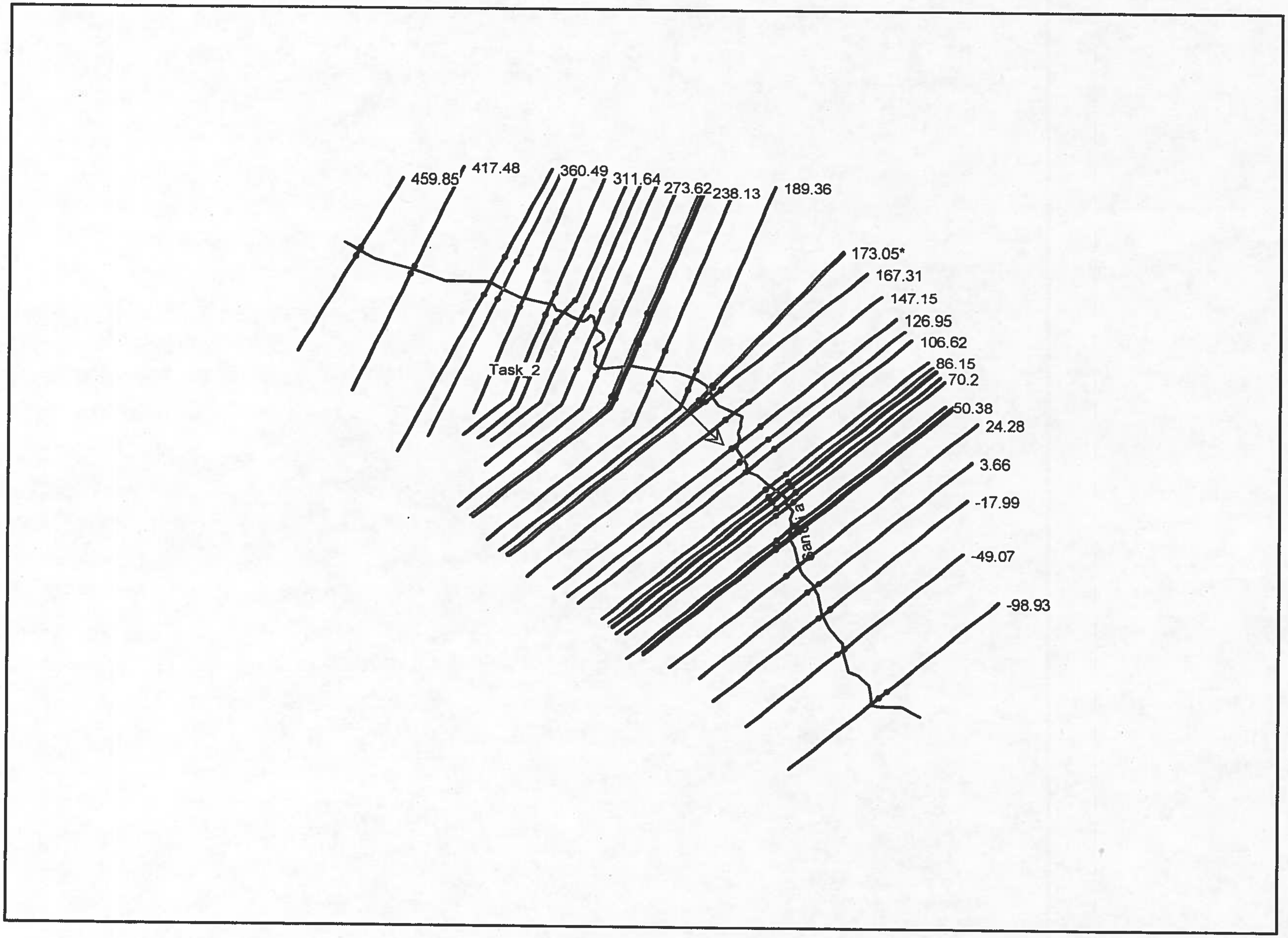
HEC website: http://www.hec.usace.army.mil/software/hec-ras.

11.0 Calculations

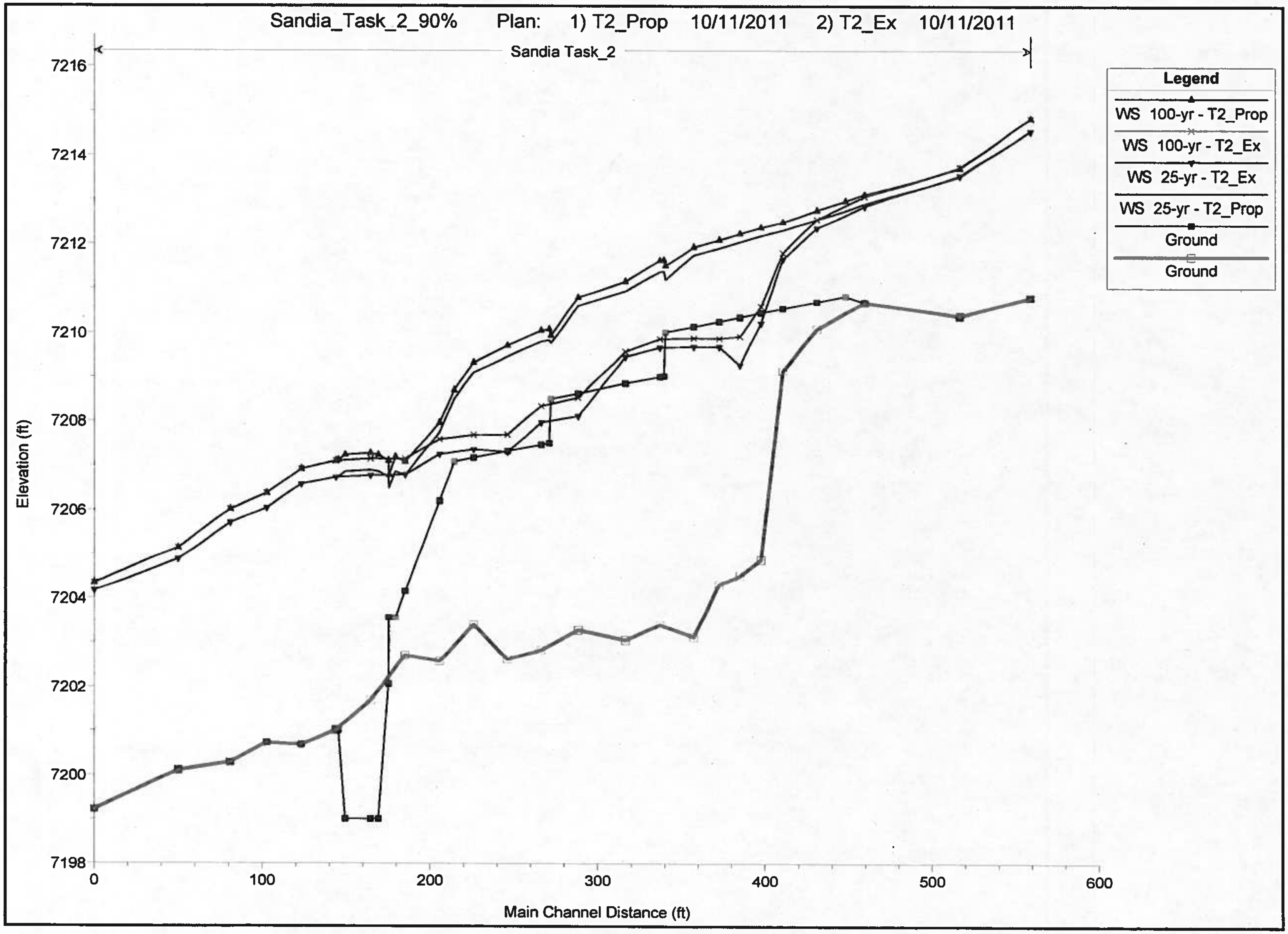
- Calculation 1 – Hydraulic profile for study channel reach (HEC-RAS)
- Calculation 2 – Plunge pool structure sizing – NRCS Design Note No. 6

Proposed Conditions							Existing								
River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Change in Velocity	Change in Shear
459.85	25-yr	498.4	7210.79	7214.55	6.16	1.77	459.85	25-yr	498.4	7210.79	7214.54	6.19	1.79	-0.03	-0.02
459.85	200cfs	200	7210.79	7213.57	5.08	1.34	459.85	200cfs	200	7210.79	7213.56	5.13	1.37	-0.05	-0.03
417.48	25-yr	498.4	7210.37	7213.52	9.19	4.48	417.48	25-yr	498.4	7210.37	7213.55	9.04	4.33	0.15	0.15
417.48	200cfs	200	7210.37	7212.88	6.37	2.37	417.48	200cfs	200	7210.37	7212.92	6.15	2.2	0.22	0.17
360.49	25-yr	498.4	7210.67	7212.9	4.48	1.15	360.49	25-yr	498.4	7210.67	7212.85	4.65	1.25	-0.17	-0.1
360.49	200cfs	200	7210.67	7212.19	3.39	0.78	360.49	200cfs	200	7210.67	7212.13	3.63	0.9	-0.24	-0.12
349.06*	25-yr	498.4	7210.82	7212.75	4.57	1.21	---	---	---	---	---	---	---		
349.06*	200cfs	200	7210.82	7212.02	3.52	0.85	---	---	---	---	---	---	---		
331.97	25-yr	498.4	7210.69	7212.56	4.26	1.06	331.97	25-yr	498.4	7210.08	7212.36	5.12	1.54	-0.86	-0.48
331.97	200cfs	200	7210.69	7211.85	2.83	0.55	331.97	200cfs	200	7210.08	7211.7	3.63	0.9	-0.8	-0.35
311.64	25-yr	498.4	7210.54	7212.31	5.04	1.48	311.64	25-yr	498.4	7209.12	7211.66	7.58	3.47	-2.54	-1.99
311.64	200cfs	200	7210.54	7211.64	3.42	0.8	311.64	200cfs	200	7209.12	7211.13	5.52	2.08	-2.1	-1.28
298.58	25-yr	498.4	7210.44	7212.18	4.65	1.27	298.58	25-yr	498.4	7204.87	7210.21	6.1	1.82	-1.45	-0.55
298.58	200cfs	200	7210.44	7211.52	3.22	0.72	298.58	200cfs	200	7204.87	7208.5	4.43	1.12	-1.21	-0.4
285.98	25-yr	498.4	7210.34	7212.04	4.49	1.19	285.98	25-yr	498.4	7204.52	7209.27	8.94	4.41	-4.45	-3.22
285.98	200cfs	200	7210.34	7211.39	3.09	0.66	285.98	200cfs	200	7204.52	7207.65	7.57	3.52	-4.48	-2.86
273.62	25-yr	498.4	7210.25	7211.91	3.98	0.95	273.62	25-yr	498.4	7204.32	7209.67	3.63	0.67	0.35	0.28
273.62	200cfs	200	7210.25	7211.27	2.73	0.52	273.62	200cfs	200	7204.32	7207.84	3.56	0.81	-0.83	-0.29
258.33	25-yr	498.4	7210.14	7211.76	4.06	0.99	258.33	25-yr	498.4	7203.13	7209.67	2.98	0.41	1.08	0.58
258.33	200cfs	200	7210.14	7211.14	2.78	0.55	258.33	200cfs	200	7203.13	7207.86	2.22	0.28	0.56	0.27
Crest of first drop structure															
241.5*	25-yr	498.4	7210.01	7211.18	5.65	2.14	---	---	---	---	---	---	---		
241.5*	200cfs	200	7210.01	7210.63	4.45	1.64	---	---	---	---	---	---	---		
240.5	25-yr	498.4	7209.01	7211.38	3.62	0.7	---	---	---	---	---	---	---		
240.5	200cfs	200	7209.01	7210.46	2.55	0.41	---	---	---	---	---	---	---		
238.13	25-yr	498.4	7208.99	7211.36	3.61	0.69	238.13	25-yr	498.4	7203.39	7209.65	2.74	0.34	0.87	0.35
238.13	200cfs	200	7208.99	7210.45	2.49	0.39	238.13	200cfs	200	7203.39	7207.83	2.02	0.23	0.47	0.16
217.54	25-yr	498.4	7208.84	7210.94	5.93	1.95	217.54	25-yr	498.4	7203.06	7209.45	4.16	0.8	1.77	1.15
217.54	200cfs	200	7208.84	7210.19	3.94	0.99	217.54	200cfs	200	7203.06	7207.71	2.94	0.47	1	0.52
189.36	25-yr	498.4	7208.62	7210.59	6.02	2.05	189.36	25-yr	498.4	7203.28	7208.1	9.3	4.34	-3.28	-2.29
189.36	200cfs	200	7208.62	7209.9	4.01	1.05	189.36	200cfs	200	7203.28	7207.2	5.33	1.59	-1.32	-0.54
Crest of second drop structure															
173.05*	25-yr	498.4	7208.5	7209.75	8.34	4.56	---	---	---	---	---	---	---		
173.05*	200cfs	200	7208.5	7209.19	6.25	3.12	---	---	---	---	---	---	---		
172.05	25-yr	498.4	7207.5	7209.82	5.39	1.55	---	---	---	---	---	---	---		
172.05	200cfs	200	7207.5	7208.94	3.82	0.91	---	---	---	---	---	---	---		
167.31	25-yr	498.4	7207.46	7209.79	5.16	1.42	167.31	25-yr	498.4	7202.84	7207.96	7.91	3.07	-2.75	-1.65
167.31	200cfs	200	7207.46	7208.9	3.7	0.86	167.31	200cfs	200	7202.84	7206.55	6.79	2.72	-3.09	-1.86
147.15	25-yr	498.4	7207.31	7209.45	5.56	1.7	147.15	25-yr	498.4	7202.62	7207.29	8.22	3.53	-2.66	-1.83
147.15	200cfs	200	7207.31	7208.64	3.83	0.94	147.15	200cfs	200	7202.62	7206.28	5.45	1.8	-1.62	-0.86

Proposed Conditions							Existing								
River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Vel Chnl (ft/s)	Shear Chan (lb/sq ft)	Change in Velocity	Change in Shear
126.95	25-yr	498.4	7207.16	7209.09	5.83	1.93	126.95	25-yr	498.4	7203.4	7207.35	5.92	1.76	-0.09	0.17
126.95	200cfs	200	7207.16	7208.35	4	1.07	126.95	200cfs	200	7203.4	7206.15	4.18	1.04	-0.18	0.03
Sill of drop															
115.38*	25-yr	498.4	7207.07	7208.5	7.69	3.72	---	---	---	---	---	---	---		
115.38*	200cfs	200	7207.07	7207.86	5.69	2.47	---	---	---	---	---	---	---		
106.62	25-yr	498.4	7206.19	7207.74	7.78	3.7	106.62	25-yr	498.4	7202.57	7207.24	5.39	1.48	2.39	2.22
106.62	200cfs	200	7206.19	7207.06	5.77	2.46	106.62	200cfs	200	7202.57	7205.94	4.16	1.06	1.61	1.4
86.15	25-yr	498.4	7204.15	7206.78	8.1	3.42	86.15	25-yr	498.4	7202.72	7206.79	6.82	2.29	1.28	1.13
86.15	200cfs	200	7204.15	7205.71	6.43	2.58	86.15	200cfs	200	7202.72	7205.59	4.95	1.4	1.48	1.18
Sill of pool															
80.3855*	25-yr	498.4	7203.57	7206.86	6.67	2.18	---	---	---	---	---	---	---		
80.3855*	200cfs	200	7203.57	7205.64	5.22	1.56	---	---	---	---	---	---	---		
76.38	25-yr	498.4	7203.57	7206.47	8.08	3.33	---	---	---	---	---	---	---		
76.38	200cfs	200	7203.57	7205.26	6.69	2.77	---	---	---	---	---	---	---		
75.88	25-yr	498.4	7202.07	7206.74	5.45	1.35	---	---	---	---	---	---	---		
75.88	200cfs	200	7202.07	7205.45	3.52	0.64	---	---	---	---	---	---	---		
70.2	25-yr	498.4	7199.01	7206.86	3.78	0.61	---	---	---	---	---	---	---		
70.2	200cfs	200	7199.01	7205.53	2.08	0.2	---	---	---	---	---	---	---		
65.53	25-yr	498.4	7199.01	7206.89	3.61	0.56	65.53	25-yr	498.4	7201.68	7206.77	5.65	1.53	-2.04	-0.97
65.53	200cfs	200	7199.01	7205.53	1.98	0.19	65.53	200cfs	200	7201.68	7205.43	4.53	1.14	-2.55	-0.95
50.38	25-yr	498.4	7199.01	7206.86	3.64	0.58	---	---	---	---	---	---	---		
50.38	200cfs	200	7199.01	7205.52	1.99	0.19	---	---	---	---	---	---	---		
46.38	25-yr	498.4	7201.01	7206.74	4.47	0.95	---	---	---	---	---	---	---		
46.38	200cfs	200	7201.01	7205.4	3.31	0.6	---	---	---	---	---	---	---		
44.91	25-yr	498.4	7201.02	7206.73	4.54	0.99	44.91	25-yr	498.4	7201.02	7206.73	4.54	0.99	0	0
44.91	200cfs	200	7201.02	7205.38	3.44	0.67	44.91	200cfs	200	7201.02	7205.38	3.44	0.67	0	0
24.28	25-yr	498.4	7200.68	7206.57	4.85	1.13	24.28	25-yr	498.4	7200.68	7206.57	4.85	1.13	0	0
24.28	200cfs	200	7200.68	7205.26	3.5	0.68	24.28	200cfs	200	7200.68	7205.26	3.5	0.68	0	0
3.66	25-yr	498.4	7200.73	7206.04	7.53	2.69	3.66	25-yr	498.4	7200.73	7206.04	7.53	2.69	0	0
3.66	200cfs	200	7200.73	7204.89	5.34	1.53	3.66	200cfs	200	7200.73	7204.89	5.34	1.53	0	0
-17.99	25-yr	498.4	7200.29	7205.7	7.78	3.01	-17.99	25-yr	498.4	7200.29	7205.7	7.78	3.01	0	0
-17.99	200cfs	200	7200.29	7204.41	6.39	2.34	-17.99	200cfs	200	7200.29	7204.41	6.39	2.34	0	0
-49.07	25-yr	498.4	7200.11	7204.88	9.36	4.27	-49.07	25-yr	498.4	7200.11	7204.88	9.36	4.27	0	0
-49.07	200cfs	200	7200.11	7203.85	6.62	2.34	-49.07	200cfs	200	7200.11	7203.85	6.62	2.34	0	0
-98.93	25-yr	498.4	7199.22	7204.17	7.98	3.01	-98.93	25-yr	498.4	7199.22	7204.17	7.98	3.01	0	0
-98.93	200cfs	200	7199.22	7202.77	7.39	2.91	-98.93	200cfs	200	7199.22	7202.77	7.39	2.91	0	0



459.85
417.48
360.49
311.64
273.62
238.13
189.36
173.05*
167.31
147.15
126.95
106.62
86.15
70.2
50.38
24.28
3.66
-17.99
-49.07
-98.93
Task_2


Sandia_Task_2_90%   Plan: 1) T2_Prop 10/11/2011 2) T2_Ex 10/11/2011
Sandia Task_2
Legend
WS 100-yr - T2_Prop
WS 100-yr - T2_Ex
WS 25-yr - T2_Ex
WS 25-yr - T2_Prop
Ground
Ground
Elevation (ft)
7216
7214
7212
7210
7208
7206
7204
7202
7200
7198
0
100
200
300
400
500
600
Main Channel Distance (ft)

RIPRAP LINED PLUNGE POOL FOR CANTILEVER OUTLET (Version 5/2005)
(Reference Design Note No. 6 (Second Edition), Jan. 23, 1986

JOB:	Sandia Wetland Plunge Pool Calculation		
DESIGNER:	Carl McDonald	Date:	########
CHECKER:	Jim O'Neill	Date:	

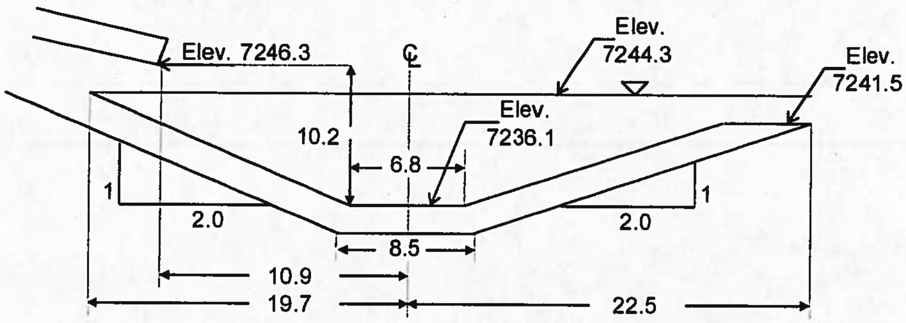
INPUT DATA:			
Conduit Diameter	D =	7.00	ft
Conduit Discharge:	Q =	357.30	cfs
Conduit Slope at Outlet:	S =	0.09	ft/ft
Conduit Outlet Invert Elevation:	El, CO =	7246.30	ft
Tailwater Elevation:	El, TW =	7244.28	ft
Outlet Channel Invert Elevation:	El, CH =	7241.50	ft
Water Density:	RHO =	1.00	
Bed/Riprap Particle Density: (Default 2.64)	RHOS =	2.64	
D, 50 Riprap Size:	RS =	1.50	ft
Riprap Thickness: (2.5*D, 50 recommended)	RT =	3.75	ft
Bedding Thickness: (6 inch min. rec.) (<u>Enter **0** for geotextile</u>)	BT =	1.00	ft
Side Slope Ratio:	Zw =	2.00	ft/ft
Upstream End Slope Ratio:	Zlu =	2.00	ft/ft
Downstream End Slope Ratio:	Zld =	2.00	ft/ft
Combined End Slope Ratio:	Z1 =	2.00	ft/ft

OUTPUT---POOL LOCATION AND DIMENSIONS:			
Vert. Dist. from Tailwater to Conduit Invert:	Zp =	2.02	ft
Submergence Check: (If Zp < 0 , Use Zp = 0)	Use Zp =	2.02	ft
Beaching Check: [Q/(gD^5)^0.5 <= (1.0+25*D,50/D)]		O.K.	
Beaching Controlled			
Distance from Conduit Exit to C/L Pool:	Xm =	10.87	ft
Pool depth at C/L Below Conduit Invert:	Zp+0.8Zm =	10.16	ft
Pool Bottom Elev:	El,PB =	7236.14	ft
Pool Bottom Length:	2Lr2 =	6.76	ft
Pool Bottom Width:	2Wr2 =	6.40	ft
Upstream Pool Length at Tailwater Elev.:	Lru =	19.66	ft
Downstream Pool Length at Tailwater Elev.:	Lrd =	19.66	ft
Pool Width at Tailwater Elev.:	2Wr =	38.95	ft
Check Side Slope Ratio: (Wr>=We)		O.K.	
Side Slope Ratio Zw O.K.			
Check Min. End Slope Ratio: (Lru & Lrd >= Le)		O.K.	
End Slope Ratios O.K.			
Check Upstream Length: (Lru >= Xm)		O.K.	
End Slope Ratio Zlu O.K.			
Pool Bottom Elev. at Bottom of Riprap:	El, BR =	7232.39	ft
Pool Bottom Elev. at Bottom of Bedding:	El, BB =	7231.39	ft
OUTPUT---VOLUMES BELOW WATER SURFACE ELEVATION:			
Volume of Excavation (measured from bottom surface of bedding):	V,pbs =	672.3	cu yd
Volume of Rock Riprap:	V,rs =	353.3	cu yd
Volume of Bedding:	V,bs =	134.9	cu yd

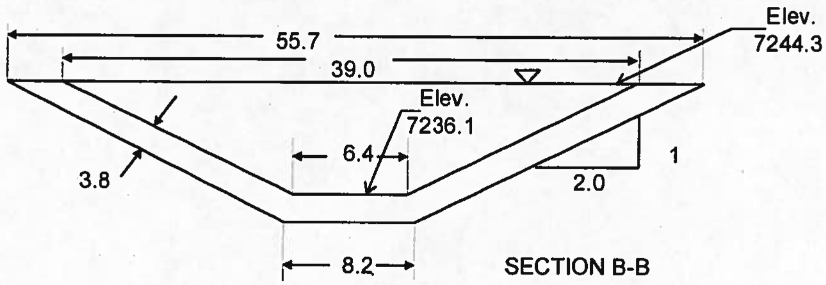
Spreadsheet developed by D. Hurtz, Midwest NTC, 1/90
Spreadsheet modified by M. Dreischmeier, Eau Claire TC, Wis., 3/98 and 5/2005
Design Note No. 6 (Second Edition), Jan. 23, 1986
"Riprap Lined Plunge Pool for Cantilever Outlet"
Natural Resources Conservation Service
Engineering Division

RIPRAP LINED PLUNGE POOL FOR CANTILEVER OUTLET

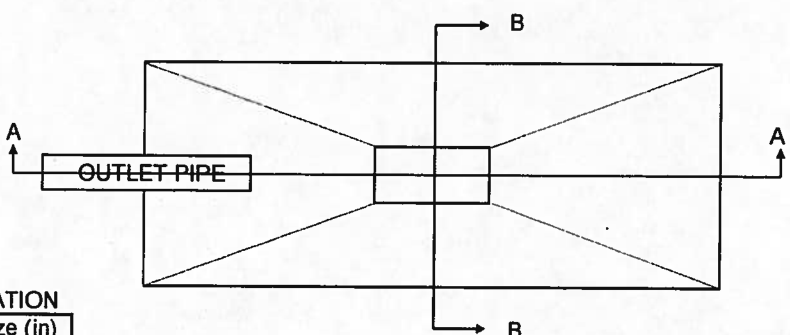
Reference Design Note No. 6 (Second Edition), Jan. 23, 1986



SECTION A-A



SECTION B-B



ROCK GRADATION

% Passing	Size (in)
100	36
60-85	27
25-50	18
5-20	9
0-5	3.6

Sandia Wetland Plunge Pool Calculation

LANDOWNER

DESIGNER: Carl McDonald

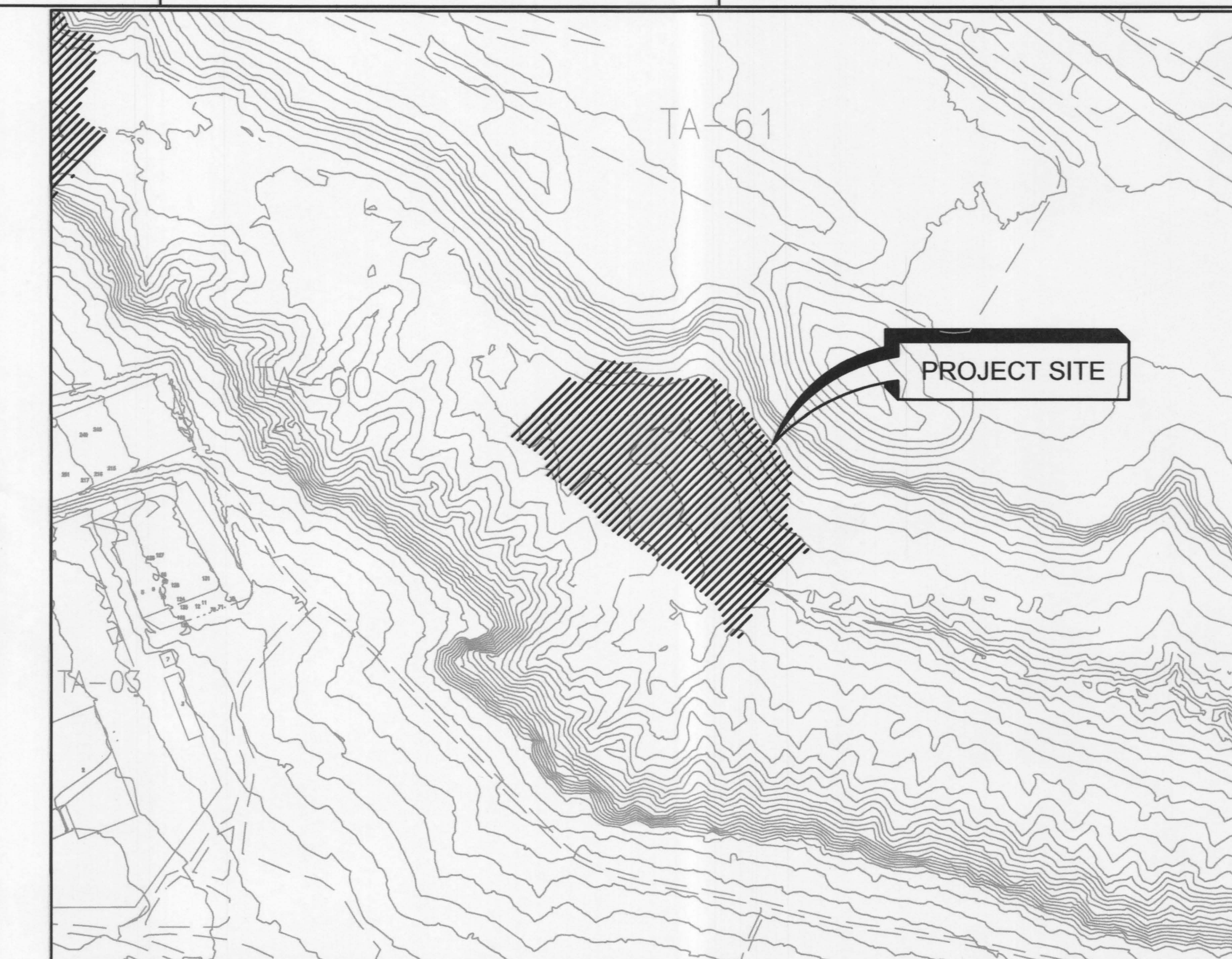
SHEET ___ OF ___

Appendix C

Sandia Canyon Wetland
Grade-Control Structure As-Built Drawings

SANDIA CANYON STREAM GRADE CONTROL AS BUILTS

BLDG N/A TA-00



LOCATION PLAN
NO SCALE TA-00

PRODUCT OPTIONS/SUBSTITUTIONS

"OR APPROVED EQUAL" IS ALWAYS IMPLIED AFTER A BRAND NAME, PATENTED PROCESS OR CATALOG NUMBER. THE SUBCONTRACTOR MAY SUBSTITUTE ANY BRAND OR PROCESS APPROVED AS AN EQUAL BY THE SPECIFYING ARCHITECT/ENGINEER THROUGH THE SUBMITTAL PROCESS. THE ONLY EXCEPTION IS WHERE "NO SUBSTITUTION" IS SPECIFIED.

LIST OF DRAWINGS

REVISION NUMBER	SHEET NUMBER	DISCIPLINE SHEET NUMBER	DRAWING TITLE
	1	G-0001	TITLE SHEET
	2	C-0001	GENERAL NOTES, LEGEND, ABBREVIATIONS
	3	C-1000	OVERALL PLAN VIEW
	4	C-1001	PLANTING AND STABILIZATION PLAN
	5	C-5000	DETAIL GRADE CONTROL STRUCTURE 1
	6	C-5001	DETAIL GRADE CONTROL STRUCTURE 2
	7	C-5002	DETAIL GRADE CONTROL STRUCTURE 3
	8	C-5003	DETAIL CASCADE POOL

PROJECT DESIGN DATA

DESIGN STORM = 25-YEAR, 2-HOUR EVENT

PEAK FLOW (Qp) =500 CFS

LANL ENGINEERING DESIGN STANDARDS MANUAL (INCLUDED BUT NOT LIMITED TO LANL MASTER SPECIFICATIONS AND DRAFTING MANUAL)

Path: P:\CAD\0Los Alamos\140793\Sandia Wetlands\As-Built Drawings Filename: G-0001.dwg Plot Date: December 16, 2013 - 5:20 PM CADD User: Martin, Edgar

J. A. O'Neill II
12/16/2013

JAMES A. O'NEILL II, NEW MEXICO, 18656, PROFESSIONAL ENGINEER

ECN # CAP-102698-ECN-00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS

TITLE SHEET

BLDG NA TA-00

DRAWN: E MARTIN
DESIGN: J O'NEILL
CHECKED: J O'NEILL
DATE: 12-17-2013

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN [signature]

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET G-0001
1 OF 8

CLASSIFICATION: Unclassified
REVIEWER: William Hardesty
DATE: 12/17/2013

PROJECT ID: 102698
DRAWING NO: C-56021
REV: 0

GENERAL NOTES

1. IF SHEETS ARE NOT 36X24, THEN THEY ARE REDUCED SIZE PLOTS. USE GRAPHIC SCALE ACCORDINGLY.
2. ALL EXISTING PLANIMETRIC AND TOPOGRAPHIC INFORMATION PRESENTED ON THIS SHEET WAS OBTAINED OR DERIVED FROM INFORMATION PROVIDED BY OTHERS (SEE SHEET C-1000 FOR EXISTING SURVEY PROVIDED).
3. DATA FOR ALL ELEVATIONS AND NORTHING/EASTING POINTS STATED (EXISTING AND PROPOSED) ARE BASED ON PROVIDED EXISTING SURVEY INFORMATION (SEE NOTE 2 AND SHEET C-1000 FOR HORIZONTAL AND VERTICAL REFERENCE DATA).
4. THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR WATER MANAGEMENT THROUGHOUT THE PROJECT. THE WETLAND RECEIVES CONTINUAL FLOW OF APPROXIMATELY 350,000 GALLONS PER DAY. THE SUBCONTRACTOR WILL ALSO BE RESPONSIBLE FOR STORMWATER FLOWS INTO THE WETLAND DURING PRECIPITATION EVENTS. ALL WATER FLOWS WILL NEED TO BE MANAGED AND TAKEN THROUGH THE WORK ZONE WITHOUT DELETERIOUS EFFECTS TO THE WORK.
5. CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL OF ALL WILLOWS AND OTHER WOODY VEGETATION PRIOR TO BEGINNING CONSTRUCTION.
6. CONSTRUCTION SUBCONTRACTOR SHALL FOLLOW THE SPECIFICATIONS INCLUDED WITH THE DESIGN PACKAGE. THESE INCLUDE:
   - 01 3545 WATER DISCHARGE REQUIREMENTS
   - 01 4000 QUALITY REQUIREMENTS
   - 01 4200 REFERENCES
   - 01 5705 TEMPORARY CONTROLS AND COMPLIANCE REQUIREMENTS
   - 01 7839 PROJECT RECORD DOCUMENTS
   - 03 3001 REINFORCED CONCRETE
   - 31 0519 GEOSYNTHETICS
   - 31 2000 EARTH MOVING
   - 31 3700 RIPRAP
   - 31 6223 STEEL SHEET PILING
   - 32 9219 SEEDING
   - 32 9300 PLANTING

LEGEND

NORTH ORIENTATION SYMBOL

10' 5' 0 5' 10'
1"=10'-0"
GRAPHIC SCALE

1 / C-5000 — DETAIL TAG

A / C-5001 — SECTION TAG

X — SECTION END LINE

(2) — KEYED NOTE

LCN A0307 — SURVEY CONTROL POINT

EXISTING TOPOGRAPHY/GRADE

EXISTING STREAMBED (AS SURVEYED)

EXISTING WETLANDS (AS SURVEYED)

EXISTING ROCK/RIPRAP (AS SURVEYED)

EXISTING TREES (AS SURVEYED)

PROPOSED AGGREGATE

PROPOSED TOPOGRAPHY/GRADE

PROPOSED WETLAND RESTORATION

PROPOSED STREAM/CHANNEL RESTORATION AREA

PROPOSED BACKFILL TO MEET EXISTING GRADE

PROPOSED CONCRETE

ABBREVIATIONS

Qp	– PEAK FLOW
CFS	– CUBIC FEET PER SECOND
NAD	– NORTH AMERICAN DATUM
NGVD	– NATIONAL GEODETIC VERTICAL DATUM
CMP	– CORRUGATED METAL PIPE
NMDOT	– NEW MEXICO DEPARTMENT OF TRANSPORTATION
OZ/SY	– OUNCE PER SQUARE YARD

ECN # CAP-102698-ECN-00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS

GENERAL NOTES, LEGEND, ABBREVIATIONS

DRAWN: E MARTIN
DESIGN: J O'NEILL
CHECKED: J O'NEILL
DATE: 12-17-2013

BLDG NA TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET: C-0001
2 OF 8

CLASSIFICATION: Unclassified
REVIEWER: William Hardesty
DATE: 12/17/2013

PROJECT ID: 102698
DRAWING NO: C-56021
REV: 0

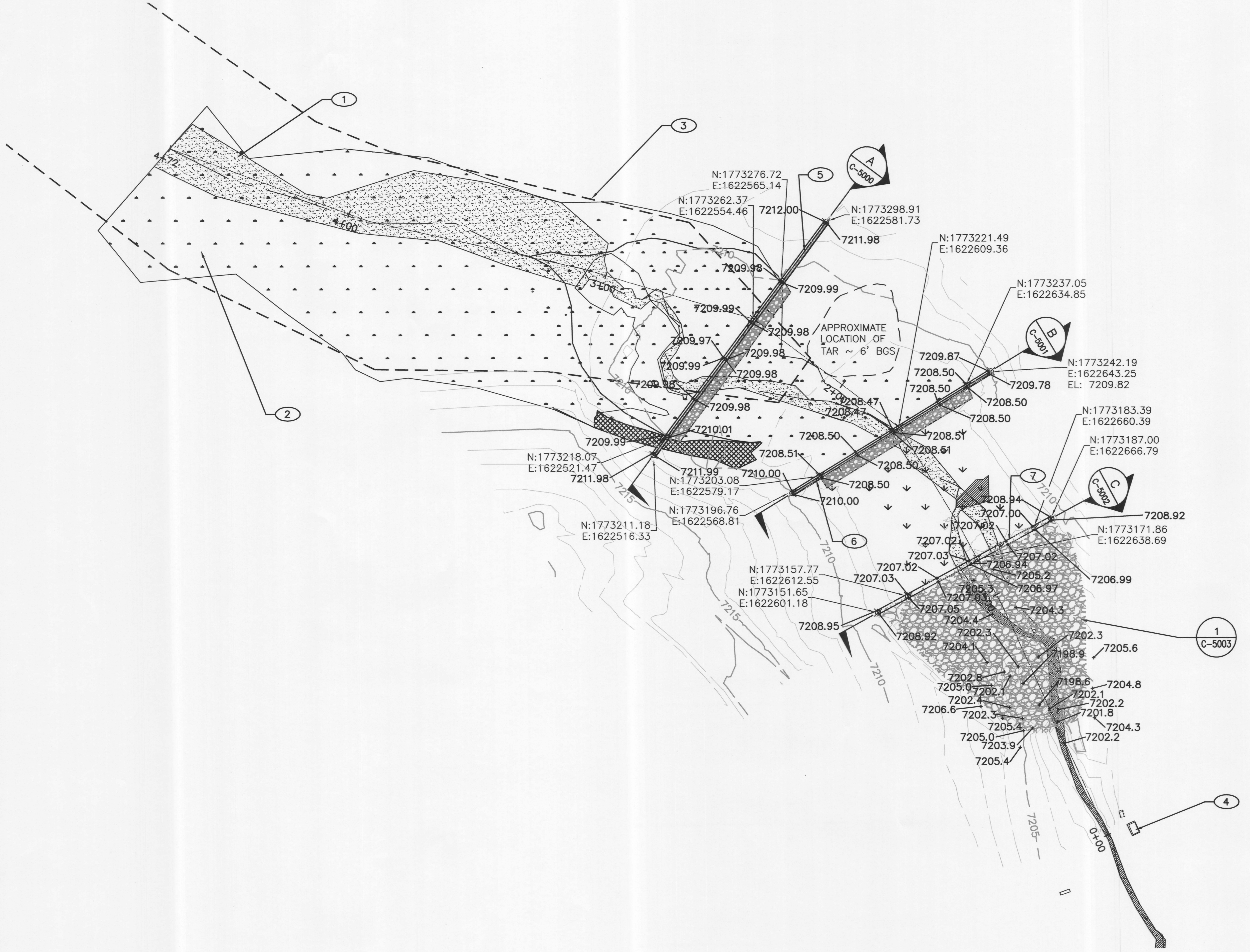
J. A. O'Neill II
12/16/2013

JAMES A. O'NEILL II NEW MEXICO 18656 PROFESSIONAL ENGINEER

Path: P:\CAD\Los Alamos\140793\Sandia Wetlands\As-Built Drawings Filename: C-0001.dwg Plot Date: December 16, 2013 - 5:21 PM CADD User: Martin, Edgar

KEYED NOTES

1. SURVEYED STREAMBED LIMITS PRIOR TO CONSTRUCTION
2. SURVEYED WETLAND LIMITS PRIOR TO CONSTRUCTION
3. GIS DELINEATION OF WETLAND LIMITS PRIOR TO CONSTRUCTION (PROVIDED BY LANL)
4. STREAM GAGE E-123
5. GRADE CONTROL STRUCTURE GC-1 (STA. 2+41.5)
6. GRADE CONTROL STRUCTURE GC-2 (STA. 1+73.1)
7. GRADE CONTROL STRUCTURE GC-3 (STA. 1+15.4)



PLAN VIEW
SCALE: 1" = 20'

20' 10' 0 10' 20'
1"=20'-0"

ECN # CAP-102698-ECN-00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS

OVERALL PLAN VIEW

DRAWN: E MARTIN
DESIGN: J O'NEILL
CHECKED: J O'NEILL
DATE: 12-17-2013

BLDG NA TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

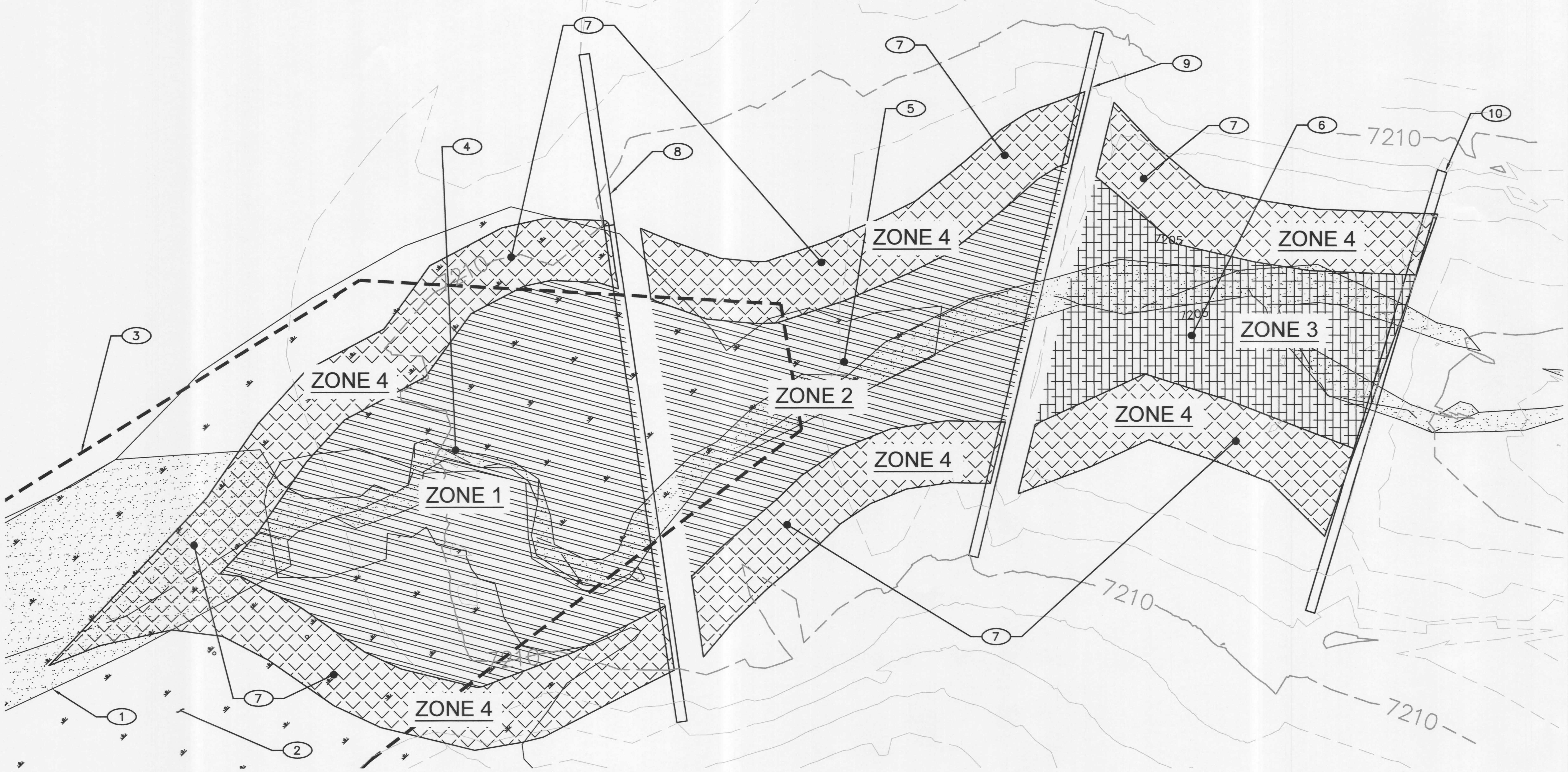
Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET: C-1000
3 OF 8

CLASSIFICATION: Unclassified
REVIEWER: William Hardesty
DATE: 12/17/2013
PROJECT ID: 102698
DRAWING NO: C-56021
REV: 0

J. A. O'Neill II
12/16/2013
JAMES A. O'NEILL II — NEW MEXICO — 18656 — PROFESSIONAL ENGINEER

Path: P:\CAD\0Los Alamos\147993\Sandia Wetlands\As-Built Drawings Filename: C-1000.dwg Plot Date: December 16, 2013 - 5:23 PM CADD User: Martin, Edgar



PLAN VIEW
1"=10'-0"

GENERAL NOTES

1. AREA SHALL BE TEMPORARILY SEEDED IMMEDIATELY UPON COMPLETION OF ANY FINAL GRADES TO PREVENT EROSION.
2. EROSION CONTROL MATTING SHALL BE USED IN WET SHALL BE USED IN WETLAND AREA TO CONTROL EROSION UNTIL VEGETATION IS ESTABLISHED.
3. AREAS OUTSIDE OF WETLAND PLANTING AREA NOTED BELOW SHALL BE SEEDED WITH NATIVE GRASSES.

KEYED NOTES

1. SURVEYED STREAMBED LIMITS
2. SURVEYED WETLAND LIMITS
3. GIS DELINEATION OF WETLAND LIMITS (PROVIDED BY LANL)
4. WETLAND RESTORATION ZONE 1 (AREA = 4,916 SF). SEE PLANTING SCHEDULE FOR SPACING.
5. WETLAND RESTORATION ZONE 2 (AREA = 3,526 SF). SEE PLANTING SCHEDULE FOR SPACING.
6. WETLAND RESTORATION ZONE 3 (AREA = 2,706 SF). SEE PLANTING SCHEDULE FOR SPACING.
7. WETLAND RESTORATION ZONE 4 (AREA = 4,945 SF). SEE PLANTING SCHEDULE.
8. GRADE CONTROL STRUCTURE GC-1
9. GRADE CONTROL STRUCTURE GC-2
10. GRADE CONTROL STRUCTURE GC-3

PLANTING SCHEDULE

QUANTITY	SCIENTIFIC NAME	COMMON NAME	TYPE	SPACING (O.C.)	ZONE
HERBACEOUS					
2120	ELEOCHARIS PALUSTRIS	COMMON SPIKERUSH	PLUG/SEED	2'	1 AND 2
2120	GLYCERIA BOREALIS	NORTHERN MANNAGRASS	PLUG/SEED	2'	1 AND 2
2120	MIMULUS GUTTATUS	SEEP MONKEYFLOWER	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS ACUTUS	HARDSTEM BULRUSH	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS PUNGENS	THREESQUARE BULRUSH	PLUG/SEED	2'	1 AND 2
2120	SCIRPUS TABERNAEMONTANI	SOFTSTEM BULRUSH	PLUG/SEED	2'	1 AND 2
2120	TYPHA LATIFOLIA	BROADLEAF CATTAIL	PLUG/SEED	2'	1 AND 2
677	CAREX AQUATILIS	WATER SEDGE	PLUG/SEED	2'	3
677	CAREX LANUGINOSA	WOOLY SEDGE	PLUG/SEED	2'	3
677	CAREX MURICATA	POINTED SEDGE	PLUG/SEED	2'	3
677	CAREX ROSTRATA	BEAKED SEDGE	PLUG/SEED	2'	3
677	JUNCUS BALTICUS	BALTIC RUSH	PLUG/SEED	2'	3
677	JUNCUS LONGISTYLIS	LONGSTYLE RUSH	PLUG/SEED	2'	3
677	JUNCUS TORREYI	TORREY RUSH	PLUG/SEED	2'	3
677	SCIRPUS PUNGENS	THREESQUARE BULRUSH	PLUG/SEED	2'	3
TREE/SHRUB					
320	ACER NEGUNDO		TUBING	4'	4
320	BACCHARIS SALICIFOLIA	SEEPWILLOW	TUBING	4'	4
640	SALIX EXIGUA	COYOTE WILLOW	LIVE STAKE	4'	4
320	SALIX IRRORATA	BLUESTEM WILLOW	LIVE STAKE	4'	4

J. A. O'Neill II
12/16/2013
JAMES A. O'NEILL II NEW MEXICO 18656 PROFESSIONAL ENGINEER

ECN # CAP-102698-ECN-00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS
PLANTING AND STABILIZATION PLAN

DRAWN: E MARTIN
DESIGN: J O'NEILL
CHECKED: J O'NEILL
DATE: 12-17-2013

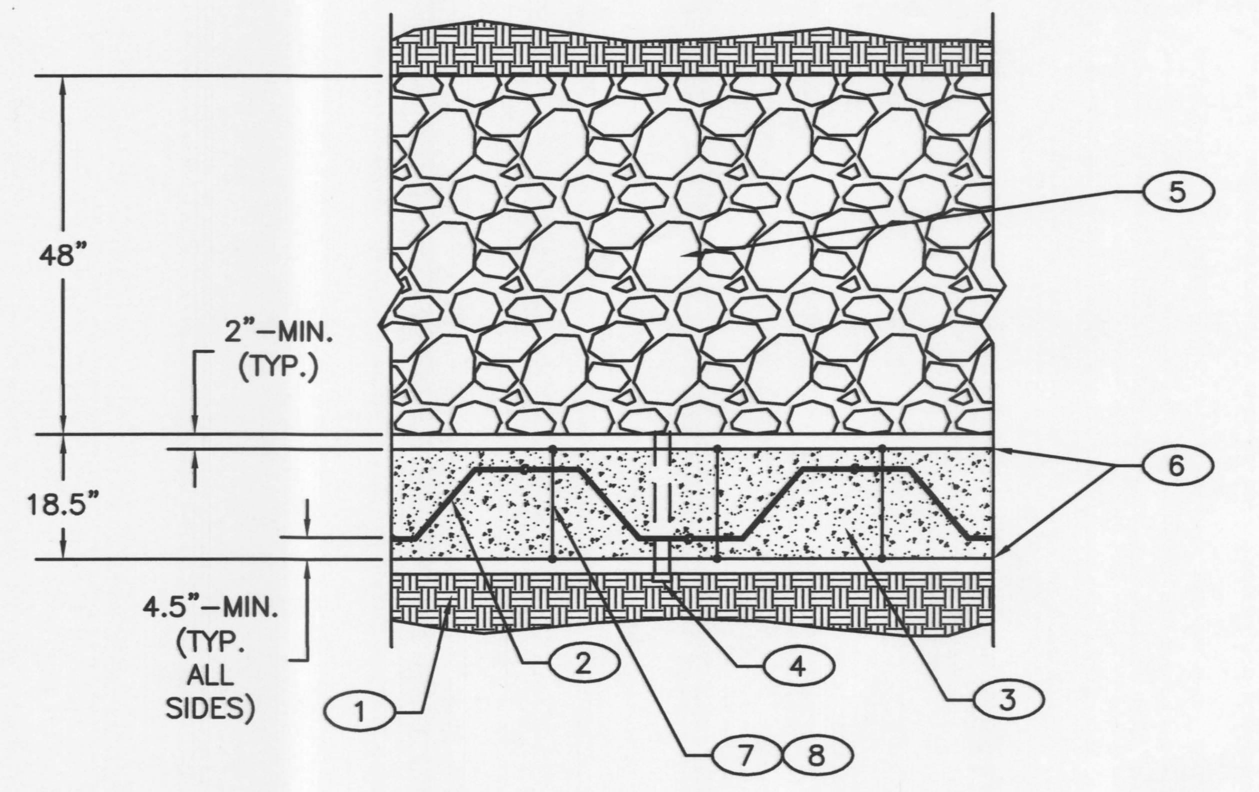
BLDG NA TA-00
SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

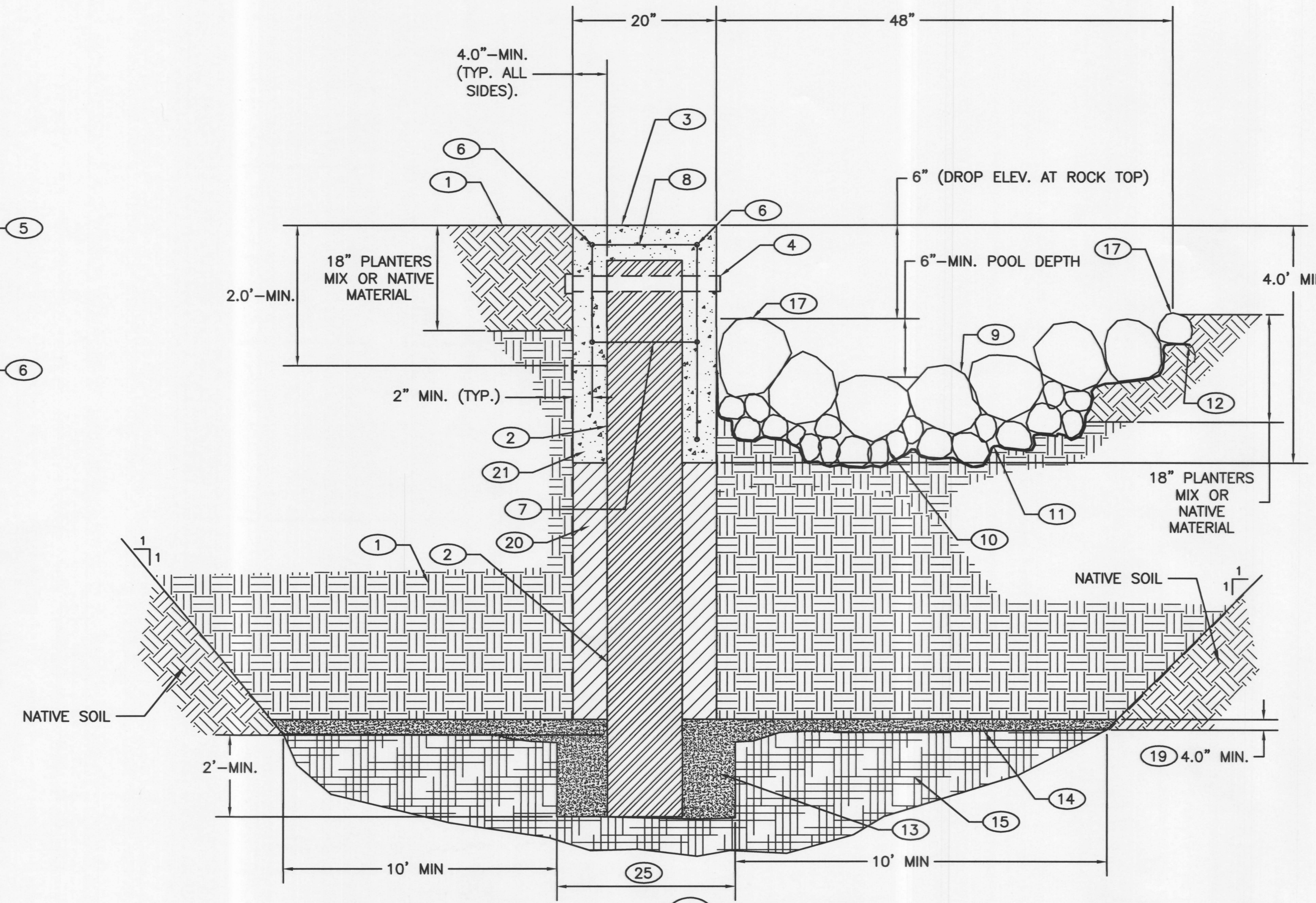
SHEET C-1001
4 OF 8
WBH 12/17/2013

CLASSIFICATION Unclassified
REVIEWER B BOHN William Barley
DATE 2012-07-30
PROJECT ID 102698
DRAWING NO C-56021
REV 0

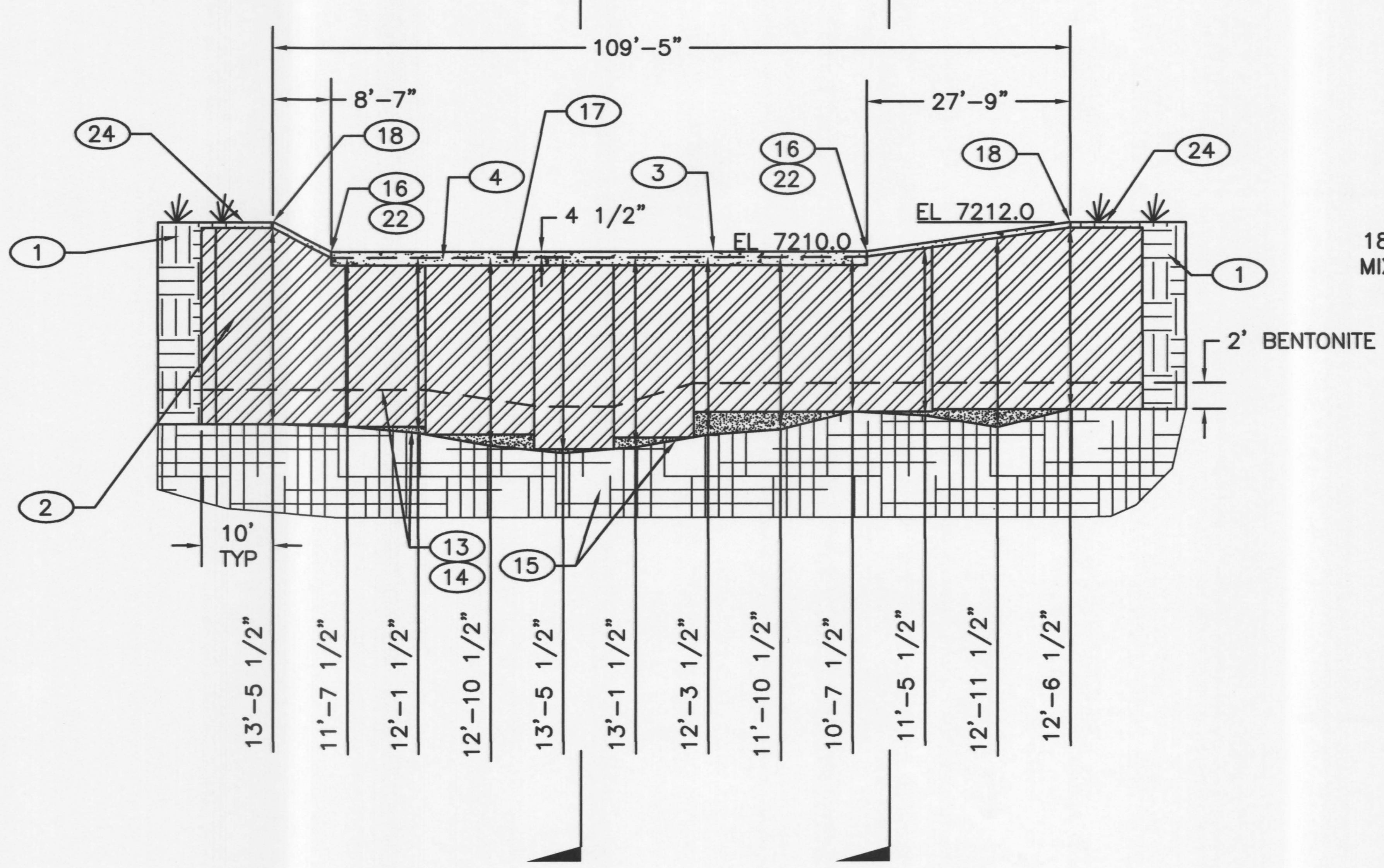
Path: P:\CAD\Los Alamos\144793\Sandia Wetlands\As-Built Drawings Filename: C-1001.dwg Plot Date: December 16, 2013 - 5:32 PM CADD User: Martin, Edgar



TOP VIEW
NOT TO SCALE

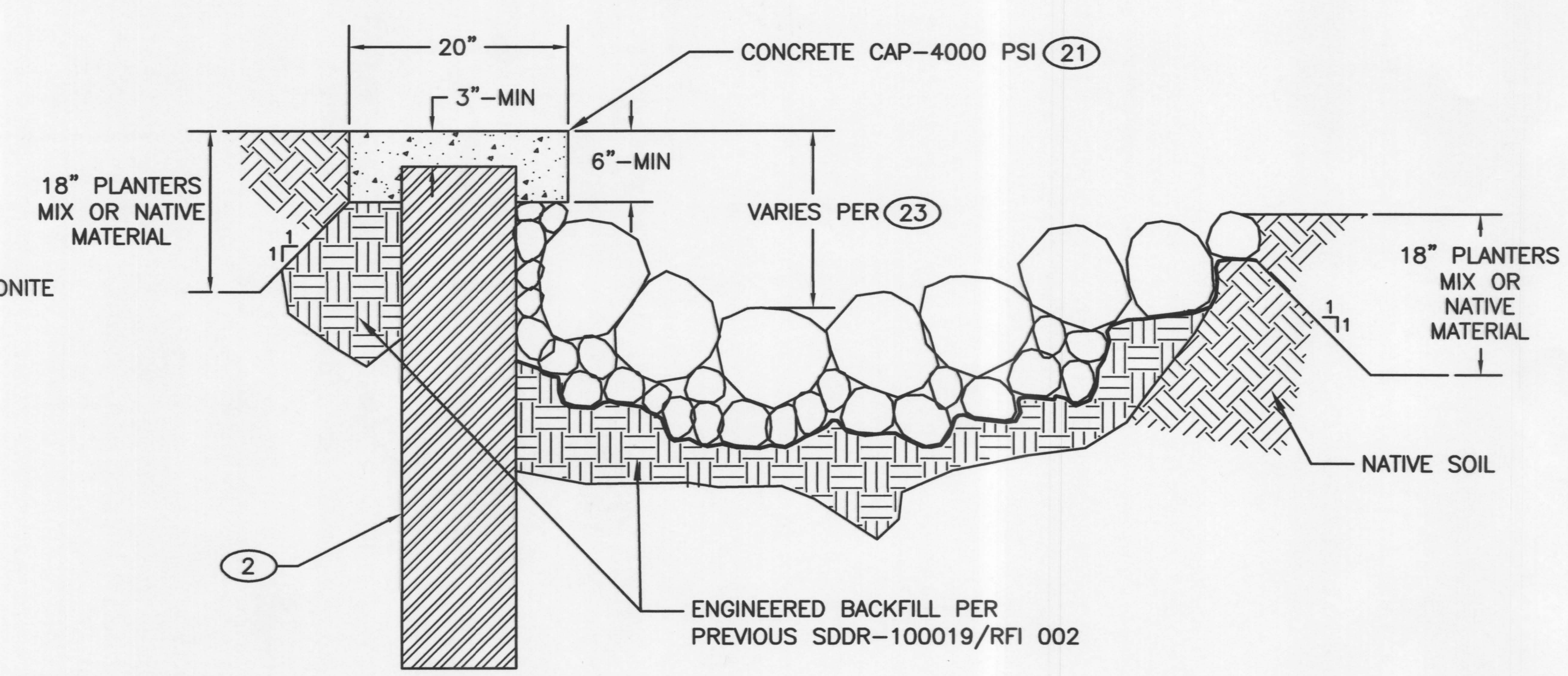


A
C-5000
SECTION VIEW
NOT TO SCALE



FRONT VIEW (DOWNSTREAM)
NOT TO SCALE

A
C-1000
SECTION
NOT TO SCALE



NON–REINFORCED CONCRETE CAP

B
C-5000
SECTION VIEW
NOT TO SCALE

STRUCTURE ELEVATIONS

GRADE CONTROL STRUCTURE	CREST OF WEIR ELEVATION	DROP ELEVATION	TIE–IN ELEVATION
GC–1	7210.0	7209.5	7212.0

KEYED NOTES

1. ENGINEERED BACKFILL 10.0' MIN. BOTH SIDES OF SHEET PILE. MINIMUM LAYBACK SLOPE 1:1. COMPACT TO 95% OF STANDARD PROCTOR DENSITY PER SPECIFICATIONS. (FIRST LIFT COMPACTION NOT VERIFIED).
2. STEEL SHEET PILE (TYPE PZ–22)
3. CREST OF WEIR ELEVATION, CONCRETE CAP – 4,000 PSI (SEE TABLE THIS SHEET). PLACE TOOL JOINTS EVERY 25' ON–CENTER WITH ONE EXPANSION JOINT IN THE CENTER OF EACH WEIR. THE EXPANSION JOINT SHALL BE 1" FILLED WITH 1" FOAM TO ALLOW THE CONCRETE TO EXPAND. FOAM SHALL ADHERE TO ONE SIDE OF THE JOINT AND BE SIMILAR TO FOAMTECH(R) FOAM MADE BY NMW INC. EDGES OF JOINT SHALL HAVE ¾" CHAMFERED EDGED TO REDUCE SPALLING.
4. PVC PIPE (2"–DIA.) WITH SCREENED CAP TO ALLOW DRAINAGE (DRILLED THROUGH PILE AND CAP AS SHOWN, 10–FEET O.C.)
5. ROCK SPLASH APRON
6. #4 LATERAL REBAR ON CORNERS OF CAP (2.0"–MIN. CLEARANCE TO CONCRETE ALL AROUND)
7. #4 REBAR DRILLED 18"–O.C. THROUGH PILE AND TIED TO BAR–(6) AND BAR–(8).
8. #4 REBAR SADDLE TIED TO BAR–(6) AND BAR–(7) @ 18"–O.C.
9. ONE–MAN STREAMBED BOULDERS FOR ENERGY DISSIPATION
10. COBBLES (12"–DIA. OR SMALLER) FOR FILLING VOIDS
11. 12–OZ PER SY NON–WOVEN GEOTEXTILE
12. ANCHOR GEOTEXTILE AT EDGES OF ROCK PAD
13. ALONG THE PROPOSED LENGTH OF EACH PILE, A TRENCH SHALL BE EXCAVATED TWO FEET INTO BEDROCK. SHEET PILES SHALL BE PLACED INTO THE TRENCH TO THE ALIGNMENT INDICATED IN THE DRAWINGS, AND THE TRENCH SHALL BE FILLED WITH GRANULAR BENTONITE TO CREATE A WATER TIGHT SEAL WHEN CONSTRUCTION IS COMPLETE. ADEQUATE SHORING SHALL BE USED TO HOLD THE SHEET PILES IN PLACE UNTIL FLOWABLE FILL AND BACKFILL CAN BE PLACED IN MANAGEABLE LIFTS ON OPPOSING SIDES IN ORDER TO LOCK THE SHEETPILES INTO ALIGNMENT.
14. TOP OF BEDROCK
15. BEDROCK
16. TIE–IN CONCRETE CAP (NOT REINFORCED)
17. DROP ELEVATION (SEE TABLE THIS SHEET)
18. TIE–IN ELEVATION (SEE TABLE THIS SHEET)
19. PLACE 4" MIN OF BENTONITE ACROSS BOTTOM OF GC–1 EXCAVATION ONLY. GC–2 & GC–3 DOES NOT REQUIRE ADDITIONAL 4" OF BENTONITE
20. FLOWABLE FILL
21. NON–REINFORCED CONCRETE
22. TOOL JOINTS PER SDDR–RFI–1. INSTALL EXPANSION JOINT BETWEEN REINFORCED CONCRETE AND UNREINFORCED CONCRETE PER SDDR–100019/RFI 002
23. TRANSITION ROCK LINED DROP FROM 12" AT REINFORCED CONCRETE CAP TO 0" AT END ON NON–REINFORCED CONCRETE
24. 3" MINIMUM ENGINEERED FILL ABOVE SHEET PILE EXTENSIONS COMPACTED TO 95% STD PROCTOR DENSITY
25. TRENCH WIDTH VARIES FROM 5' MAX ON SOUTH END TO 2.5' MIN ON NORTH END

ECN # CAP–102698–ECN–00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS

DETAIL GRADE CONTROL STRUCTURE 1

DRAWN	E MARTIN
DESIGN	J O'NEILL
CHECKED	J O'NEILL
DATE	12-7-2013

BLDG NA   TA–00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C–5000
5 OF 8

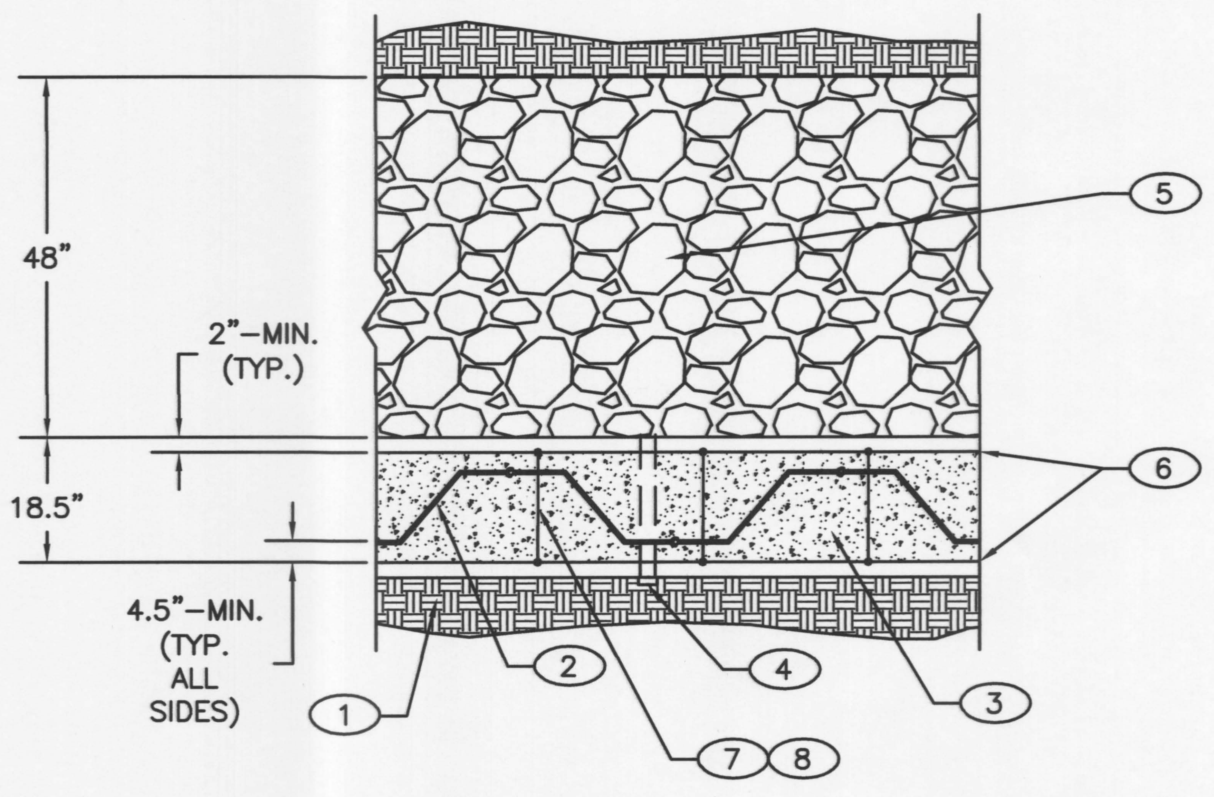
CLASSIFICATION Unclassified
REVIEWER William Hardesty
DATE 12/17/2013

PROJECT ID 102698
DRAWING NO C–56021
REV 0

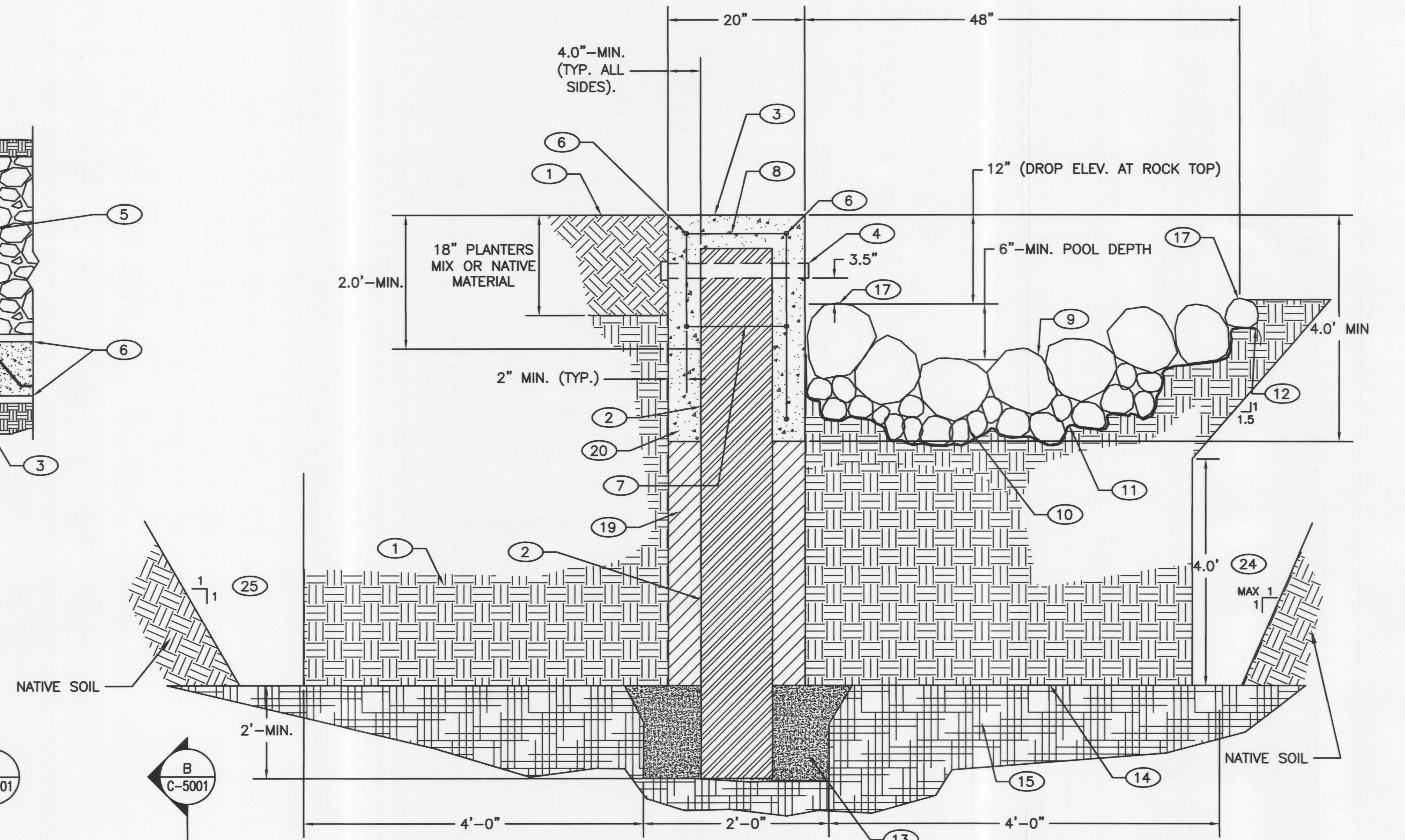
J. A. O'Neill
12/16/2013

JAMES A. O'NEILL II
NEW MEXICO
18656
PROFESSIONAL ENGINEER

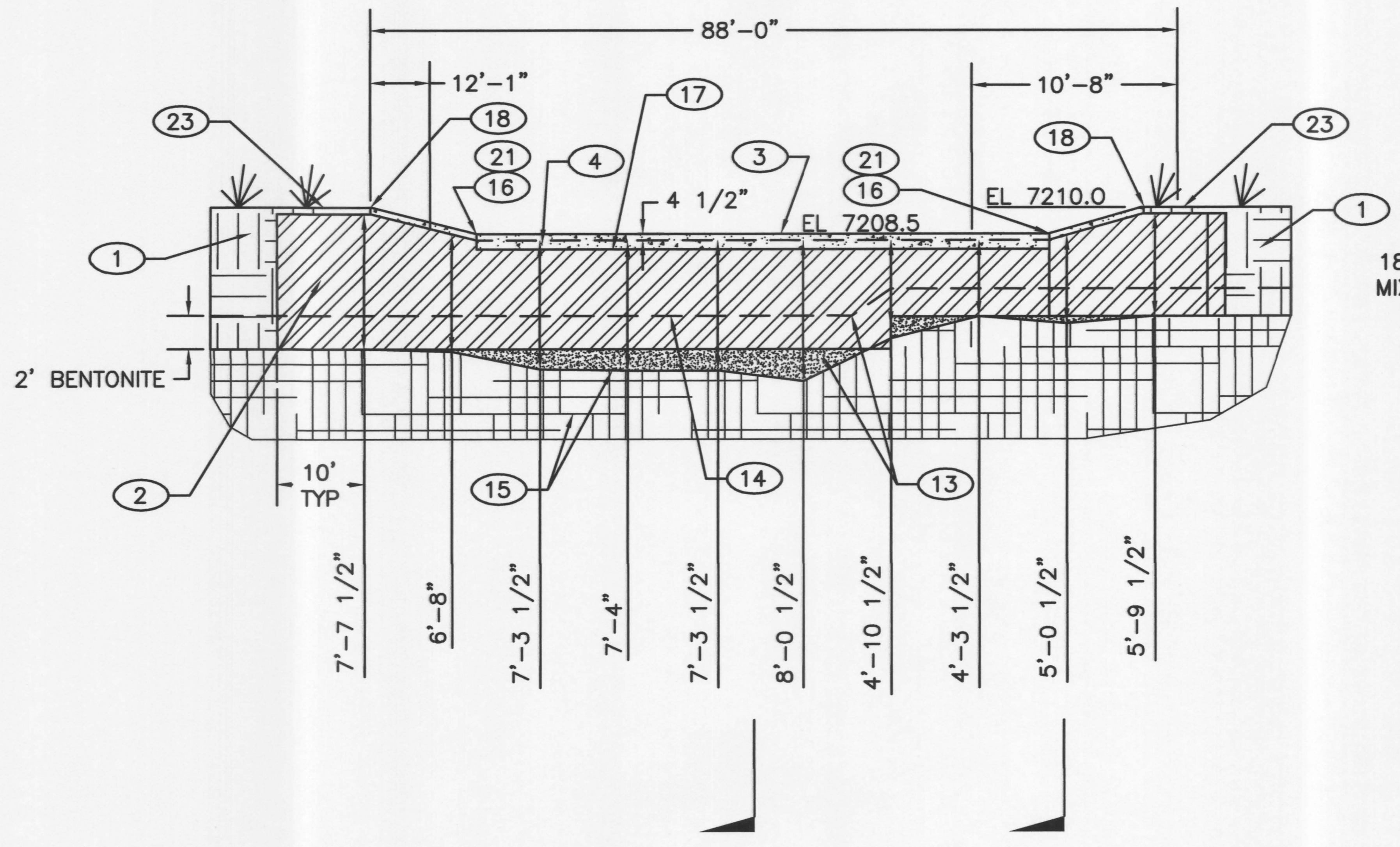
Path: P:\CAD\Los Alamos\140793\Sandia Wetlands\As-Built Drawings   Filename: C-5000.dwg   Plot Date: December 16, 2013 - 5:36 PM   CADD User: Martin, Edgar



TOP VIEW
NOT TO SCALE

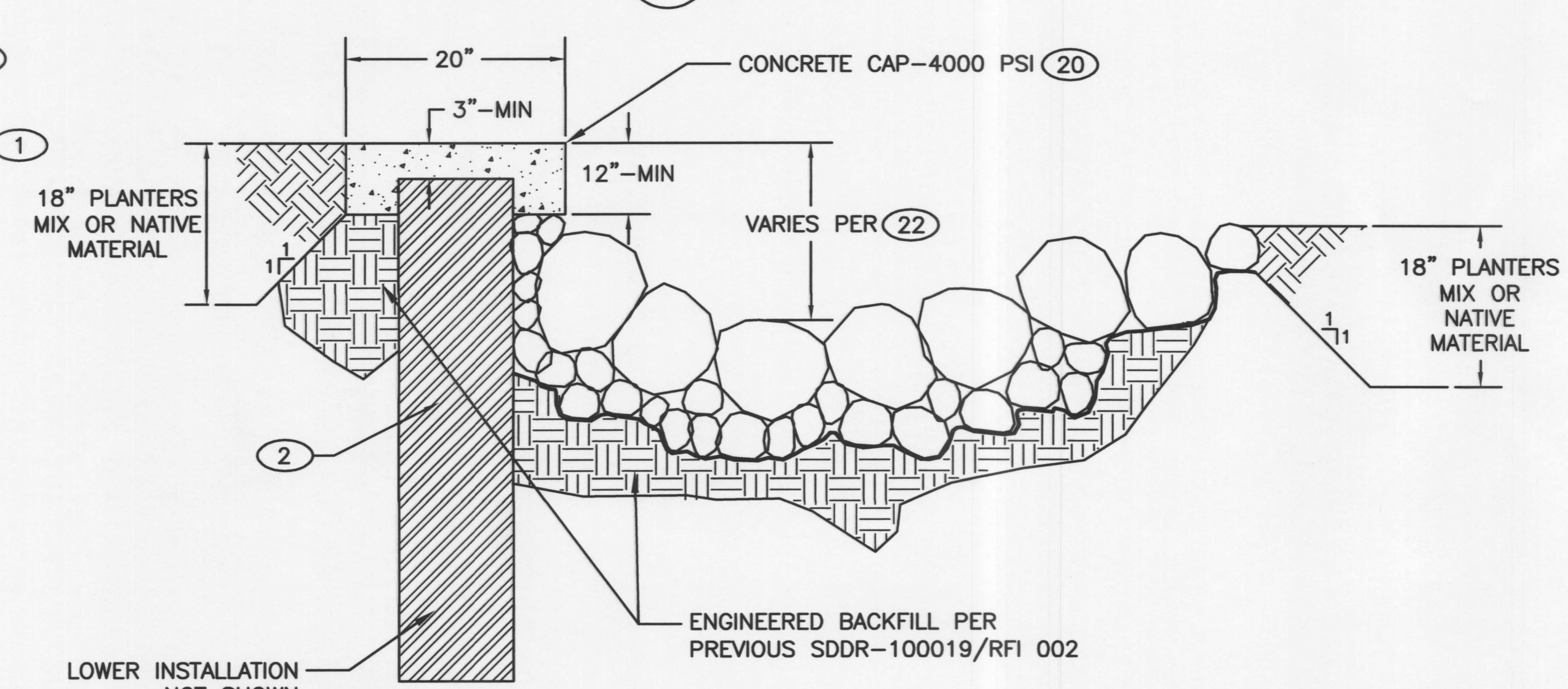


A SECTION VIEW
C-5001 NOT TO SCALE



FRONT VIEW (DOWNSTREAM)
NOT TO SCALE

B SECTION
C-1000 NOT TO SCALE



NON–REINFORCED CONCRETE CAP

B SECTION VIEW
C-5001 NOT TO SCALE

STRUCTURE ELEVATIONS			
GRADE CONTROL STRUCTURE	CREST OF WEIR ELEVATION	DROP ELEVATION	TIE–IN ELEVATION
GC–2	7208.5	7207.5	7210.0

J. A. O'Neill II
12/16/2013

JAMES A. O'NEILL II NEW MEXICO 18656 PROFESSIONAL ENGINEER

KEYED NOTES

1. ENGINEERED BACKFILL 10.0' MIN. BOTH SIDES OF SHEET PILE. MINIMUM LAYBACK SLOPE 1:1. COMPACT TO 95% OF STANDARD PROCTOR DENSITY PER SPECIFICATIONS.
2. STEEL SHEET PILE (TYPE PZ–22)
3. CREST OF WEIR ELEVATION, CONCRETE CAP – 4,000 PSI (SEE TABLE THIS SHEET). PLACE TOOL JOINTS EVERY 25' ON–CENTER WITH ONE EXPANSION JOINT IN THE CENTER OF EACH WEIR. THE EXPANSION JOINT SHALL BE 1" FILLED WITH 1" FOAM TO ALLOW THE CONCRETE TO EXPAND. FOAM SHALL ADHERE TO ONE SIDE OF THE JOINT AND BE SIMILAR TO FOAMTECH(R) FOAM MADE BY NMW INC. EDGES OF JOINT SHALL HAVE ¾" CHAMFERED EDGED TO REDUCE SPALLING.
4. PVC PIPE (2"–DIA.) WITH SCREENED CAP TO ALLOW DRAINAGE (DRILLED THROUGH PILE AND CAP AS SHOWN, 10–FEET O.C.)
5. ROCK SPLASH APRON
6. #4 LATERAL REBAR ON CORNERS OF CAP (2.0"–MIN. CLEARANCE TO CONCRETE ALL AROUND)
7. #4 REBAR DRILLED 18"–O.C. THROUGH PILE AND TIED TO BAR–(6) AND BAR–(8).
8. #4 REBAR SADDLE TIED TO BAR–(6) AND BAR–(7) @ 18"–O.C.
9. ONE–MAN STREAMBED BOULDERS FOR ENERGY DISSIPATION
10. COBBLES (12"–DIA. OR SMALLER) FOR FILLING VOIDS
11. 12–OZ PER SY NON–WOVEN GEOTEXTILE
12. ANCHOR GEOTEXTILE AT EDGES OF ROCK PAD
13. ALONG THE PROPOSED LENGTH OF EACH PILE, A TRENCH SHALL BE EXCAVATED TWO FEET INTO BEDROCK. SHEET PILES SHALL BE PLACED INTO THE TRENCH TO THE ALIGNMENT INDICATED IN THE DRAWINGS, AND THE TRENCH SHALL BE FILLED WITH GRANULAR BENTONITE TO CREATE A WATER TIGHT SEAL WHEN CONSTRUCTION IS COMPLETE. ADEQUATE SHORING SHALL BE USED TO HOLD THE SHEET PILES IN PLACE UNTIL FLOWABLE FILL AND BACKFILL CAN BE PLACED IN MANAGEABLE LIFTS ON OPPOSING SIDES IN ORDER TO LOCK THE SHEETPILES INTO ALIGNMENT.
14. TOP OF BEDROCK
15. BEDROCK
16. TIE–IN CONCRETE CAP (NOT REINFORCED)
17. DROP ELEVATION (SEE TABLE THIS SHEET)
18. TIE–IN ELEVATION (SEE TABLE THIS SHEET)
19. FLOWABLE FILL
20. NON–REINFORCED CONCRETE
21. TOOL JOINTS PER SDDR–RFI–1. INSTALL EXPANSION JOINT BETWEEN REINFORCED CONCRETE AND UNREINFORCED CONCRETE PER SDDR–100019/RFI 002
22. TRANSITION ROCK LINED DROP FROM 12" AT REINFORCED CONCRETE CAP TO 0" AT END ON NON–REINFORCED CONCRETE
23. 3" MINIMUM ENGINEERED FILL ABOVE SHEET PILE EXTENSIONS, COMPACTED TO 95% STD PROCTOR DENSITY
24. NON–ENGINEERED BACKFILL. ENGINEERED BACKFILL WITH OVERSIZED MATERIAL PRESENT

ECN # CAP–102698–ECN–00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL

DETAIL GRADE CONTROL STRUCTURE 2

DRAWN	E MARTIN
DESIGN	J O'NEILL
CHECKED	J O'NEILL
DATE	12-17-2013

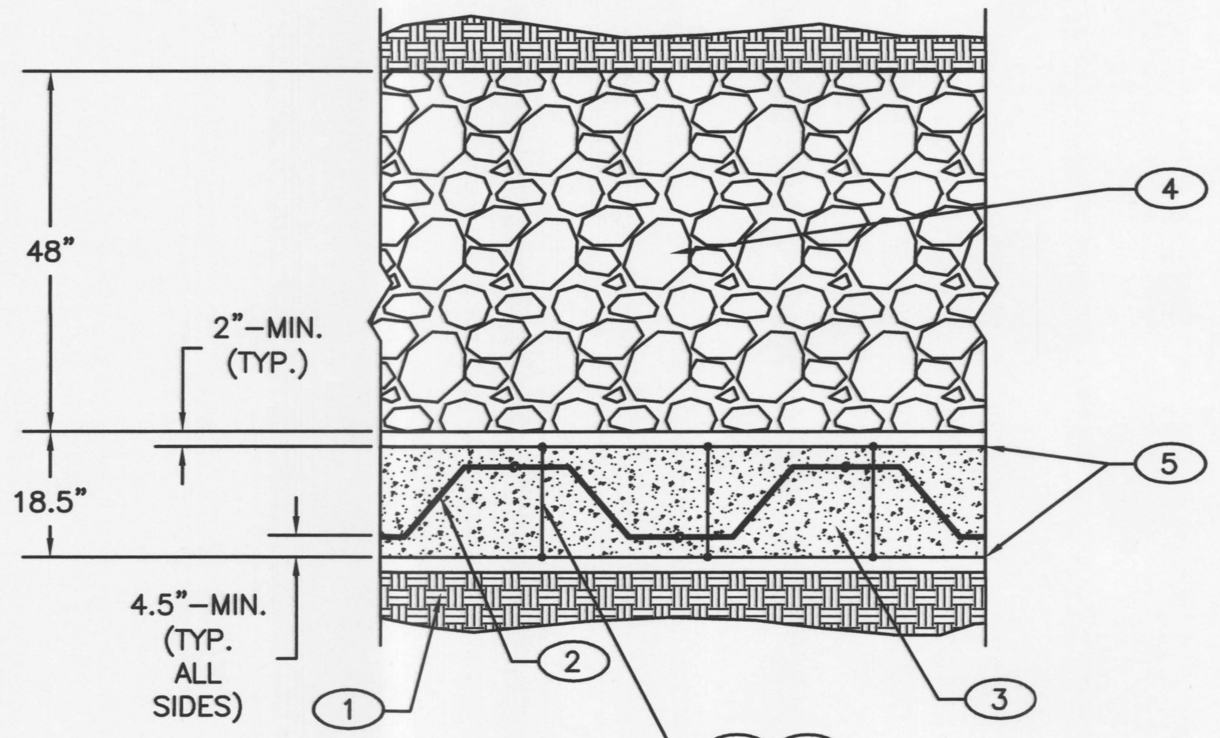
BLDG NA TA–00

SUBMITTED JAMES O'NEILL
APPROVED FOR RELEASE JOHN P. MCCANN

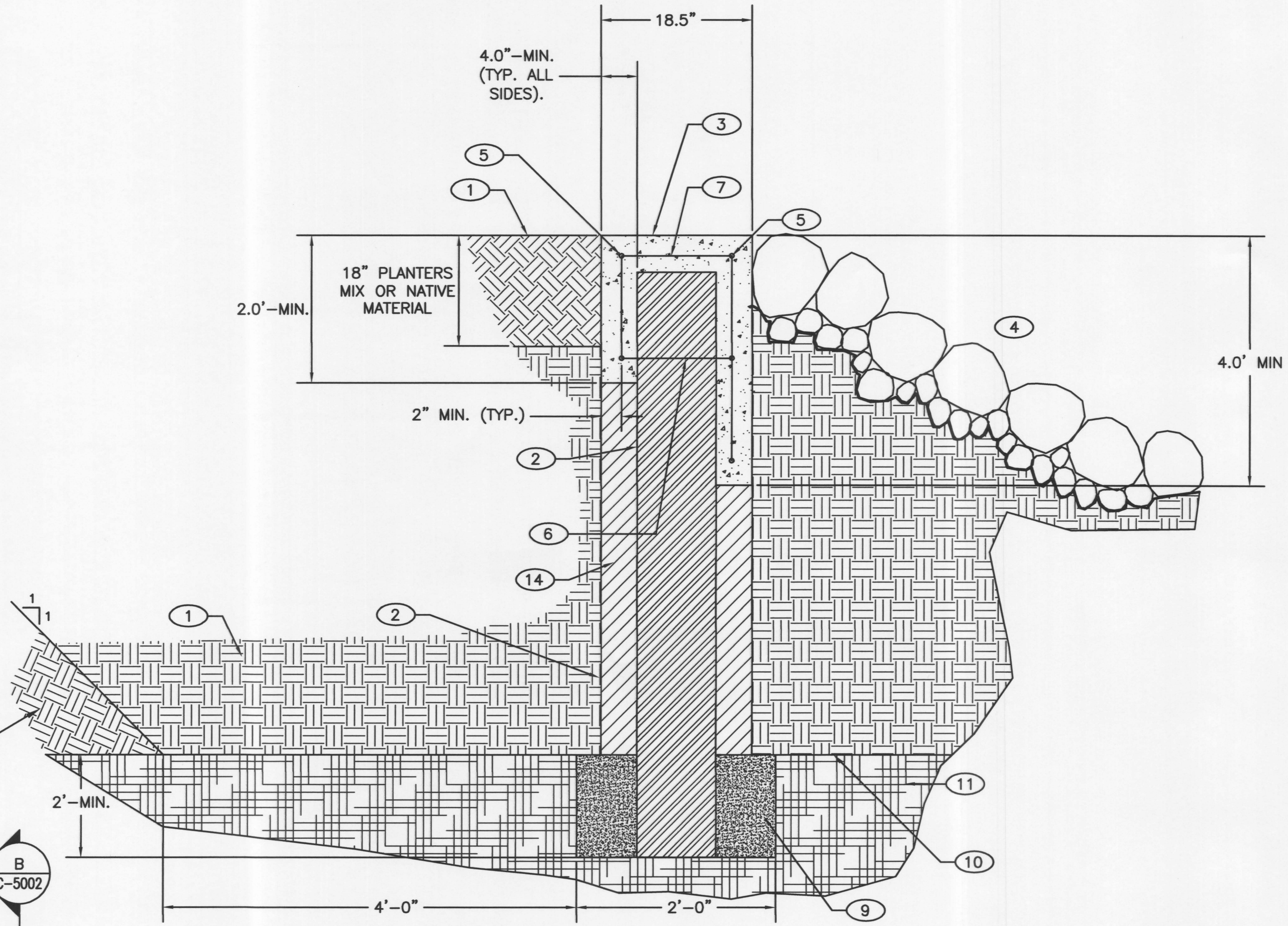
Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C–5001 6 OF 8

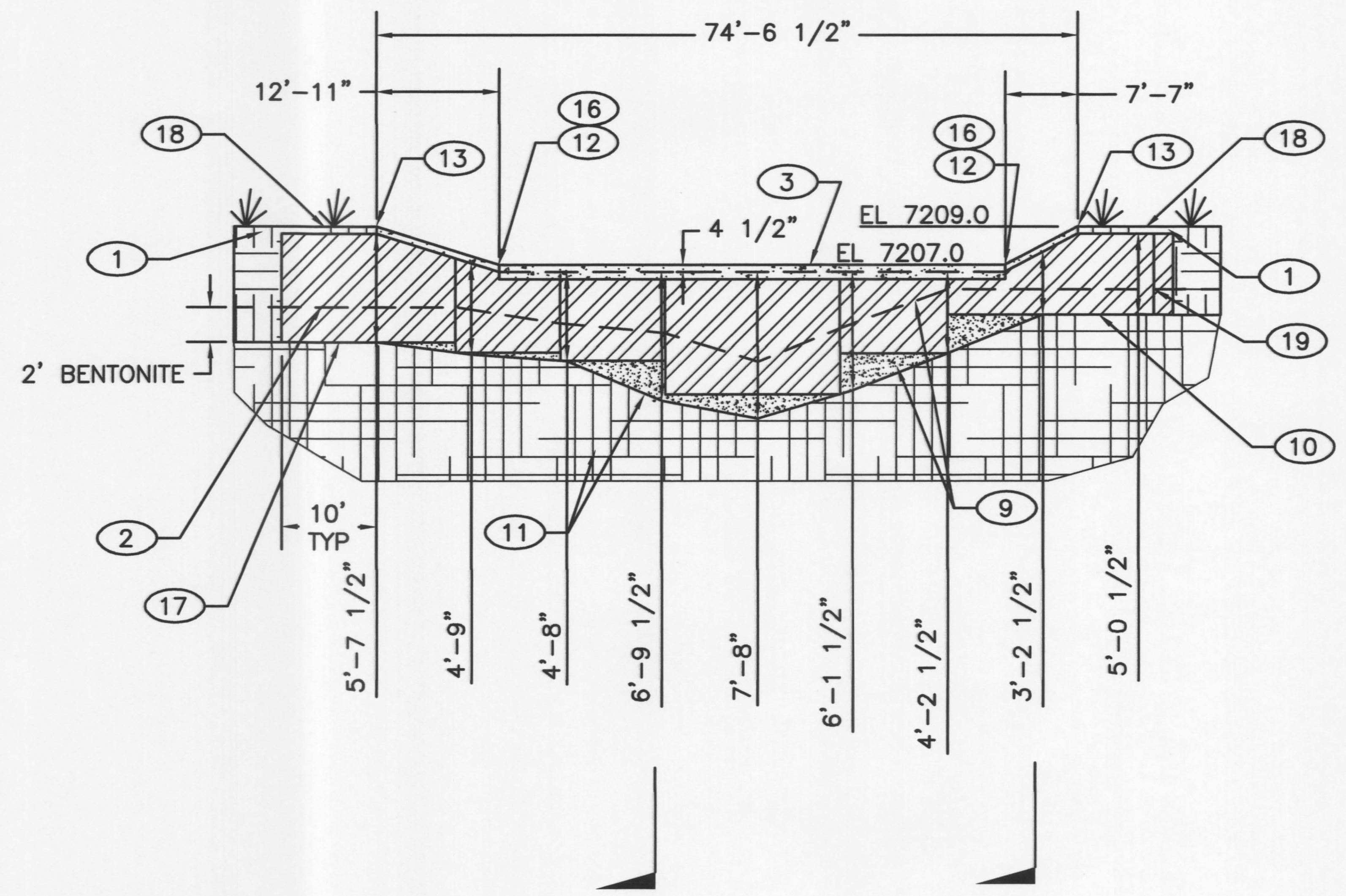
CLASSIFICATION Unclassified
REVIEWER William Hardesty
DATE 12/17/2013
PROJECT ID 102698
DRAWING NO C–56021
REV 0



TOP VIEW
NOT TO SCALE

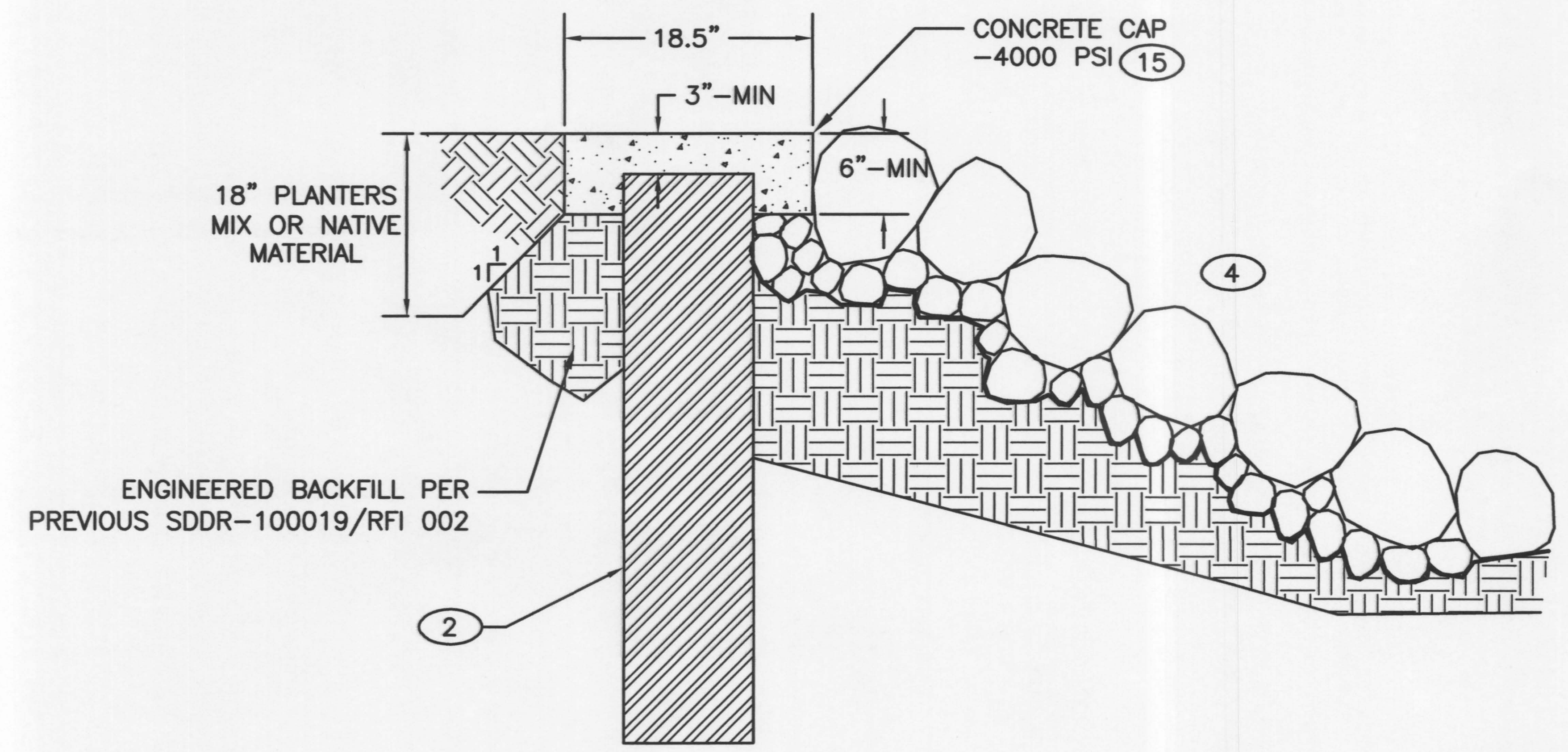


A SECTION VIEW (C-5002)
NOT TO SCALE



FRONT VIEW (DOWNSTREAM)
NOT TO SCALE

C SECTION (C-1000)
NOT TO SCALE



NON-REINFORCED CONCRETE CAP

B SECTION VIEW (C-5002)
NOT TO SCALE

STRUCTURE ELEVATIONS			
GRADE CONTROL STRUCTURE	CREST OF WEIR ELEVATION	DROP ELEVATION	TIE-IN ELEVATION
GC-3	7207.0	N/A*	7209.0

*SEE DETAIL C-5001 FOR DROP CONSTRUCTION ON GC-3

KEYED NOTES

1. ENGINEERED BACKFILL 10.0' MIN. BOTH SIDES OF SHEET PILE. MINIMUM LAYBACK SLOPE 1:1. COMPACT TO 95% OF STANDARD PROCTOR DENSITY PER SPECIFICATIONS.
2. STEEL SHEET PILE (TYPE PZ-22)
3. CREST OF WEIR ELEVATION, CONCRETE CAP - 4,000 PSI (SEE TABLE THIS SHEET). PLACE TOOL JOINTS EVERY 25' ON-CENTER WITH ONE EXPANSION JOINT IN THE CENTER OF EACH WEIR. THE EXPANSION JOINT SHALL BE 1" FILLED WITH 1" FOAM TO ALLOW THE CONCRETE TO EXPAND. FOAM SHALL ADHERE TO ONE SIDE OF THE JOINT AND BE SIMILAR TO FOAMTECH(R) FOAM MADE BY NMW INC. EDGES OF JOINT SHALL HAVE ¾" CHAMFERED EDGED TO REDUCE SPALLING.
4. SEE SHEET C-5003 FOR DETAIL AT GC-3
5. #4 LATERAL REBAR ON CORNERS OF CAP (2.0"-MIN. CLEARANCE TO CONCRETE ALL AROUND)
6. #4 REBAR DRILLED 18"-O.C. THROUGH PILE AND TIED TO BAR-(6) AND BAR-(8).
7. #4 REBAR SADDLE TIED TO BAR-(6) AND BAR-(7) @ 18"-O.C.
8. BOTTOM OF TRENCH
9. ALONG THE PROPOSED LENGTH OF EACH PILE, A TRENCH SHALL BE EXCAVATED TWO FEET INTO BEDROCK. SHEET PILES SHALL BE PLACED INTO THE TRENCH TO THE ALIGNMENT INDICATED IN THE DRAWINGS, AND THE TRENCH SHALL BE FILLED WITH GRANULAR BENTONITE TO CREATE A WATER TIGHT SEAL WHEN CONSTRUCTION IS COMPLETE. ADEQUATE SHORING SHALL BE USED TO HOLD THE SHEET PILES IN PLACE UNTIL FLOWABLE FILL AND BACKFILL CAN BE PLACED IN MANAGEABLE LIFTS ON OPPOSING SIDES IN ORDER TO LOCK THE SHEETPILES INTO ALIGNMENT.
10. TOP OF BEDROCK
11. BEDROCK
12. TIE-IN CONCRETE CAP (NOT REINFORCED)
13. TIE-IN ELEVATION (SEE TABLE THIS SHEET)
14. FLOWABLE FILL
15. NON-REINFORCED CONCRETE
16. TOOL JOINTS PER SDDR-RFI-1. INSTALL EXPANSION JOINT BETWEEN REINFORCED CONCRETE AND UNREINFORCED CONCRETE PER SDDR-100019/RFI 002
17. END SHEET PILE IS 22" INTO TUFF AND 2" ABOVE BOTTOM OF EXCAVATION
18. 3" MINIMUM ENGINEERED FILL ABOVE SHEET PILE EXTENSIONS COMPACTED TO 95% STD PROCTOR DENSITY
19. 2ND SHEET PILE IS 22" INTO BEDROCK AND 2" ABOVE BOTTOM OF TRENCH

ECN # CAP-102698-ECN-00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS

DETAIL GRADE CONTROL STRUCTURE 3

DRAWN E MARTIN
DESIGN J O'NEILL
CHECKED J O'NEILL
DATE 12-17-2013

BLDG NA TA-00

SUBMITTED JAMES O'NEILL
APPROVED FOR RELEASE JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-5002
7 OF 8

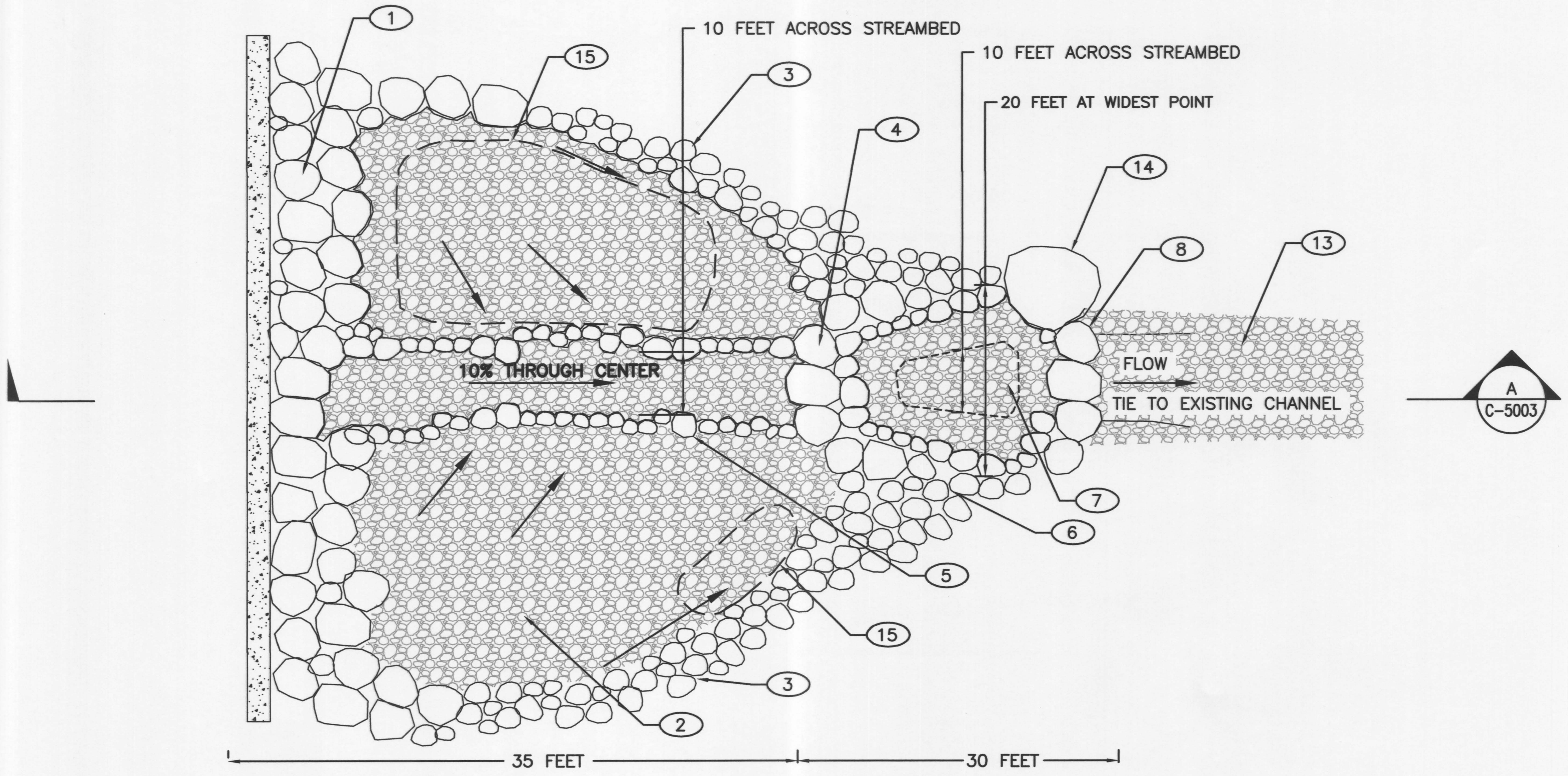
CLASSIFICATION Unclassified
REVIEWER William Hardesty
DATE 12/17/2013
PROJECT ID 102698
DRAWING NO C-56021
REV 0

J. A. O'Neill III
12/16/2013

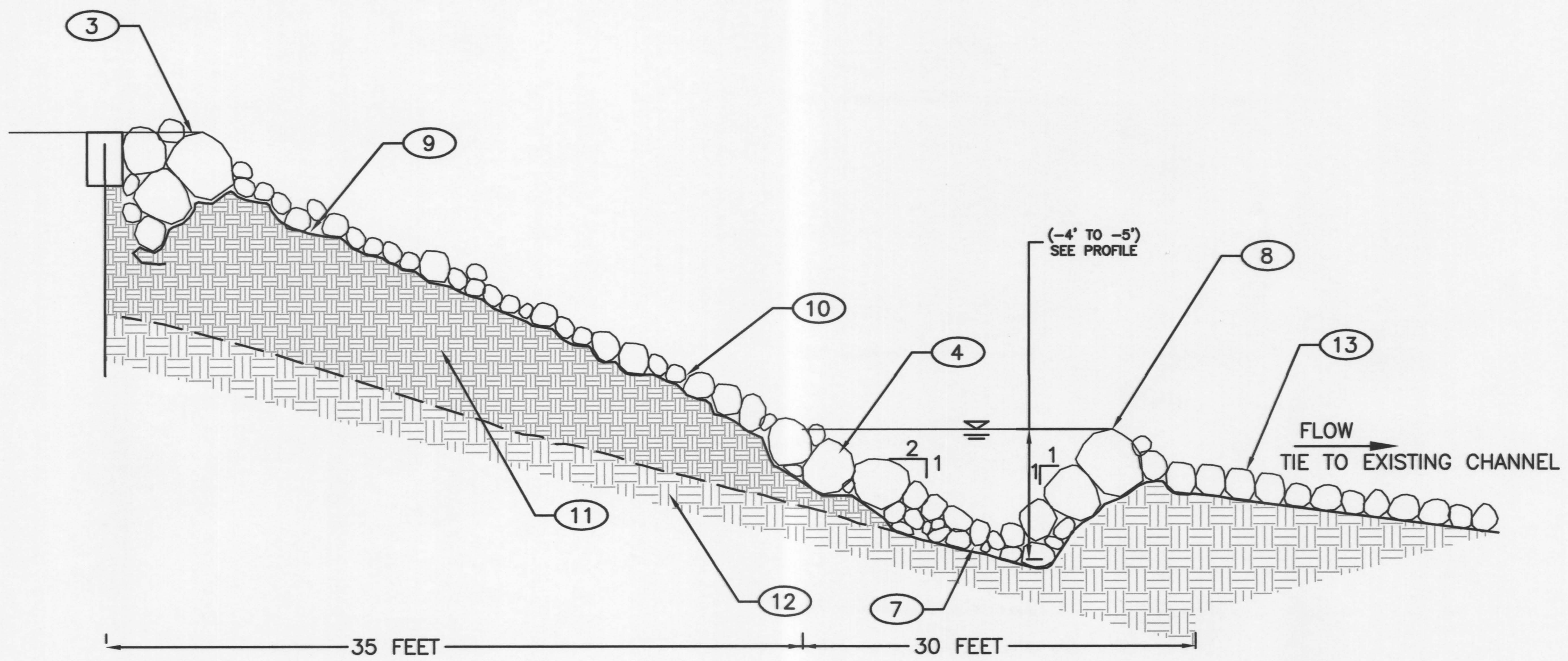
JAMES A. O'NEILL III
NEW MEXICO
18656
PROFESSIONAL ENGINEER

KEYED NOTES

1. TWO MAN STREAM BOULDERS AT CREST OF CASCADE
2. 12" STREAMBED COBBLES THROUGHOUT CASCADE INTERIOR
3. PLACE ONE MAN STREAMBED BOULDERS TO FORM CASCADE EDGE
4. TWO MAN STREAMBED BOULDERS AT END OF CASCADE
5. PLACE ONE MAN STREAMBED BOULDERS TO FORM CENTER CHANNEL
6. PLACE ONE MAN STREAMBED BOULDERS TO LINE EDGE OF POOL
7. 12" STREAMBED COBBLES THROUGHOUT CASCADE POOL (BOTTOM ELEV. = 7199.0')
8. TWO MAN BOULDERS AT CREST OF POOL SILL TO STREAM CHANNEL TIE-IN
9. GEOSYNTHETIC CLAY LINER (16-OZ/SY NON-WOVEN BOUND) TO LINE CASCADE
10. FILL VOID SPACES WITH SMALL COBBLES AND STREAMBED SEDIMENT
11. EXCAVATED MATERIAL BACKFILLED AS NEEDED AND COMPACTED TO 95% OF STANDARD PROCTOR DENSITY
12. EXISTING GRADE
13. 12" STREAMBED COBBLES AND GEOSYNTHETIC CLAY LINER EXTENDED INTO STREAM CHANNEL
14. LARGE EXISTING BOULDER FIELD WORKED INTO EDGE OF CASCADE POOL
15. APPROXIMATE AREAS WHERE NMDOT CLASS C RIPRAP WAS USED TO REPAIR STORM DAMAGED 12" STREAMBED COBBLES



TOP VIEW



A / C-5003 SECTION VIEW
NOT TO SCALE

1 / C-1000 DETAIL

ECN # CAP-102698-ECN-00012

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS

DETAIL CASCADE POOL

DRAWN: E MARTIN
DESIGN: J O'NEILL
CHECKED: J O'NEILL
DATE: 12-17-2013

BLDG NA TA-00

SUBMITTED: JAMES O'NEILL
APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-5003
8 OF 8

CLASSIFICATION: Unclassified
REVIEWER: William Hardesty
DATE: 12/17/2013

PROJECT ID: 102698
DRAWING NO: C-56021
REV: 0

J. A. O'Neill II
12/16/2013

JAMES A. O'NEILL II — NEW MEXICO — 18656 — PROFESSIONAL ENGINEER

Path: P:\CAD\0Los Alamos\147793\Sandia Wetlands\As-Built Drawings Filename: C-5003.dwg Plot Date: December 16, 2013 - 5:39 PM CADD User: Martin, Edgar

Appendix D

Photo Documentation

Sheet-pile wall 1 of the grade-control structure after construction, November 20, 2013

Upstream of sheet-pile wall 1, November 21, 2013

Sheet-pile wall 2 of the grade-control structure, November 21, 2013

Downstream of sheet-pile wall 2, November 21, 2013

Sandia wetland, looking upstream, September 11, 2013

Looking north of the second sheet-pile wall of the grade-control structure after September 13, 2013, rain event. Photo taken September 18, 2013.

Looking south of the second sheet-pile wall of the grade-control structure after September 13, 2013, rain event. Photo taken September 18, 2013.

Sandia wetland run-on control and grade-control structure looking north, November 21, 2013

Sandia wetland run-on control and grade-control structure looking southeast, December 5, 2013

Sheet-pile wall 1 looking upstream, September 23, 2014

Sheet-pile wall 2 looking upstream, September 23, 2014

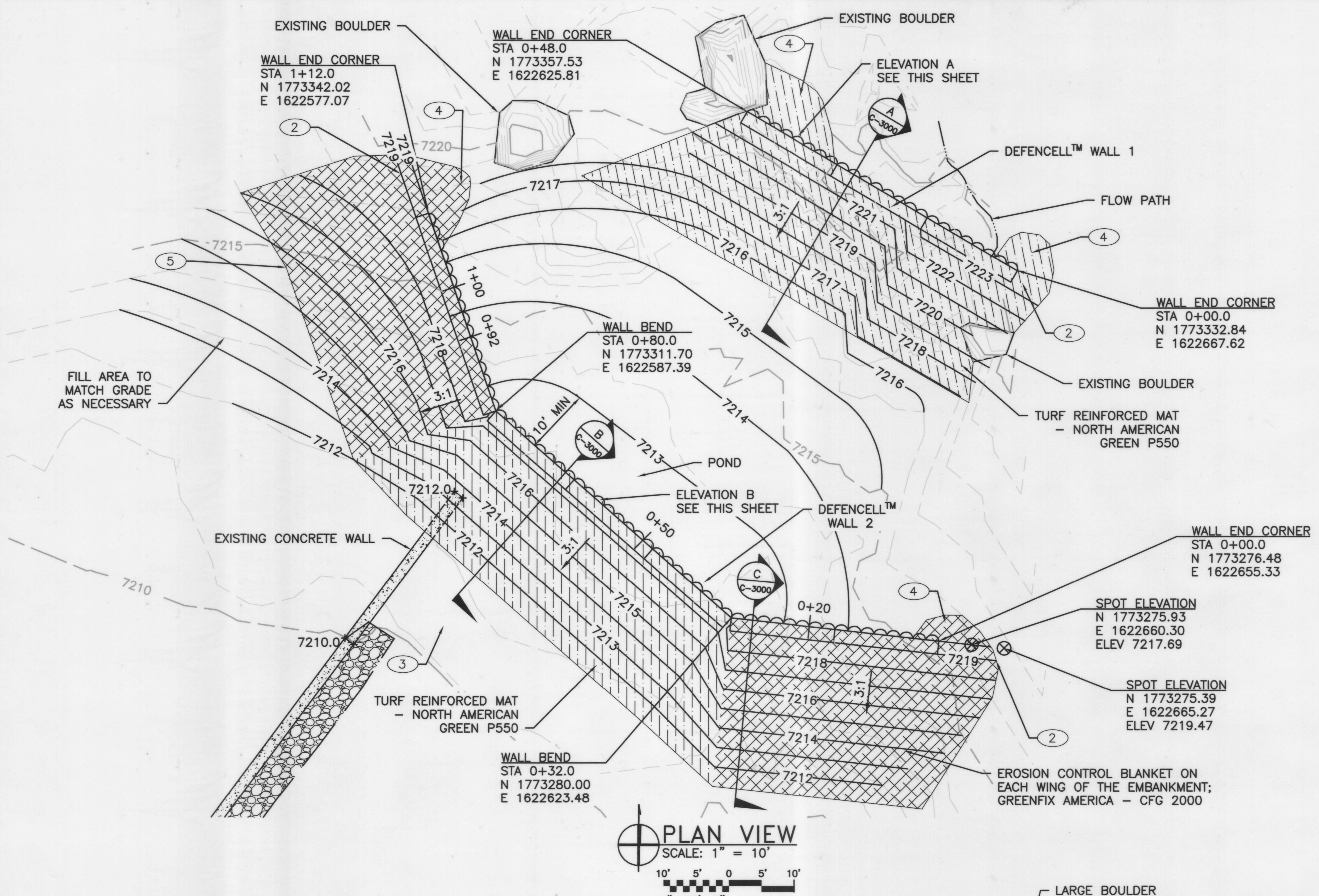
Cascade structure looking downstream, September 23, 2014

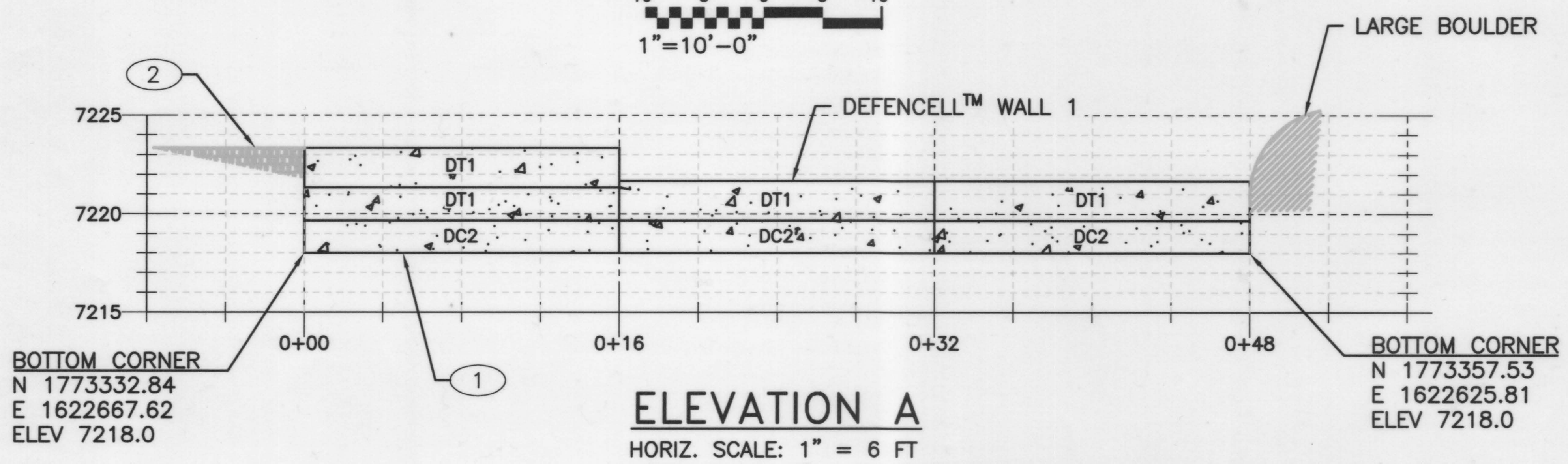
Erosion controls at south-entering swale looking southeast with established vegetation and no signs of erosion or rilling taking place, September 23, 2014

Earthen berm erosion control below south-entering swale looking south with established vegetation and no signs of erosion or rilling taking place, September 23, 2014

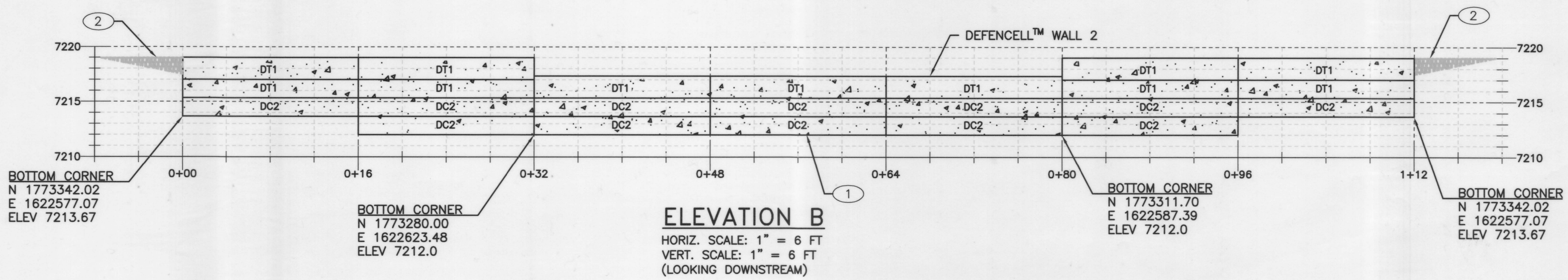
Appendix E

Sandia Canyon Wetland Run-On Control Design





ELEVATION A
HORIZ. SCALE: 1" = 6 FT
VERT. SCALE: 1" = 6 FT
(LOOKING DOWNSTREAM)



ELEVATION B
HORIZ. SCALE: 1" = 6 FT
VERT. SCALE: 1" = 6 FT
(LOOKING DOWNSTREAM)

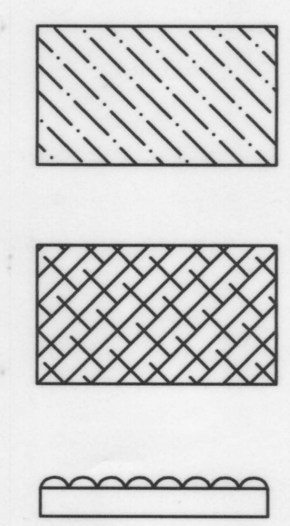
GENERAL NOTES

1. IF THIS SHEET IS NOT 24" x 36", THEN IT IS A REDUCED SIZE PLOT.
2. LANL ENGINEERING MUST BE ON-SITE TO WITNESS INSTALLATION AND PROVIDE TECHNICAL DIRECTION.
3. FILL FOR DEFENCELL™ AND BERMS SHALL BE ALLUVIAL FAN DEBRIS FROM LANDFILL. NO NATIVE MATERIAL FROM WETLANDS STOCKPILE SHALL BE USED.
4. CONTRACTOR TO PROVIDE AS-BUILT INFORMATION.
5. GENERAL MANUFACTURERS INSTALLATION DIRECTIONS ARE PROVIDED BY FIBERWEB INC. AND ARE SHOWN ON SHEET C-3001.
6. APPLICABLE SPECIFICATIONS:
   31-0519 SANDIA CANYON WETLAND GRADE CONTROL STRUCTURE GEOSYNTHETICS
   32-9219 SANDIA CANYON WETLAND GRADE CONTROL STRUCTURE SEEDING
   31-2000 GRADE CONTROL STRUCTURE EARTH MOVING

KEYED NOTES:

(1) PLACE DEFENCELL™ WALL HORIZONTALLY SUCH THAT EACH CELL IS PLUS OR MINUS 0.05 FT TOLERANCE FROM LEVEL.
(2) EXTEND BERM LATERALLY TO CATCH EXISTING SLOPE. EXTEND EROSION CONTROL MAT TO COVER BERM. TYPICAL AT EACH END OF DEFENCELL™ WALLS.
(3) GRADE EXISTING GROUND FROM AS-CONSTRUCTED ELEVATION OF THE GRADE CONTROL STRUCTURE PROJECT EDGE OF ZONE 4 BOUNDARY AND SLOPE UPWARD AT A 15% MAXIMUM SLOPE UNTIL THE GROUND SURFACE OF THE BERM IS MET. USE CONTOUR 7210 AS THE LIMIT OF DISTURBANCE.
(4) FILL UPSTREAM OF DEFENCELL™ WALL USING BERM FILL.
(5) TRANSITION FROM 3:1 SLOPE TO LESS STEEP GRADE TO WRAP CORNER AND MATCH EXISTING GRADE AS NECESSARY.

LEGEND:



NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP
1	10/29/13	U.C.	JBR	GENERAL REVISION					

ENVIRONMENTAL PROGRAMS

SANDIA CANYON WETLAND GRADE CONTROL STRUCTURE – RUNON CONTROL

DEFENCELL™ WALLS 1 AND 2
PLAN AND PROFILE SHEET

DRAWN	E. MARTIN
DESIGN	R. RAGER
CHECKED	T. KOSTRUBALA
DATE	9/24/2013

BLDG NA — TA-00

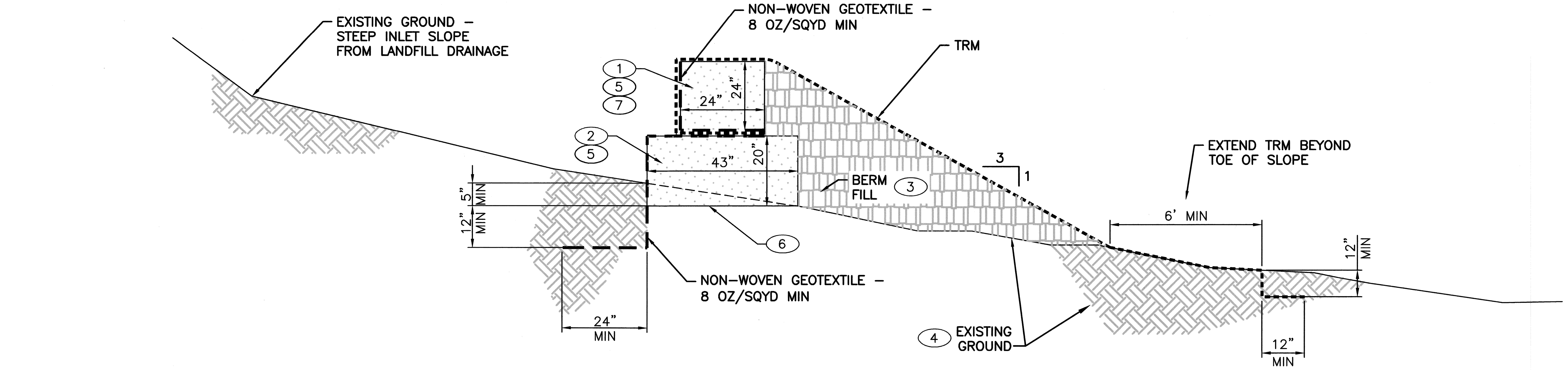
SUBMITTED: DEBRA NEVERGOLD — APPROVED FOR RELEASE: JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY — PO Box 1663, Los Alamos, New Mexico 87545

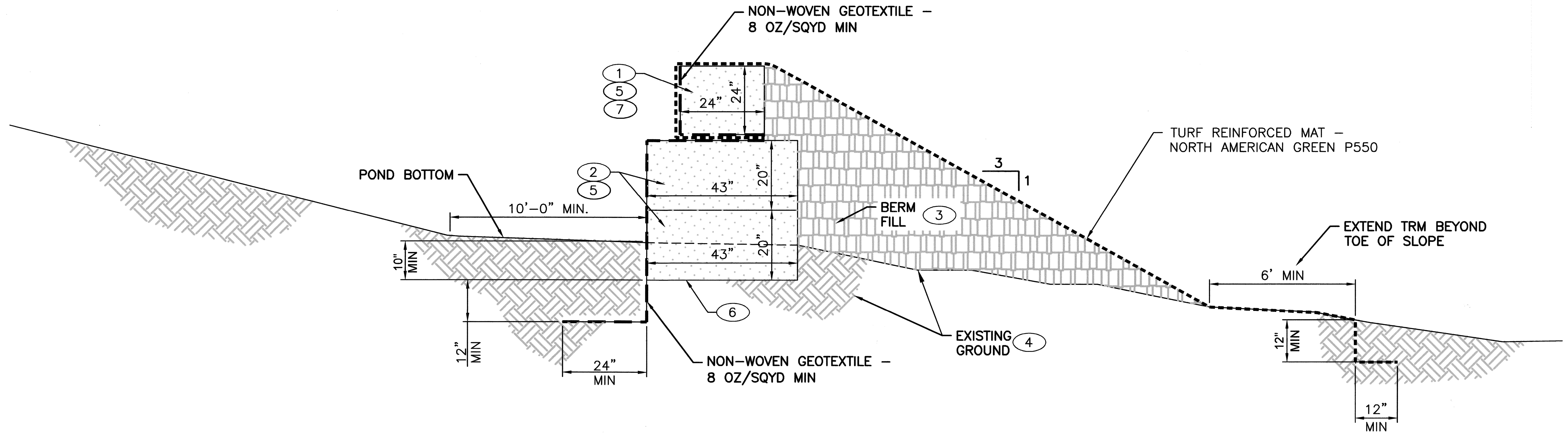
SHEET C-1000 — 1 OF 3

CLASSIFICATION UNC — REVIEWER WILLIAM TURNEY — DATE 9/24/2013

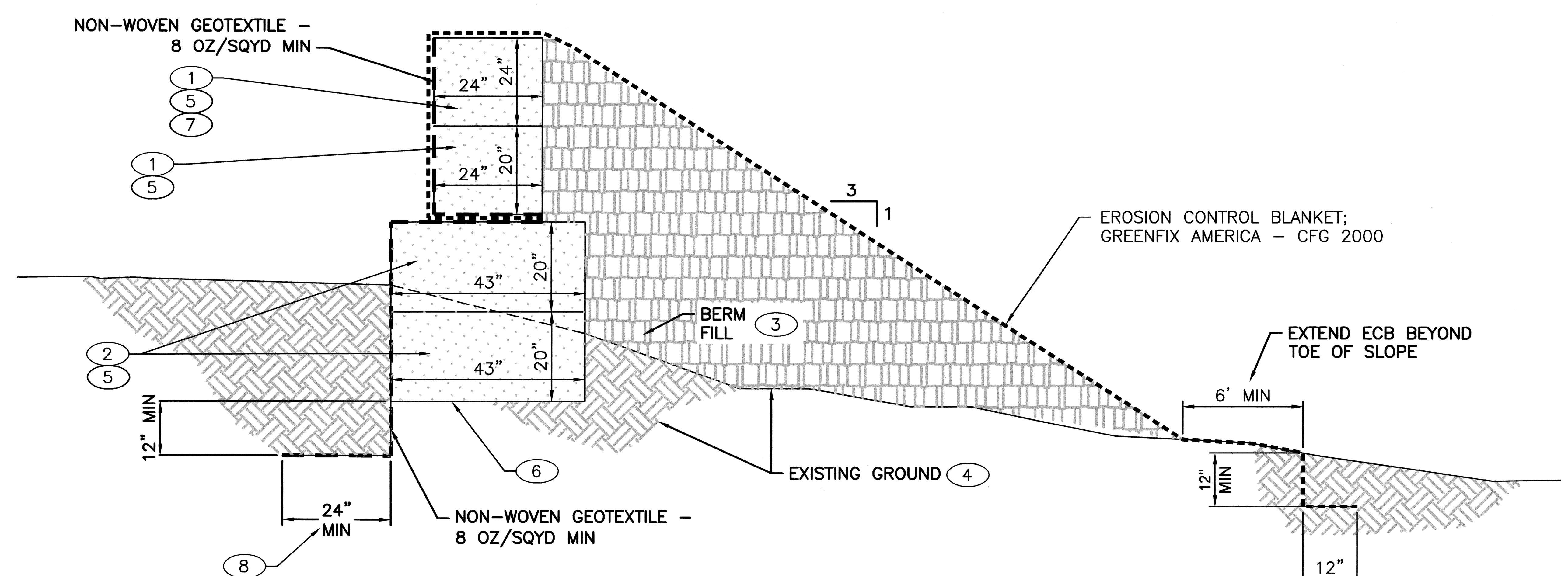
PROJECT ID 102698 — DRAWING NO C-56069 — REV 1



A C-1000 CROSS SECTION – DEFENCELL™ WALL 1
SCALE: NONE



B C-1000 CROSS SECTION – DEFENCELL™ WALL 2
SCALE: NONE



C C-1000 CROSS SECTION – DEFENCELL™ WALL 2
SCALE: NONE

GENERAL NOTES:

1. IF THIS SHEET IS NOT 24" x 36", THEN IT IS A REDUCED SIZE PLOT.
2. SITE CONDITIONS ARE AS FOUND.
3. DIMENSIONS WITHOUT TOLERANCES ARE NOMINAL.
4. BROADCAST SEED BENEATH EROSION CONTROL BLANKET AND TURF REINFORCED MAT PER SPECIFICATIONS (SEEDING, 31-2000 GRADE CONTROL STRUCTURE EARTH MOVING). (2)

KEYED NOTES:

1. DEFENCELL™ DT1 – 24" WIDE BY 20" TALL BY 16 FT LONG (1 PANEL) DT1 DEFENCELL™ MAY BE SUBSTITUTED FOR DC2.
2. DEFENCELL™ DC2 – 43" WIDE BY 20" TALL BY 16 FT LONG (1 PANEL) DC2 DEFENCELL™ MAY BE SUBSTITUTED FOR DC3 DEFENCELL™. DEFENCELL™ DC3 – 65" WIDE BY 20" TALL BY 16 FT LONG (1 PANEL).
3. BERM FILL TO BE ALLUVIAL FAN DEBRIS FROM LANDFILL SCREENED TO A MAXIMUM PARTICLE SIZE OF 3". MOISTURE CONDITION IN ACCORDANCE WITH THE SANDIA WETLANDS GRADE CONTROL STRUCTURE EARTHMOVING SPECIFICATION 31-2000.3.13.B-C AND F.4&5. FIELD MOISTURE CONTENT SHALL BE BETWEEN 11% TO 17%. COMPACT IN MAXIMUM OF 8" LIFTS USING 2 PASSES OF TRACKED OR WHEELED VEHICLE OR VIBRATING WALK BEHIND EQUIPMENT. (2)
4. SCREENING OF EXISTING GROUND IS NOT REQUIRED. PLACE AND COMPACT ANY EXISTING GROUND MATERIAL USING METHODS IDENTICAL TO BERM FILL.
5. FILL DEFENCELL™ WITH ALLUVIAL FAN DEBRIS FROM LANDFILL SCREENED TO A MAXIMUM PARTICLE SIZE OF 3". COMPACT IN MAXIMUM OF 8" LIFTS USING NARROW DIAMETER (LESS THAN 5" DIAMETER) HAND TAMPER.
6. LOWER CELLS MAY CONSIST OF DC3 PROVIDING THE LATERAL EXTENSION IS INTO THE BERM.
7. TOP CELL IN DEFENCELL™ STACK IS 24" TALL. SEE C-3001.
8. ANCHORING OF GEOTEXTILE BELOW BOTTOM GRADE OF DEFENCELL™ WALL AND BY LATERAL EXTENSION IS NOT REQUIRED FOR STATION SECTIONS 0+00 TO 0+20 FEET AND 0+92 TO 1+12 FEET PROVIDED FINAL UPSTREAM GRADE ABUTTING DEFENCELL™ WALL IS 2 FT OR HIGHER THAN DEFENCELL™ BOTTOM GRADE.

LEGEND:

- — — — GEOTEXTILE
- - - - - - TURF REINFORCED MAT OR EROSION CONTROL BLANKET
- (dotted box) DEFENCELL™

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP
2	11/07/2013		DBR	REVISED FIELD MOISTURE CONTENT. ADDED SEEDING REQUIREMENT.	EM	RR	TK		
1	10/29/2013	U.C.	DR	GENERAL REVISION	EM	RR	TK	DN	JM

ENVIRONMENTAL PROGRAMS

SANDIA CANYON WETLAND GRADE CONTROL STRUCTURE – RUNON CONTROL

CROSS SECTIONS

DRAWN	E. MARTIN
DESIGN	R. RAGER
CHECKED	T. KOSTRUBALA
DATE	9/24/2013

BLDG NA — TA-00

SUBMITTED: DEBRA NEVERGOLD — APPROVED FOR RELEASE: JOHN P. MCCANN

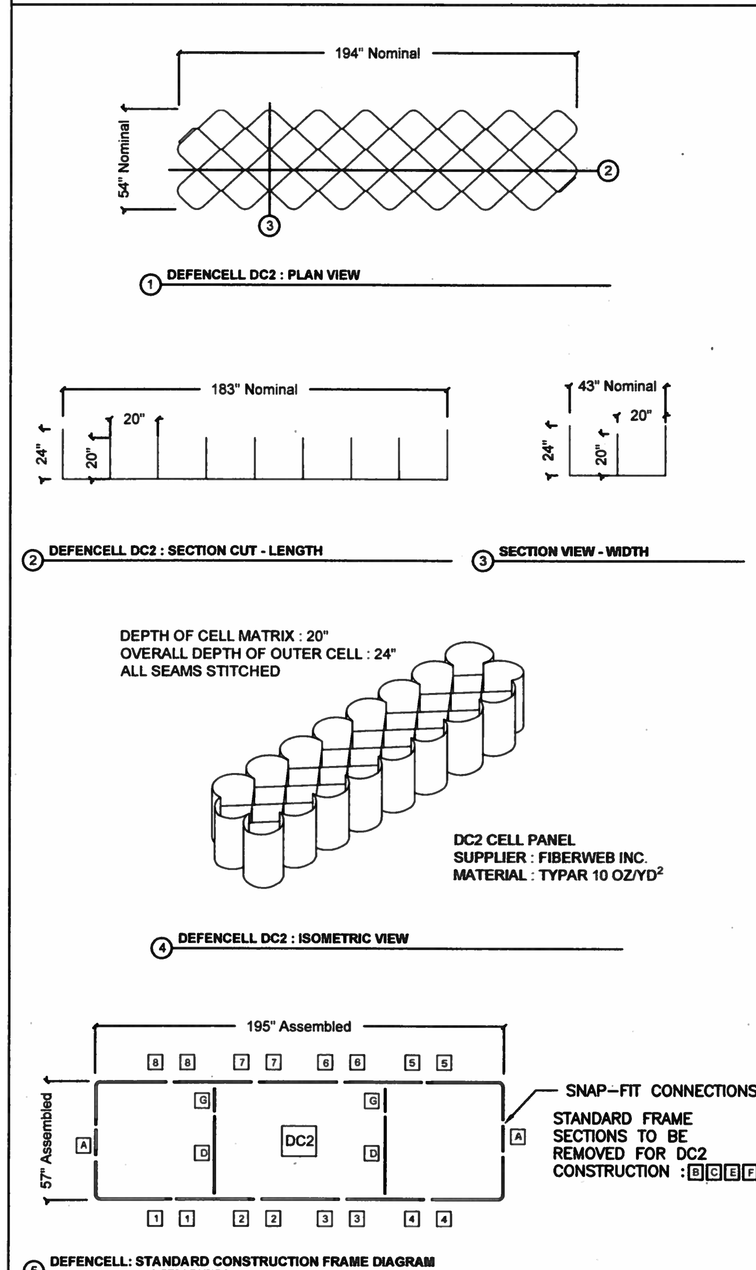
Los Alamos NATIONAL LABORATORY — PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-3000 — 2 OF 3

CLASSIFICATION UNC — REVIEWER WILLIAM TURNEY — DATE 9/24/2013

PROJECT ID 102698 — DRAWING NO C-56069 — REV 2

DEFENCELL DC2 PRODUCT SPECIFICATIONS:



STANDARD FLOOD WALL DESIGN:

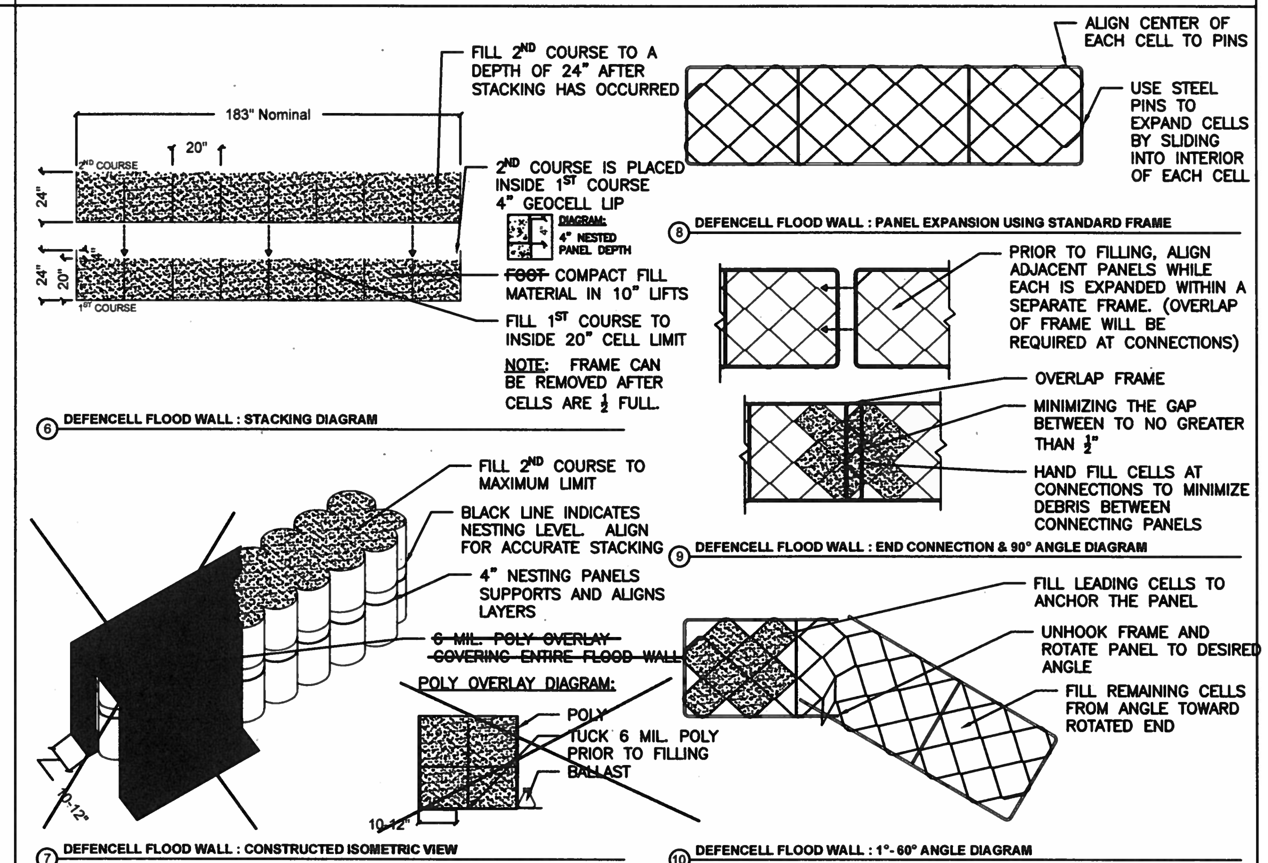


Table 1 : DC2 Specifications

PHYSICAL PROPERTIES	UNITS	DC2
PANEL LENGTH	m / in	4.9 / 194
FOOTPRINT WIDTH	m / in	1.35 / 54
PROTECTED WIDTH	m / in	1.10 / 43
PANEL VOLUME	y^3	4.9
80% COMPACTED [1]	tons	6.4
CELLS IN LENGTH	No.	8
CELL IN WIDTH	No.	2
CELL DIAMETER	m / in	0.5 / 20
CELL DEPTH	m / in	0.5 / 20
COLOR		Tan
PANEL WEIGHT	lbs	15
PANELS PER PALLET	No.	44
PALLET GROSS WEIGHT [2]	lbs	740

[1] CALCULATED 80% COMPACTION (SAND) - 20% SHRINKAGE/SPILLAGE FACTOR (US TONS)
[2] GROSS WEIGHT - INCLUDES WEIGHT OF PALLET PLUS FRAME KIT
[3] TESTED BY ERDC, WBS, HP WHITE, TRL, AND CEC, INC.

GENERAL NOTES

1. THE INFORMATION CONTAINED IN THIS DETAIL IS PROVIDED FOR THE CONVENIENCE OF THE USER AND DOES NOT TAKE PLACE OF CONSTRUCTION PLANS AND/OR SPECIFICATIONS. FIBERWEB INC. CANNOT BE HELD RESPONSIBLE FOR THE USE OR MISUSE OF THIS INFORMATION. WE RECOMMEND YOU CONTACT US FOR FURTHER DESIGN ASSISTANCE.
2. THIS DETAIL IS FOR CONCEPT PURPOSES ONLY AND DOES NOT IMPLY ANY ACTUAL DESIGN OR ENGINEERING HAS BEEN COMPLETED. ENGINEERING MODELING WILL NEED TO BE PERFORMED TO DETERMINE PROPER STRUCTURAL REQUIREMENTS AND COMPONENTS INCLUDING SAND AND AGGREGATE.
3. ~~ALL MATERIALS ARE SUBJECT TO APPROVAL BY FIBERWEB INC.~~

NO	DATE	CLASS REV	ADC	DESCRIPTION	DWN	DES	CHKD	SUB	APP

ENVIRONMENTAL PROGRAMS

SANDIA CANYON WETLAND GRADE CONTROL STRUCTURE – RUNON CONTROL

DETAILS

DRAWN	E. MARTIN
DESIGN	R. RAGER
CHECKED	B. FOLEY
DATE	09/24/2013

BLDG NA TA-00

SUBMITTED DEBRA NEVERGOLD

APPROVED FOR RELEASE JOHN P. MCCANN

Los Alamos NATIONAL LABORATORY PO Box 1663 Los Alamos, New Mexico 87545

SHEET C-3001 3 OF 3

CLASSIFICATION UNC | REVIEWER | DATE 9/24/13

PROJECT ID 102698 | DRAWING NO C-56069 | REV 0