# Appendix A

*Sandia Canyon Wetland Hydrology*

Los Alamos NATIONAL LABORATORY EST. 1943

Conduct of Engineering Calculations

# Calculation Cover Sheet

Calc No.: CALC-000518 Rev. No.: 0 DRP 3/20/13 MO 3/21/13 Page 1 of 18

Calc Title: Sandia Canyon Wetland Hydrology

Calculation Cover Sheet

| | |
|---|---|
| 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| 1.4 Superseded Calc No.: | |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 ☐ SB Calculation ☐ N/A ; Explain: | 1.10 Associated with Technical Baseline: ☐ Yes ☒ No |
| 2.1 Security Classification: Unclassified | |
| 2.2 PNO: (Name, Z Number, Organization, Signature, Date) William L. Turney, 12765, ADEP, William L. Turney 01/25/13 | |
| 3.1 Checker (Note 1): (Name, Z Number (if applicable), Organization, Signature, Date) Carl J. McDonald, Brown + Caldwell, 2/19/2013 | |
| 4.1 Independent Review: ☐ Required ☐ Not Required | |
| 4.2 Independent Reviewer: (Name, Z Number (if applicable), Organization, Signature, Date) Carl J. McDonald, Brown + Caldwell, 2/19/2013 | |
| 5.1 Design Authority Representative Review: ☒ Required ☐ Not Required | |
| 5.2 Design Authority Representative: (Name, Z Number, Organization, Signature, Date) GARY BLAUCET 098713 ES-U1 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.

Los Alamos NATIONAL LABORATORY EST. 1943

*Conduct of Engineering*
*Calculations*
**Calculation Cover Sheet**

Calc No.: CAL - ~~XSWSC~~ — 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. Orchard, J. A. Orchard II, 280099, Brown & Caldwell 3/1/2012

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

NA DMP 3/20/13

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

Ken MacGregor 112805 ET-ER 3.21.13

**7.0 REGISTERED PROFESSIONAL ENGINEER'S SEAL**

NEW MEXICO 18656 PROFESSIONAL ENGINEER 3/6/13

**8.0 REVISION LOG**

| 8.1 Rev. | 8.2 Date | 8.3 Description of Change(s) |
|---|---|---|
| 0 | ~~Aug-11~~ 3/1/12 DMP MO 3/21/2013 | Original Issue |
| 1 | ~~Oct-11~~ | ~~90% Design Revision~~ DMP 3/20/13 Rev 3/21/13 |
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**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/

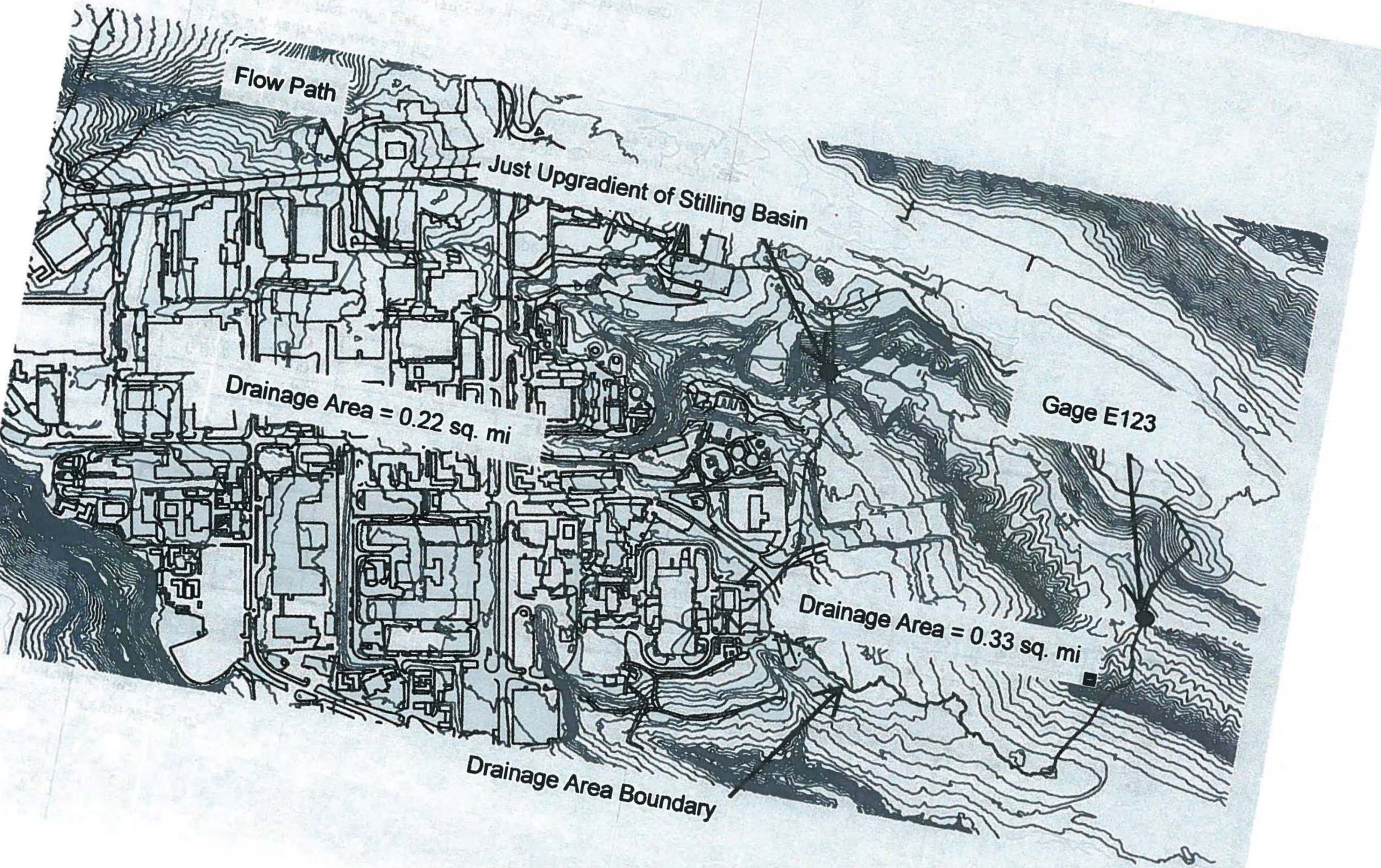
United States Department of Agriculture, Technical Release 55 - Urban Hydrology for Small Watersheds, June 1998.

**11.0** Calculation

- Calculation 1: HEC-HMS model output (spreadsheet format)
- Appendix – Supporting Information
  - Drainage Area Map

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

Canyon Wetland
Drainage Area Map
3/24/2011



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**

| | | | | | | | | 100-year Storm | |
|---|---|---|---|---|---|---|---|---|---|
| **Month** | **Day** | **Year** | **Hour** | **Minute** | **Prcp 15 min (in)** | **Event Time** | **Distribution** | **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

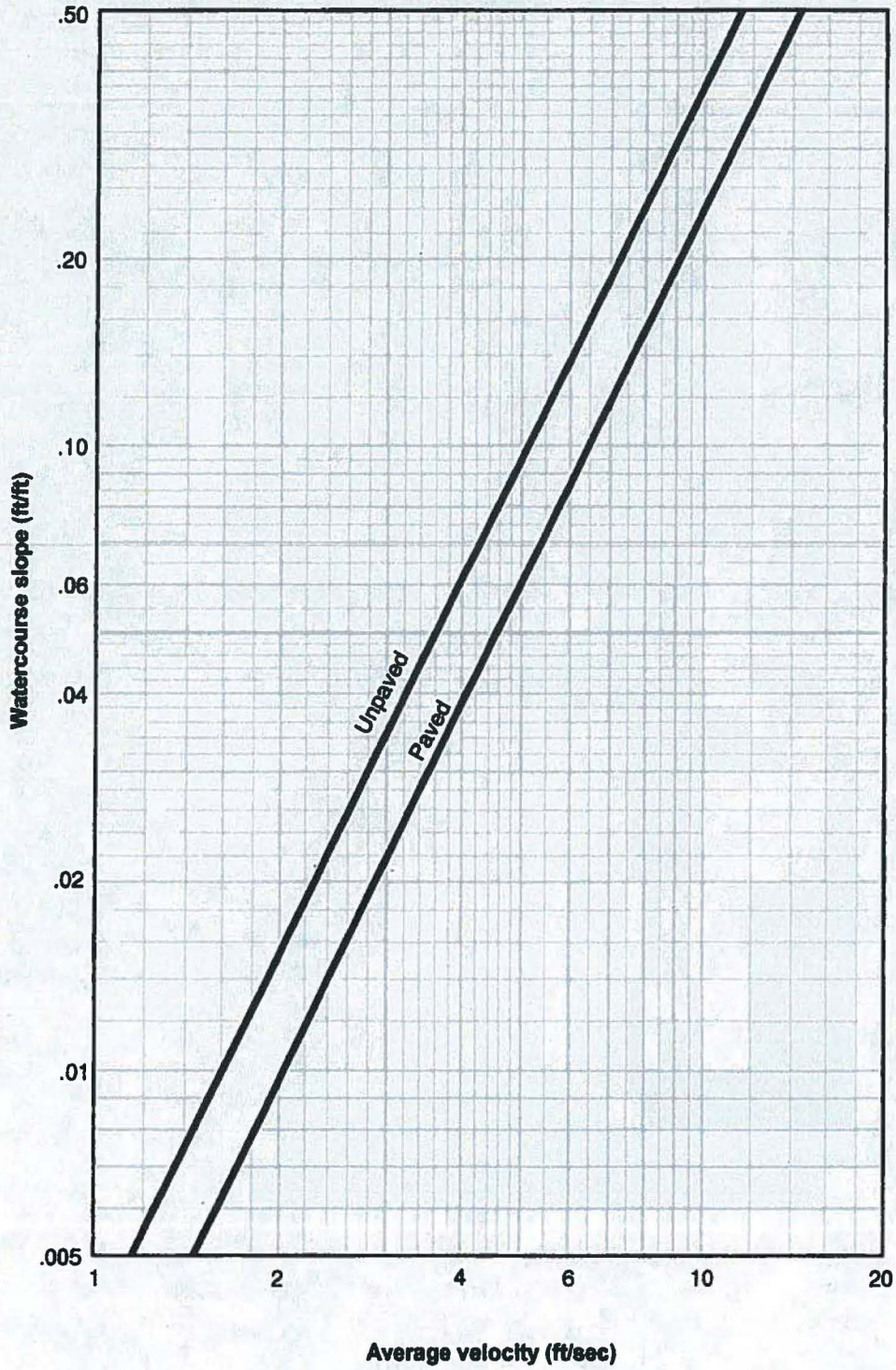
After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix 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*

Los Alamos NATIONAL LABORATORY EST. 1943

Conduct of Engineering Calculations

Calculation Cover Sheet

Calc No.: CALC-ODS-14 Rev. No.: 0 DMP 3/20/13 JAO 3/21/13 Page 1 of 11

Calc Title: Sandia Wetland Hydraulics

Calculation Cover Sheet

| | |
|---|---|
| 1.1 Calculation Status: ☐ Preliminary ☒ Final | |
| 1.2 DP/DOP/DOF/EON No.: | |
| 1.3 Project ID No.: 107693 → 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 |

2.1 Security Classification: Unclassified

2.2 ECN: (Name, Z Number, Organization, Signature, Date)

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

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

CARL J. McDONALD, BROWN AND CALDWELL 3/14/2013

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 3/14/2013

5.1 Design Authority Representative Review: ☒ Required ☐ Not Required

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

GARY BLAUCAT, 098713 ES-UI 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-00054



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

6.2 Subcontractor Approver: *(Name, Z Number (if applicable), Organization, Signature, Date)*
NA DNP 3/20/13

6.3 Responsible Manager: *(Name, Z Number, Organization, Signature, Date)*
Alan MacGregor 112606 ET-EA 3-21-13

**7.0 REGISTERED PROFESSIONAL ENGINEER SEAL**

JAMES A. O'NEILL III NEW MEXICO 18668 PROFESSIONAL ENGINEER

**8.0 REVISION LOG**

| 8.1 Rev. | 8.2 Date | 8.3 Description of Change(s) |
|---|---|---|
| | 3/8/12 DNP 3/20/13 NO 3/21/13 | |
| 0 | Aug '11 | Original issue |
| 1 | Oct '11 | 90% Design Revision DNP 3/20/13 NO 3/21/13 |
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**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 normal 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

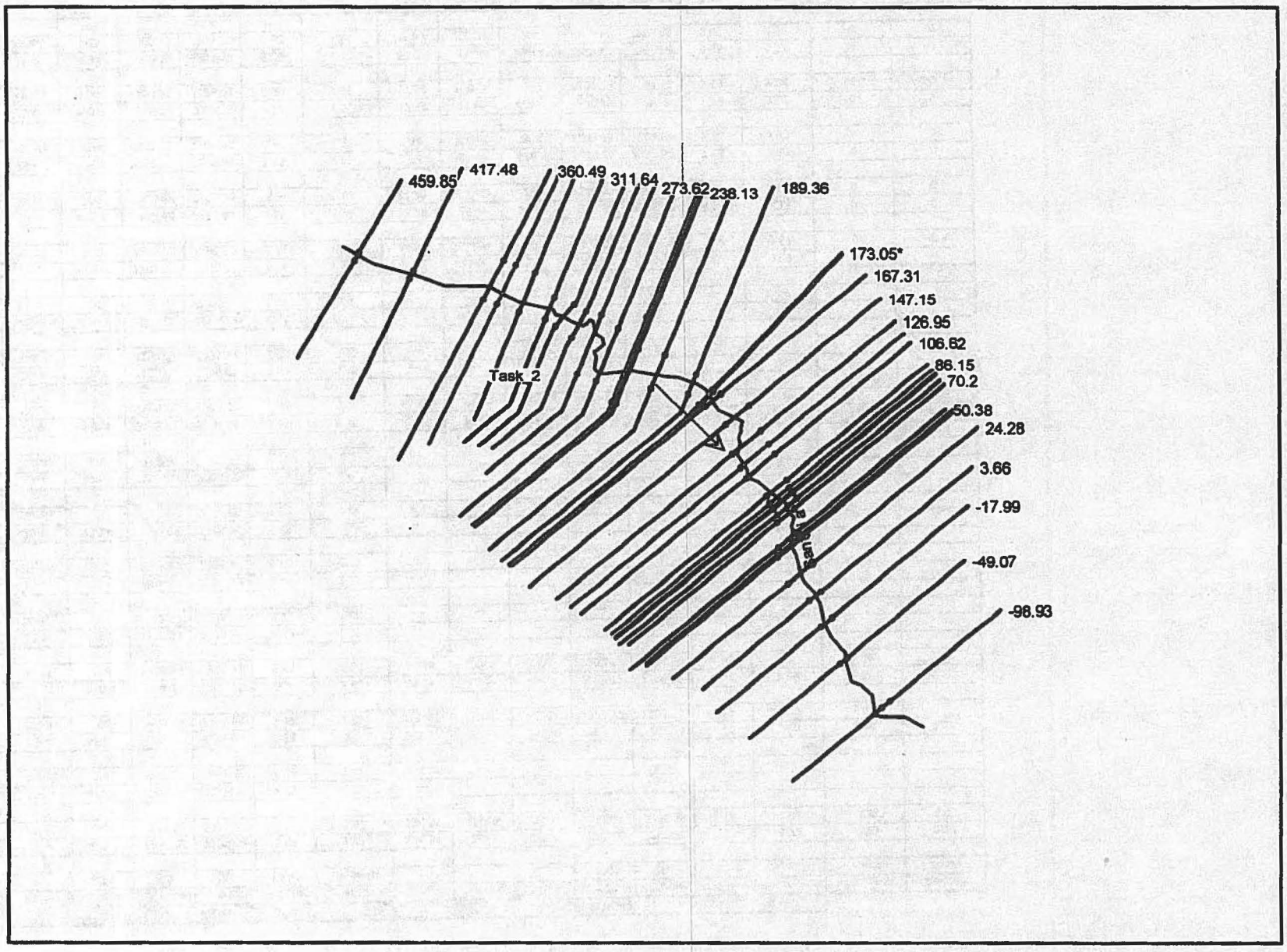
HEC website: http://www.hec.usace.army.mil/software/hec-ras.

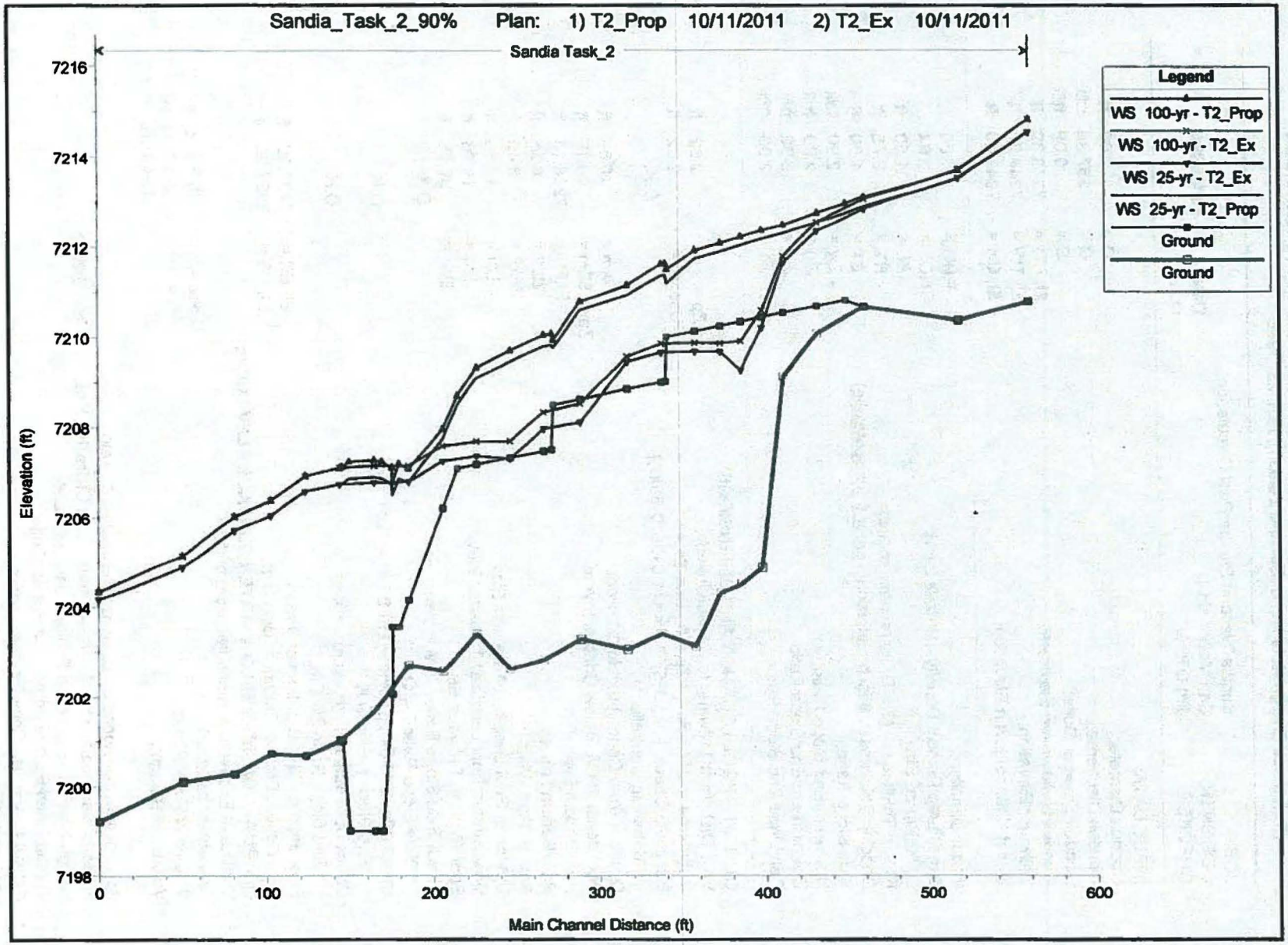
**11.0** Calculations

- 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
106.82
86.15
70.2
50.38
24.28
3.66
-17.99
-49.07
-98.93
Task_2

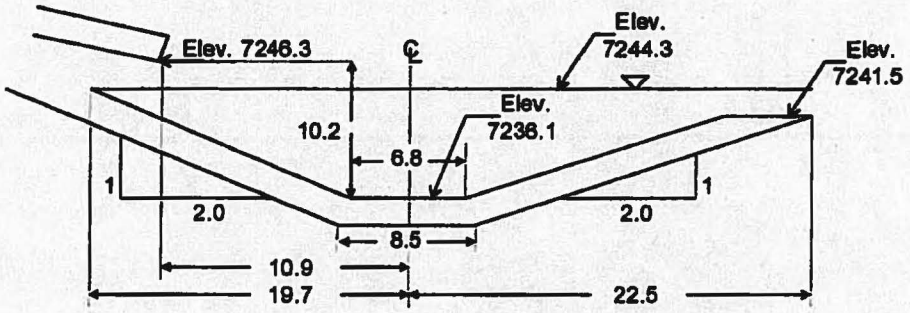

Sandia_Task_2_90% Plan: 1) T2_Prop 10/11/2011 2) T2_Ex 10/11/2011
Sandia Task_2
Legend
WS 100-yr - T2_Prop
WS 100-yr - T2_Ex
WS 25-yr - T2_Ex
WS 25-yr - T2_Prop
Ground
Ground
Elevation (ft)
7216
7214
7212
7210
7208
7206
7204
7202
7200
7198
0
100
200
300
400
500
600
Main Channel Distance (ft)

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

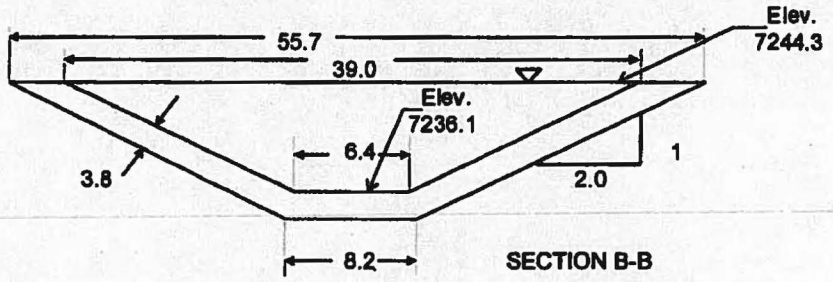
| | | | | |
|---|---|---|---|---|
| JOB: | Sandia Wetland Plunge Pool Calculation | | | |
| DESIGNER: | Carl McDonald | Date: | ######## | |
| CHECKER: | Jim O'Neill | Date: | | |
| INPUT DATA: | | | | |
| Conduit Diameter | | D = | 7.00 | ft |
| Conduit Discharge: | | Q = | 357.30 | cfs |
| Conduit 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.) (Enter 0 for geotextile) | | 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

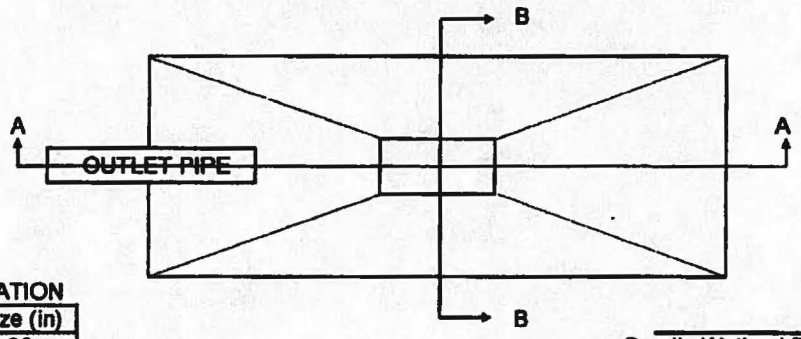
## RIPRAP LINED PLUNGE POOL FOR CANTILEVER OUTLET
Reference Design Note No. 6 (Second Edition), Jan. 23, 1986




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

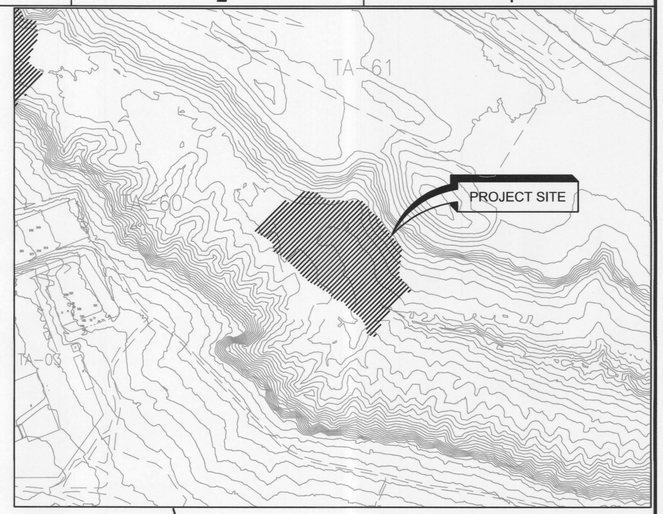
DESIGNER: Carl McDonald
SHEET ___ OF ___

# 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

### 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)

| 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 |

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

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

SHEET G-0001
1 OF 8

CLASSIFICATION Unclassified
REVIEWER William Harkesty DATE 12/17/2013

PROJECT ID 102698
DRAWING NO C-56021
REV 0

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

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

Path: P:\CAD\Los Alamos\1k\0793\Sandia Wetlands\As-Built Drawings Filename: G-0001.dwg Plot Date: December 16, 2013 - 5:20 PM CADD User: Martin, Edgar

## 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

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

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

SHEET C–0001
2 OF 8

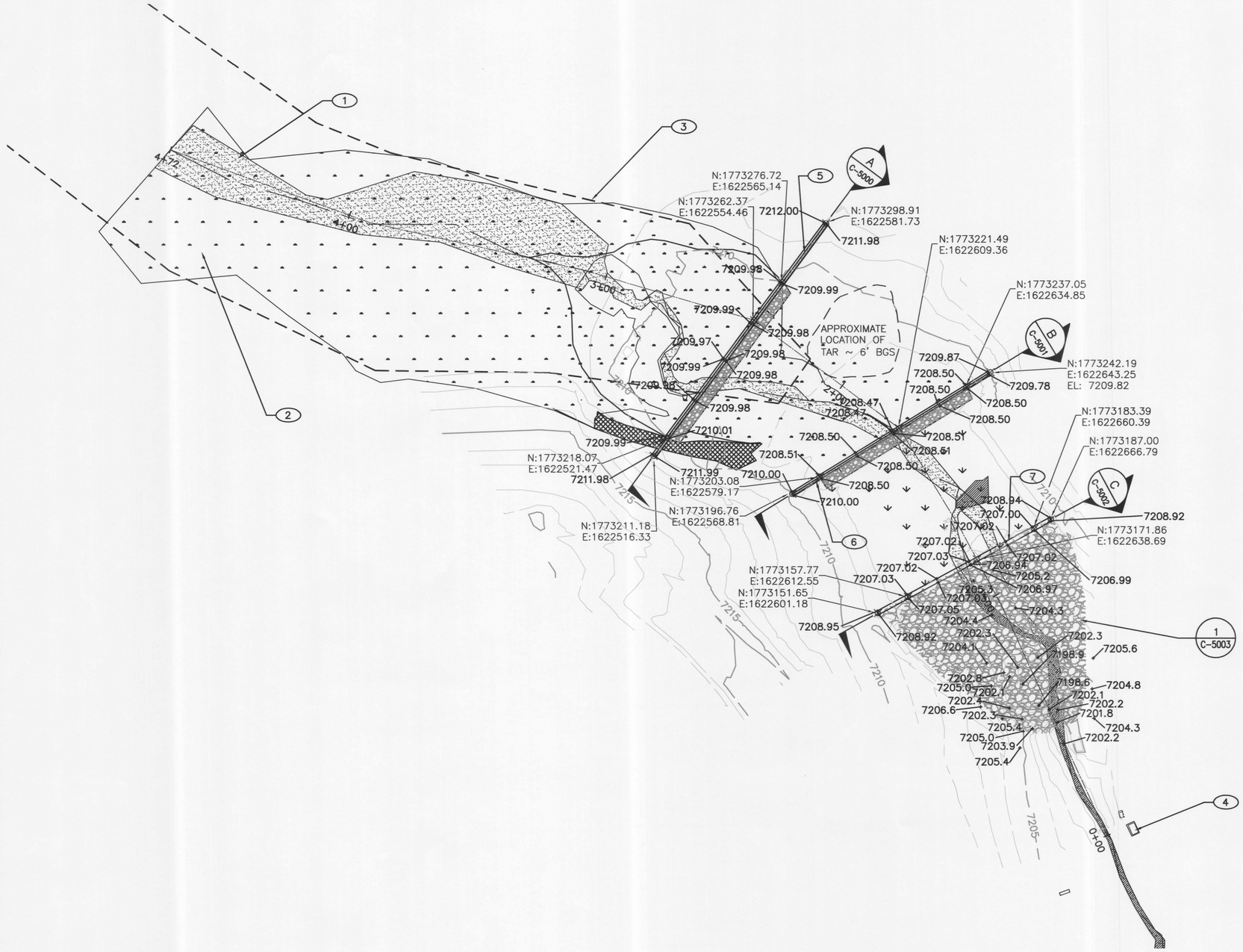
CLASSIFICATION Unclassified
REVIEWER William Hardesty
DATE 12/17/2013

PROJECT ID 102698
DRAWING NO C–56021
REV 0

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

JAMES A. O'NEILL III — 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"

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

JAMES A. O'NEILL III
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

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

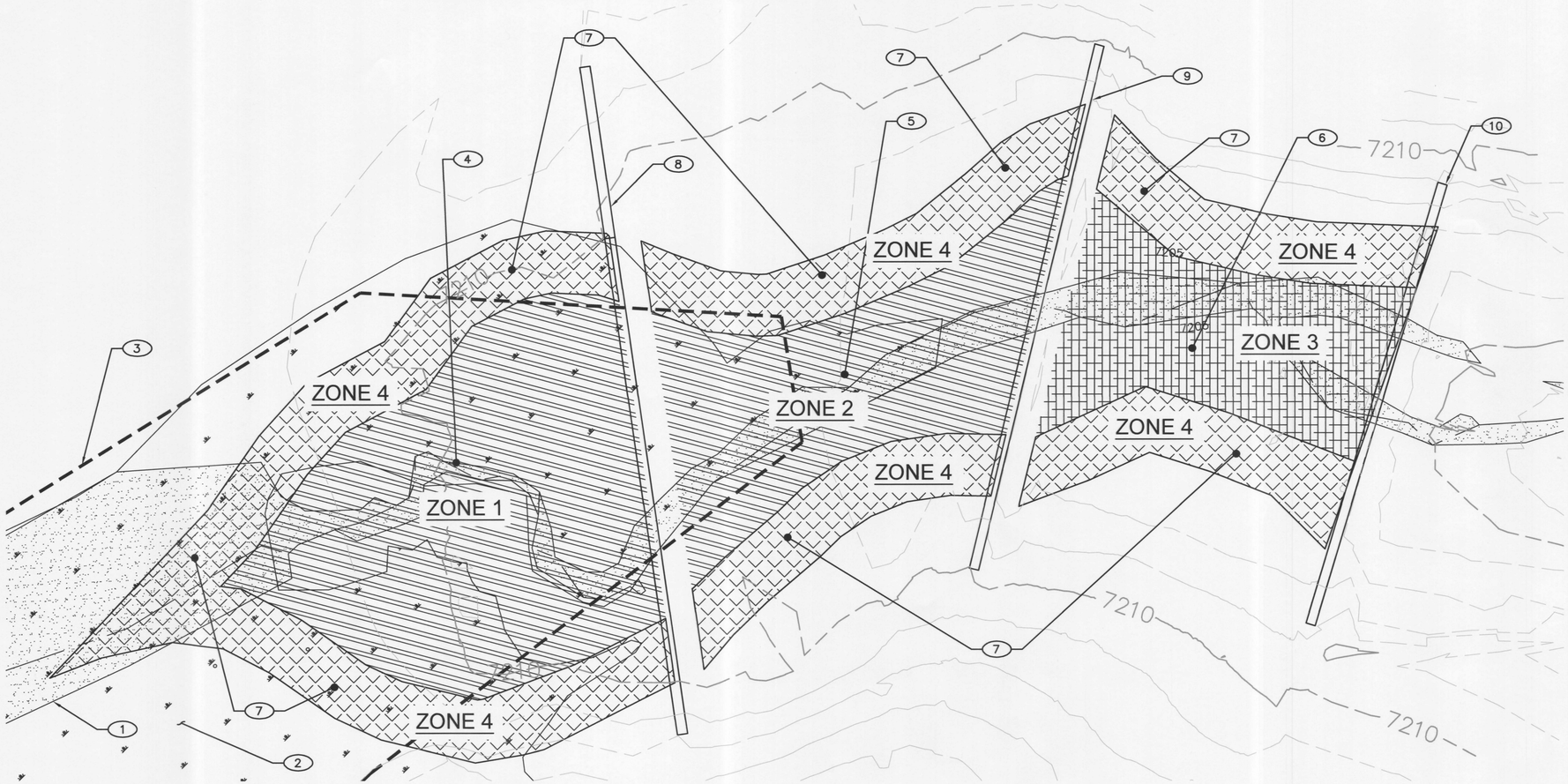
Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1000
3 OF 8

CLASSIFICATION Unclassified
REVIEWER William Harkenrider DATE 12/17/2013

PROJECT ID 102698
DRAWING NO C-56021
REV 0

Path: P:\CAD\Los Alamos\147931\Sandia Wetlands\As-Built Drawings Filename: C-1000.dwg Plot Date: December 16, 2013 - 5:23 PM CADD User: Martin, Edgar




PLAN VIEW

10' 5' 0 5' 10'

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

| 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 | | TUBLING | 4' | 4 |
| 320 | BACCHARIS SALICIFOLIA | SEEPWILLOW | TUBLING | 4' | 4 |
| 640 | SALIX EXIGUA | COYOTE WILLOW | LIVE STAKE | 4' | 4 |
| 320 | SALIX IRRORATA | BLUESTEM WILLOW | LIVE STAKE | 4' | 4 |

PLANTING SCHEDULE

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

BLDG NA TA-00

SUBMITTED JAMES O'NEILL

APPROVED FOR RELEASE JOHN P. MCCANN

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

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PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1001

WBH 4 OF 8 12/17/2013

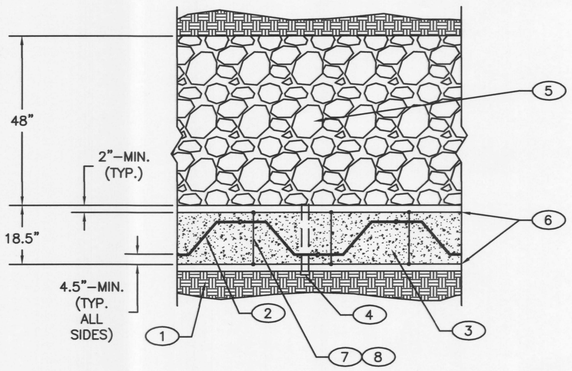
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REVIEWER R BOHN William Hansen DATE 2012-07-30

PROJECT ID 102698
DRAWING NO C-56021
REV 0

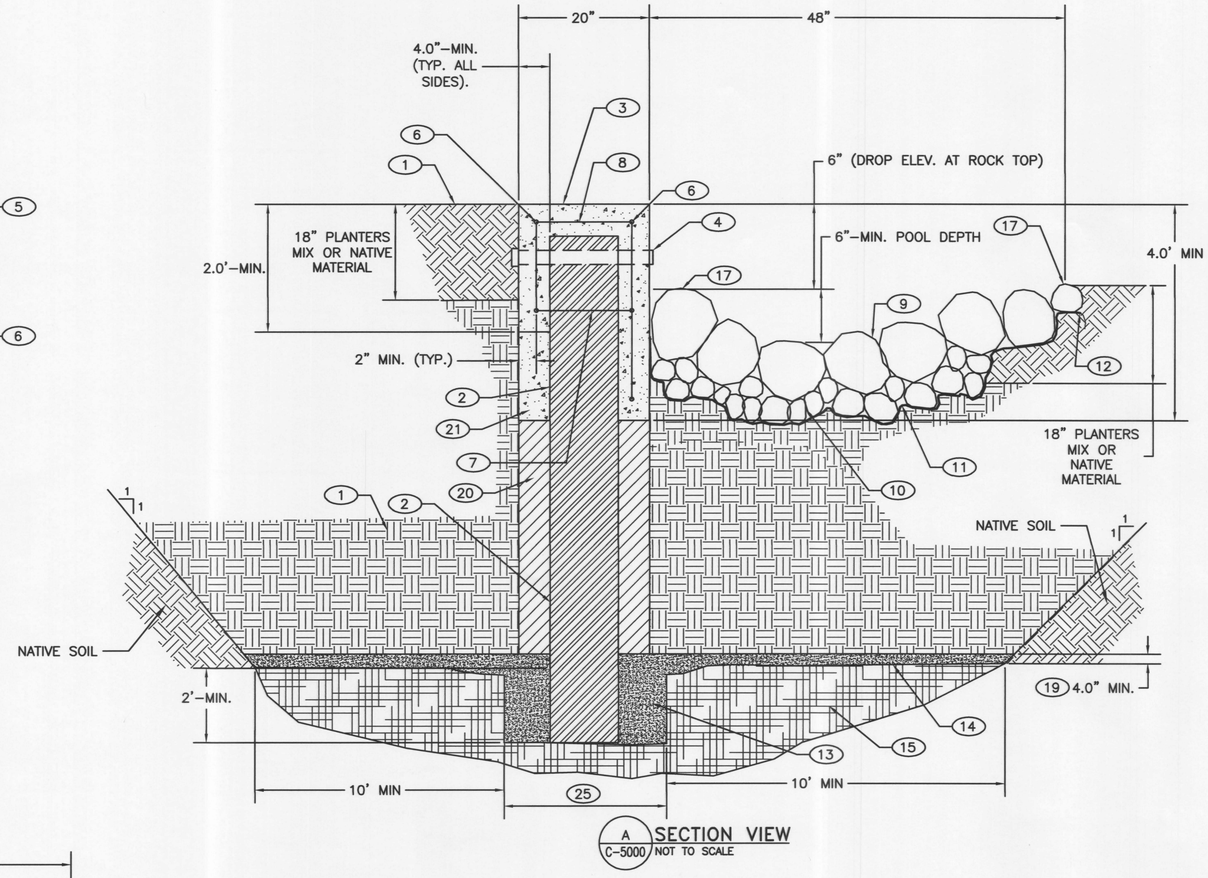
J. O'Neill 12/16/2013

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

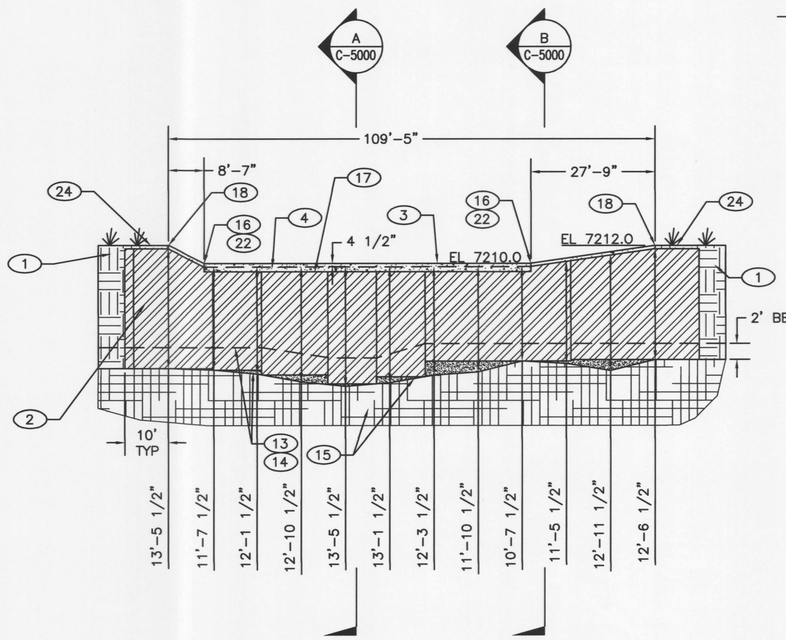
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TOP VIEW
NOT TO SCALE

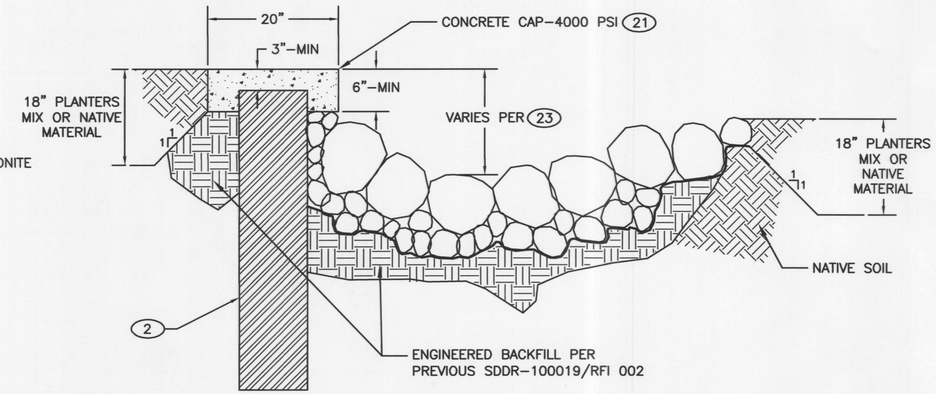



A C-5000 SECTION VIEW
NOT TO SCALE




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 |
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Brown AND Caldwell

SANDIA CANYON
STREAM GRADE CONTROL AS BUILTS

DETAIL GRADE CONTROL STRUCTURE 1

BLDG NA TA–00

| | |
|---|---|
| DRAWN | E MARTIN |
| DESIGN | J O'NEILL |
| CHECKED | J O'NEILL |
| DATE | 12-9-2013 |

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

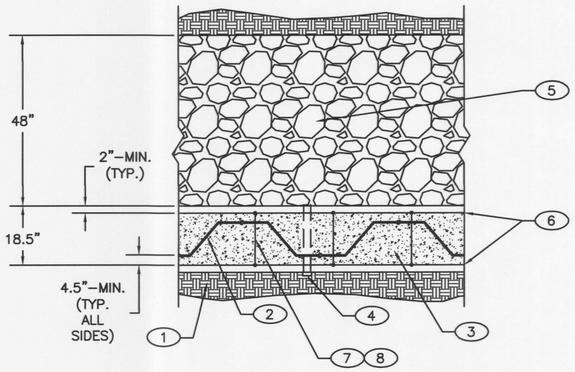
CLASSIFICATION Unclassified
REVIEWER William Hardesty DATE 12/17/2013

PROJECT ID 102698
DRAWING NO C–56021
REV 0

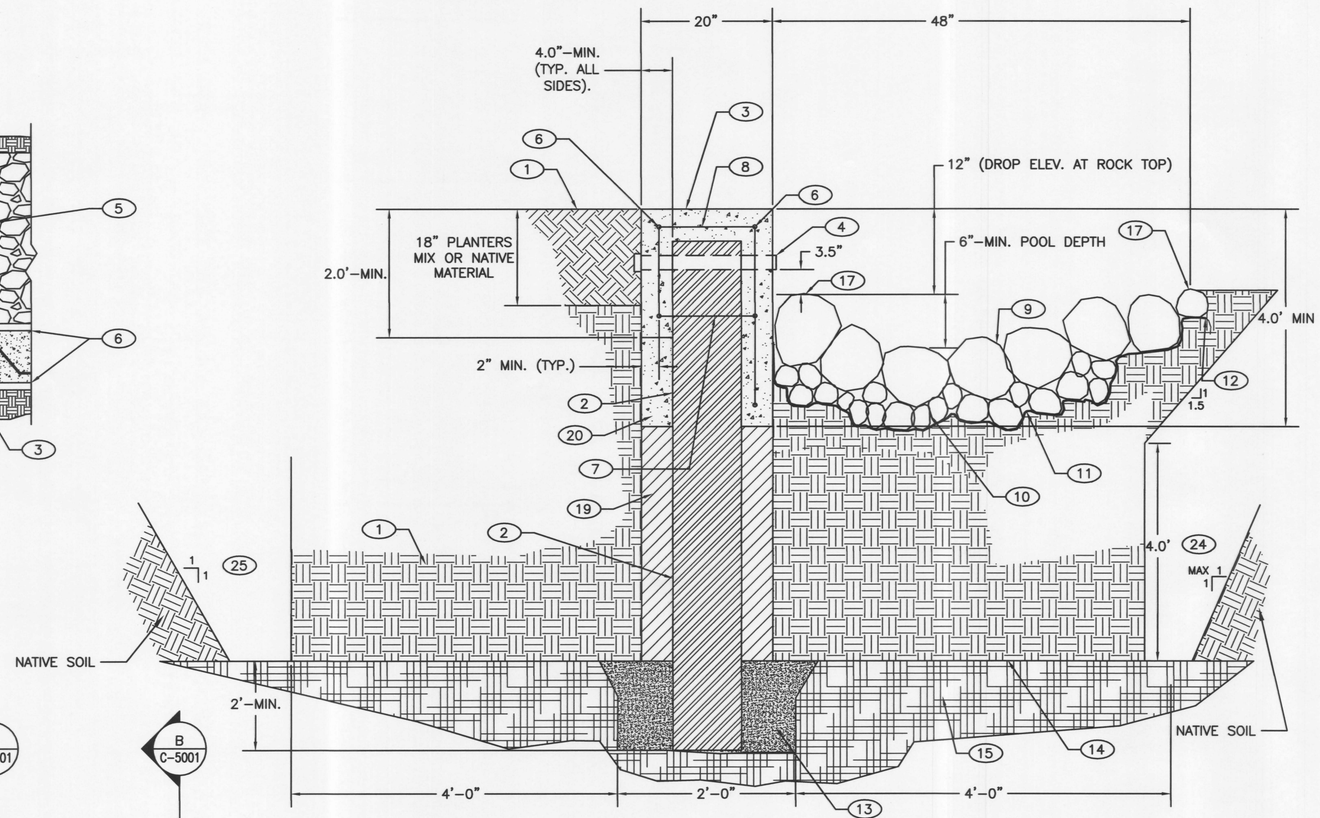
J. A. O'Neill Jr. 12/6/2013

JAMES A. O'NEILL NEW MEXICO 18656 PROFESSIONAL ENGINEER

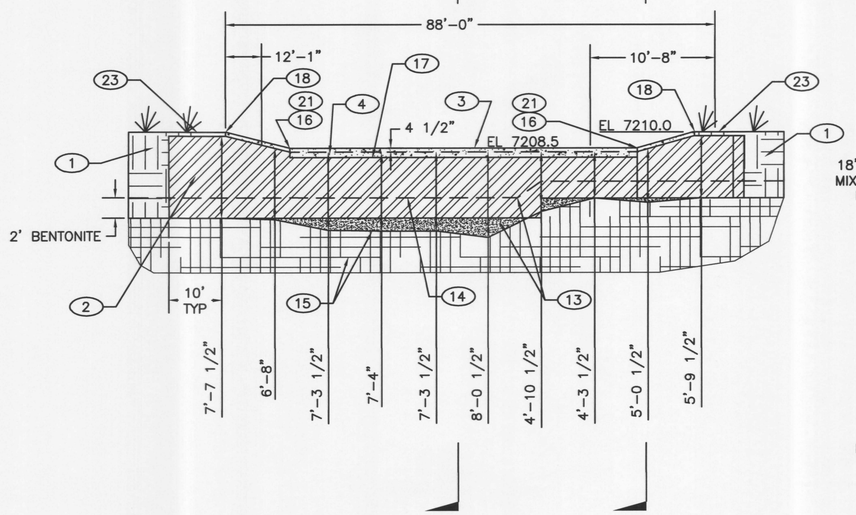
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TOP VIEW
NOT TO SCALE

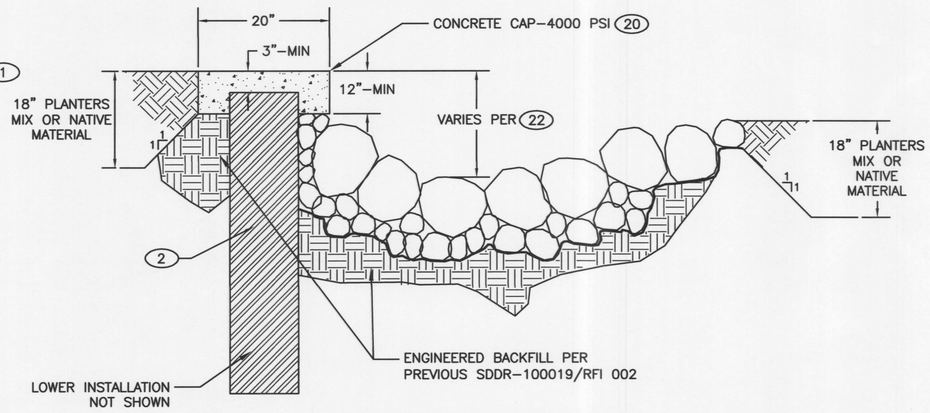



A C-5001 SECTION VIEW
NOT TO SCALE




FRONT VIEW (DOWNSTREAM)
NOT TO SCALE

B C-1000 SECTION
NOT TO SCALE




NON–REINFORCED CONCRETE CAP

B C-5001 SECTION VIEW
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 |

## 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

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

Los Alamos NATIONAL LABORATORY
P0 Box 1663
Los Alamos, New Mexico 87545

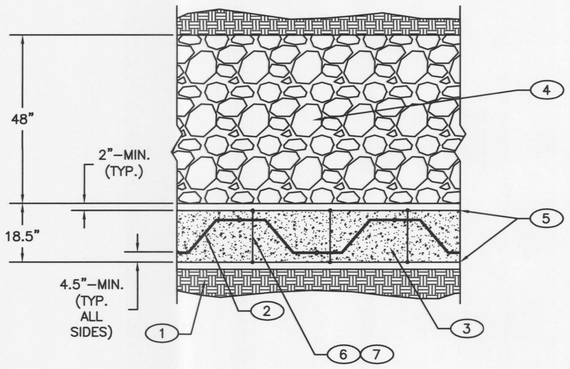
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CLASSIFICATION Unclassified
REVIEWER William Hardesty DATE 12/17/2013
PROJECT ID 102698
DRAWING NO C–56021
REV 0

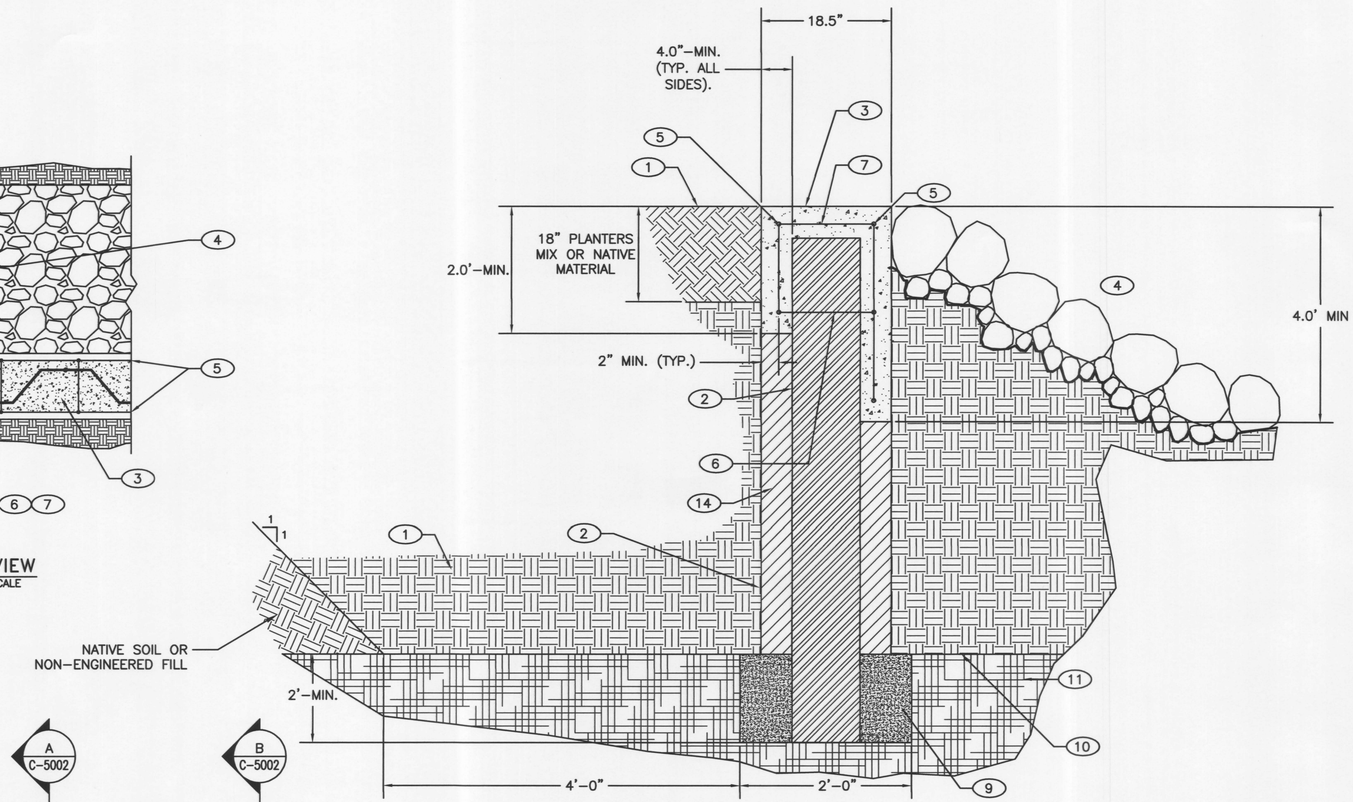
J. A. O'Neill IV 12/16/2013

JAMES A. O'NEILL NEW MEXICO 18656 PROFESSIONAL ENGINEER

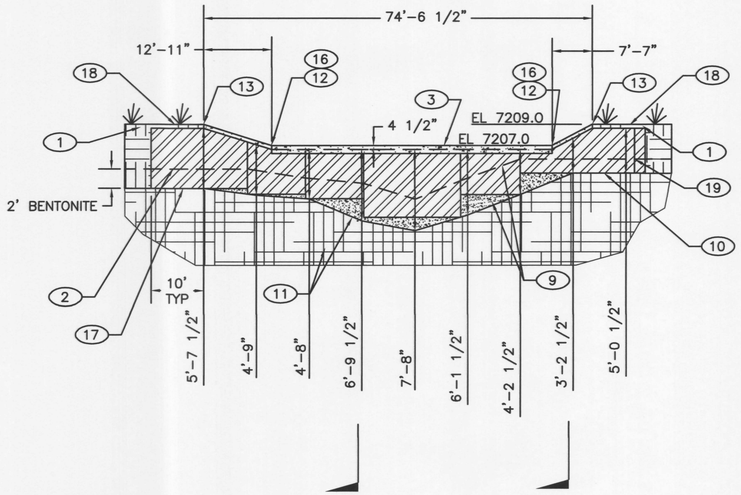
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TOP VIEW
NOT TO SCALE

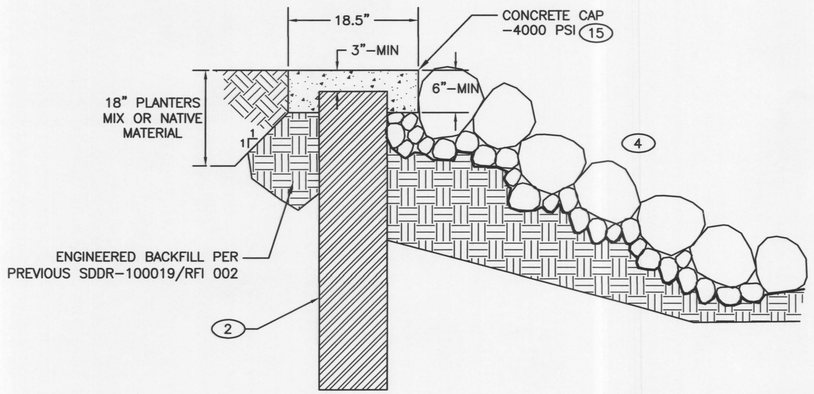



A C–5002 SECTION VIEW
NOT TO SCALE




FRONT VIEW (DOWNSTREAM)
NOT TO SCALE

C C–1000 SECTION
NOT TO SCALE




NON–REINFORCED CONCRETE CAP

B C–5002 SECTION VIEW
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

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

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

SHEET C–5002
7 OF 8

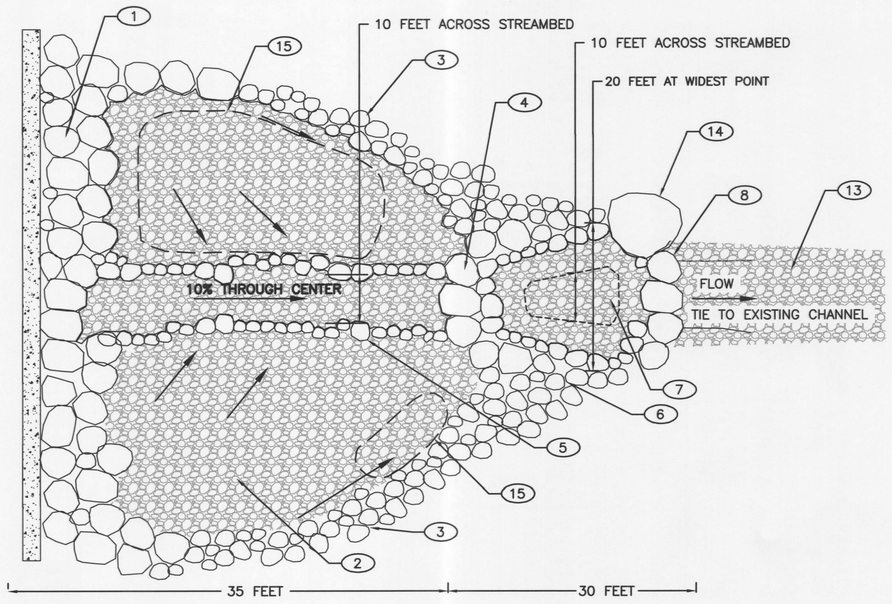
CLASSIFICATION Unclassified
REVIEWER William Hardesty
DATE 12/17/2013

PROJECT ID 102698
DRAWING NO C–56021
REV 0

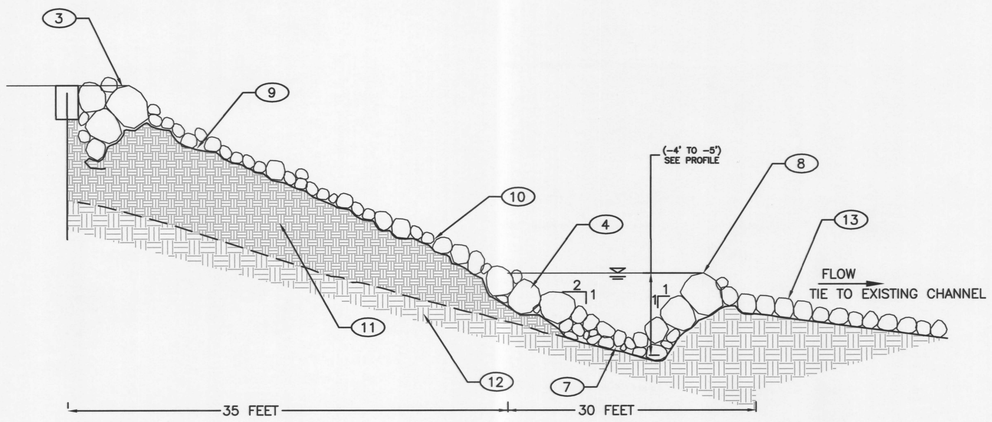
J. G. O'Neill III
12/16/2013

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

Path: P:\CAD\DLos Alamos\14#793\Sandia Wetlands\As-Built Drawings Filename: C-5002.dwg Plot Date: December 16, 2013 - 5:38 PM CADD User: Martin, Edgar




TOP VIEW




A / C-5003 SECTION VIEW
NOT TO SCALE

1 / C-1000 DETAIL

A / C-5003

**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

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

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

Los Alamos NATIONAL LABORATORY
P0 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 IV
12/16/2013

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

Path: P:\CAD\Los Alamos\114079\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.**



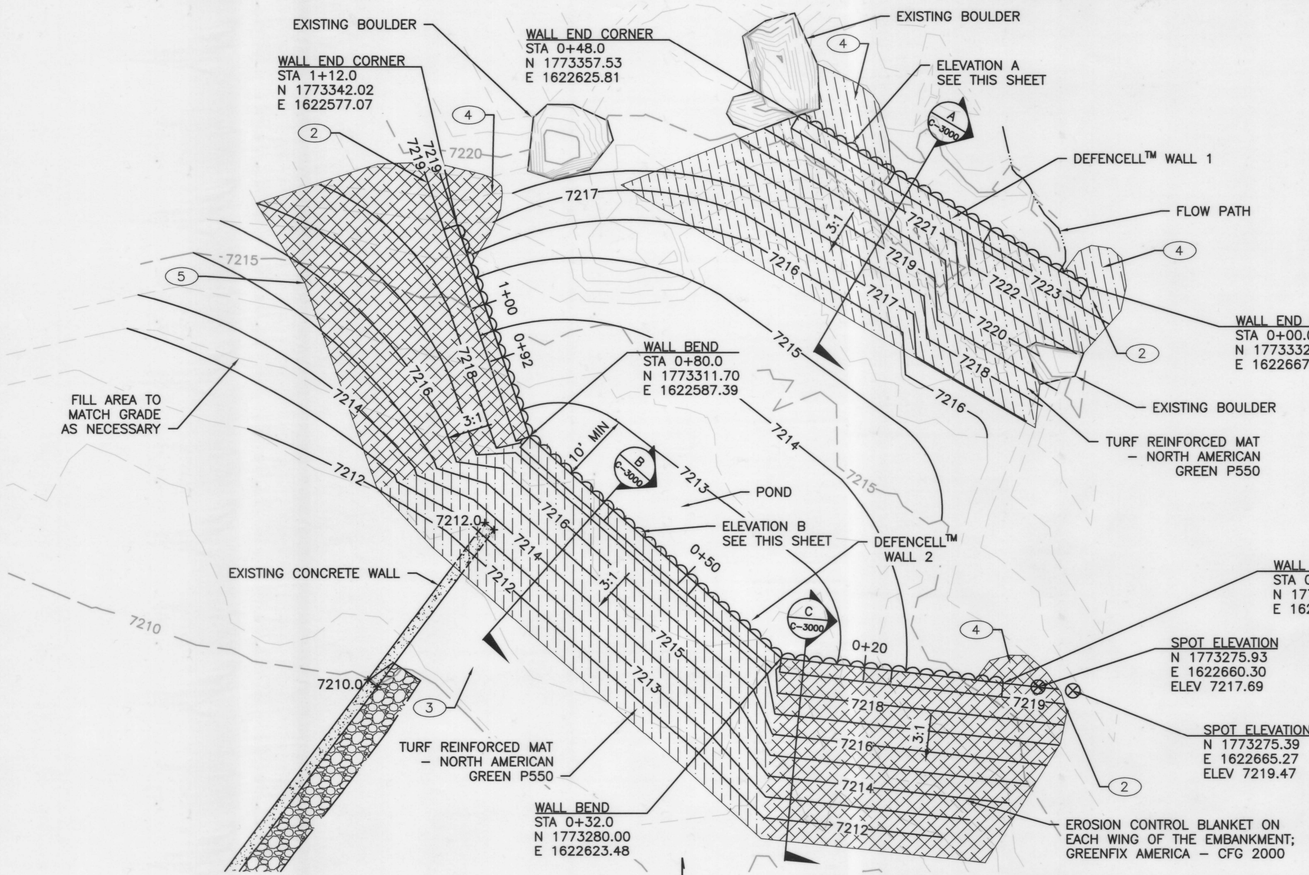
**Sandia wetland run-on control and grade-control structure looking north, November 21, 2013**

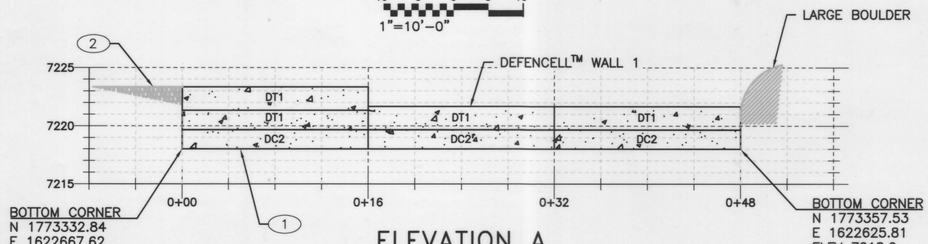


**Sandia wetland run-on control and grade-control structure looking southeast, December 5, 2013**

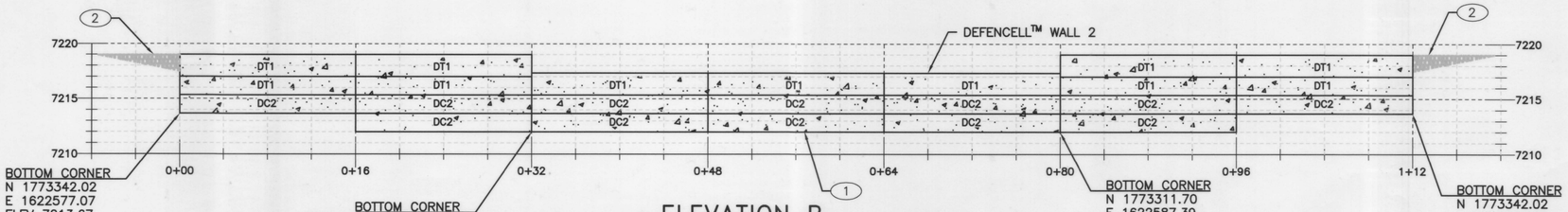
# Appendix E

*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:

TURF REINFORCED MAT

EROSION CONTROL BLANKET

DEFENCELL™

| 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

BLDG NA TA–00

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

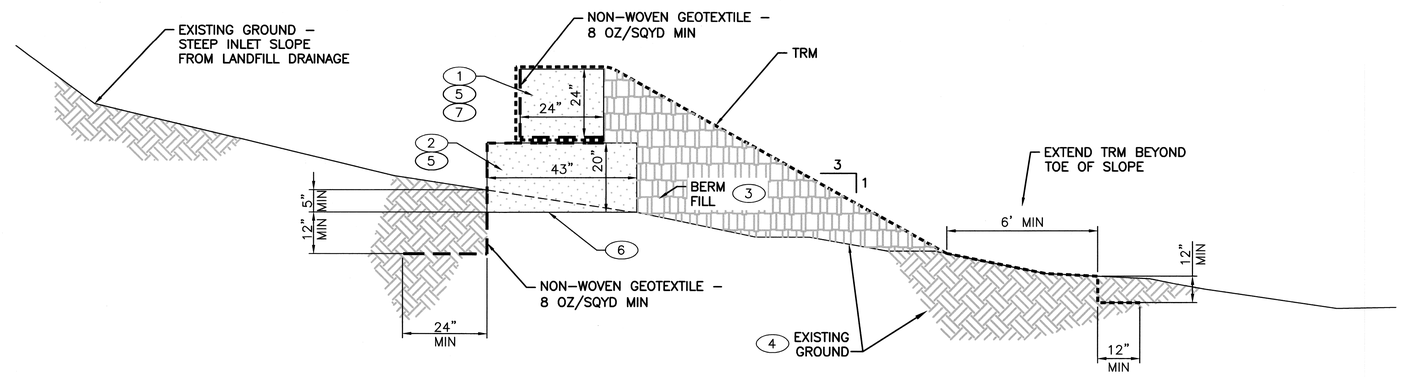
SUBMITTED: DEBRA NEVERGOLD
APPROVED FOR RELEASE: JOHN P. MCCANN

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

SHEET C–1000
1 OF 3

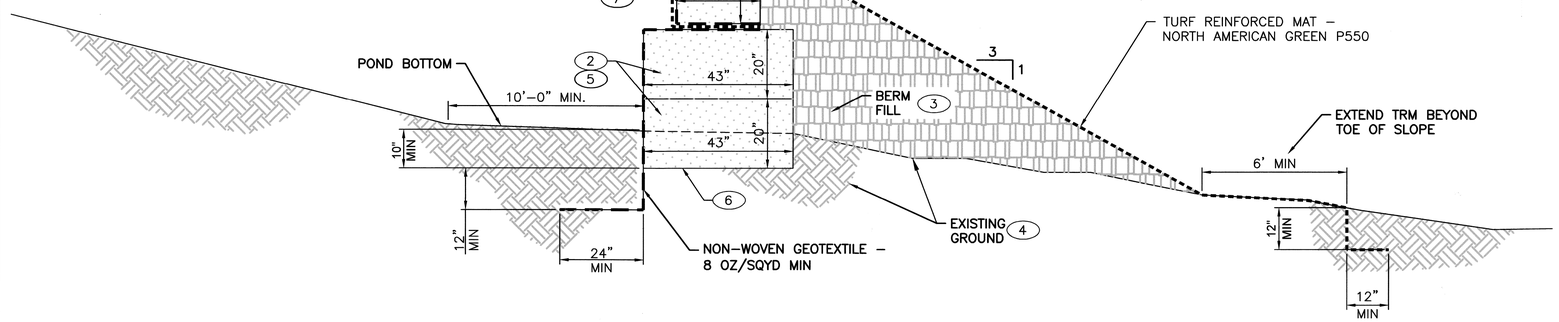
CLASSIFICATION UNC
REVIEWER WILLIAM TURNEY
DATE 9/24/2013

PROJECT ID 102698
DRAWING NO C–56069
REV 1



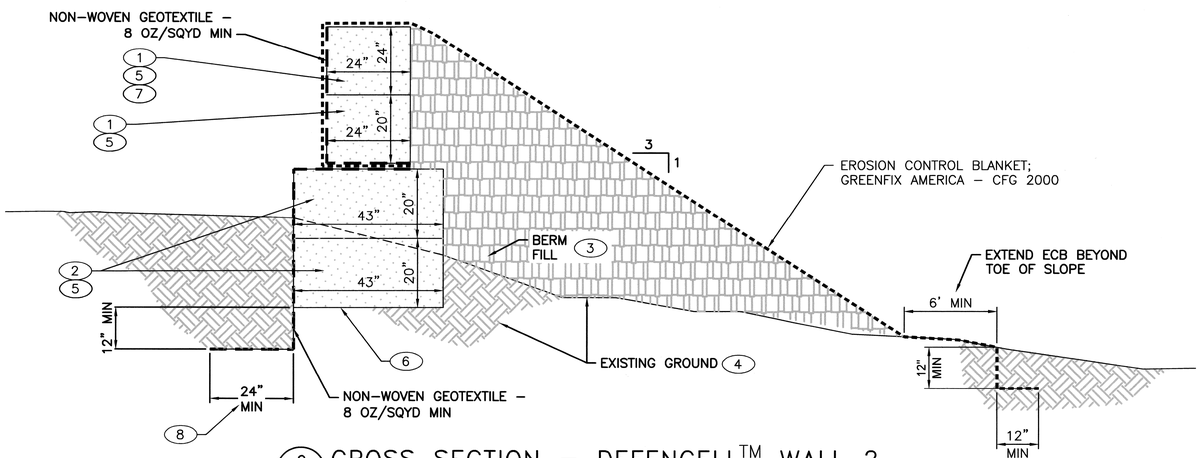

A C-1000 CROSS SECTION – DEFENCELL™ WALL 1

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

DEFENCELL™

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

ENVIRONMENTAL PROGRAMS

SANDIA CANYON WETLAND GRADE CONTROL STRUCTURE – RUNON CONTROL

CROSS SECTIONS

BLDG NA TA–00

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

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

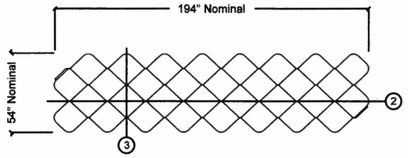
DATE 9/24/2013

PROJECT ID 102698

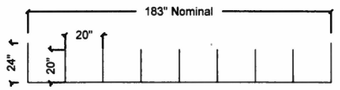
DRAWING NO C–56069

REV 2

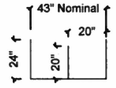
## DEFENCELL DC2 PRODUCT SPECIFICATIONS:




1 DEFENCELL DC2 : PLAN VIEW

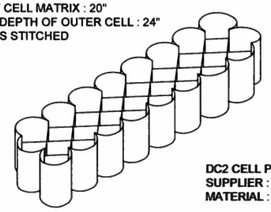



2 DEFENCELL DC2 : SECTION CUT - LENGTH



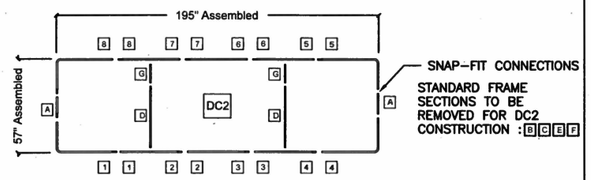

3 SECTION VIEW - WIDTH

DEPTH OF CELL MATRIX : 20"
OVERALL DEPTH OF OUTER CELL : 24"
ALL SEAMS STITCHED



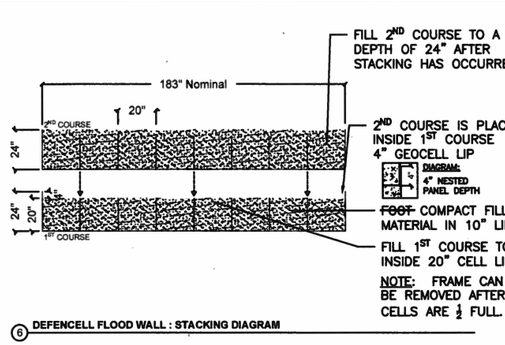
DC2 CELL PANEL
SUPPLIER : FIBERWEB INC.
MATERIAL : TYPAR 10 OZ/YD$^2$

4 DEFENCELL DC2 : ISOMETRIC VIEW

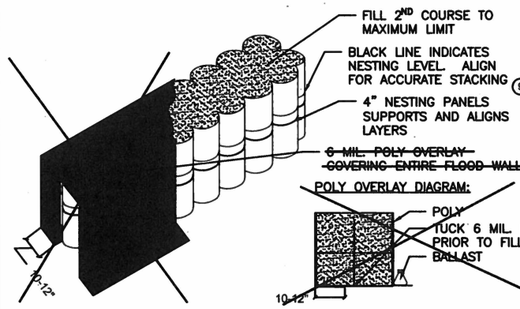



5 DEFENCELL: STANDARD CONSTRUCTION FRAME DIAGRAM

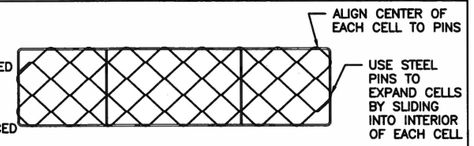
## STANDARD FLOOD WALL DESIGN:



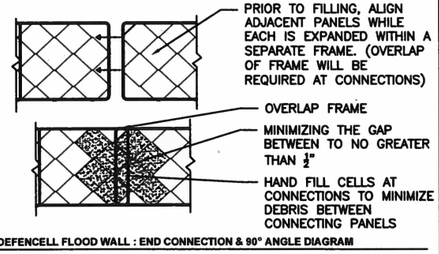

6 DEFENCELL FLOOD WALL : STACKING DIAGRAM



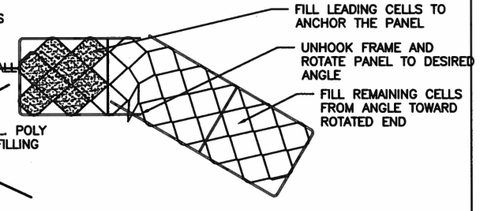

7 DEFENCELL FLOOD WALL : CONSTRUCTED ISOMETRIC VIEW




8 DEFENCELL FLOOD WALL : PANEL EXPANSION USING STANDARD FRAME




9 DEFENCELL FLOOD WALL : END CONNECTION & 90° ANGLE DIAGRAM




10 DEFENCELL FLOOD WALL : 1°- 60° ANGLE DIAGRAM

**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, KP 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 RER | | |
| CHECKED | B. FOLEY BF | | |
| 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 Billie Foley DATE 9/24/13
PROJECT ID 102698
DRAWING NO C–56069
REV 0