



DEPARTMENT OF THE AIR FORCE
27TH CIVIL ENGINEER SQUADRON (ACC)
CANNON AIR FORCE BASE NEW MEXICO

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MAR 28 2006

Ms. Tammy Diaz
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East Building 1
Santa Fe NM 87505-6303



Dear Ms. Diaz

Attached are two documents in response to Mr. James Bearzi's Notice of Deficiency letter, dated 23 Dec 05. Mr. Bearzi's letter included comments from the Hazardous Waste Bureau (HWB) on the 2005 *Final Construction Completion Report Remedial Action* report submitted by Cannon Air Force Base (AFB). Cannon AFB was asked to provide written comments within 90 days of receipt of the letter.

In his 23 Mar 06 e-mail, Mr. John Rebman, Environmental Flight, provided the attached documents to you, Ms. Cheryl Frischkorn, and Mr. Dave Cobrain, also of the HWB. The Comment/Resolution Form (Attachment 1) provides specific responses to each comment in Mr. Bearzi's letter. The revised report pages (Attachment 2) are meant to substitute for pages in the *Final Construction Completion Report Remedial Action* report. As Mr. Dennis Timmons, also of my Environmental Flight, told you in a 22 Mar 06 telephone conversation, a hard copy of the documents Mr. Rebman e-mailed would also be provided.

Please contact Mr. Peter Zamie, Environmental Flight, if you have any questions regarding our response. Mr. Zamie can be reached at (505) 784-1092.

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

Sincerely

ALEXANDER P. KARIBIAN, Lt Col, USAF

Attachments:

1. Comment/Resolution Form
2. Revised Report Pages

COMMENT/RESOLUTION FORM

Final Construction Completion Report Remedial Action at SWMU 101—Sewage Lagoons Cannon Air Force Base, New Mexico March 2005

ITEM NO.	PAGE NO.	REVIEWER'S COMMENT	COMMENT RESOLUTION
<i>General Comments</i>			
1.		The purpose of the SWMU 101 remedial action is not clearly explained in the report. Although Section 2.3 (page 2-2) mentions the need to "prevent exposure to ecological receptors" as the reason for constructing the engineered cover and biotic barrier, the specific ecological receptors and contaminants that present unacceptable risks are not identified. A wide range of parameters is listed in discussion of groundwater monitoring (page 2-2), and additional chemicals are identified in several reports of soil sample analyses (Appendix A). The purpose of the remedial action, however, is not described in any further detail. CAFB must identify the specific ecological receptors and hazardous constituents (and their concentrations), and any other factors that resulted in the decision to consolidate contaminated sludge and soil and to construct the cover system.	The Corrective Measures Study (CMS) Report (April 2001) presents the rationale for selection of the corrective measure (sludge consolidation and dewatering) conducted at the Sewage Lagoons. Section 2.3 will be revised to present information on the ecological risk assessment results. Replacement pages will be included in the Comment Response package.
2.		While the report provides a reasonably complete description of the construction of the corrective measure, design criteria are not provided. For example, the report does not provide required hydraulic conductivity and Unified Soil Classification System (USCS) classification of the soil barrier, thicknesses and tolerances of the soil barrier, biota barrier and erosion/vegetation layer, compaction requirements for sludge and contaminated soil from the North Lagoon. CAFB must provide a summary of the design criteria for the project.	A criteria for the Sewage Lagoons corrective measure design were originally provided in the Final Work Plan for the Closure of the Sewage Lagoons (February 2003). Section 3.1 in the Construction Completion Report will be revised and a new Table 3-1 will provide a summary of the design specifications and criteria. Replacement pages will be included in the Comment Response package.
3.		The 6-inch thick erosion/vegetation soil cover is not separated from the biota barrier by soil or synthetic filter material. The absence of a filter raises the concern that soil may eventually infiltrate into the coarse broken concrete biota barrier. The infiltration of soil may occur whether or not the coarse or fine concrete biota barrier material was placed immediately below the erosion/vegetation soil cover. CAFB must explain or justify the lack of filter material or include one in the final design.	The purpose of the biota barrier is to prevent burrowing through the underlying soil barrier layer. During construction, conducted in accordance to the Final Work Plan; Field Change Requests (FCRS) #6, #9, and #10; and Design Change Notice (DCN) #2 (Appendix B of the CCR) the biota barrier was constructed of two layers: <ul style="list-style-type: none"> • Bottom 9 inches contained imported crushed concrete sized to 3-inch to 6-inch. • Top 9 inches contained the 4-inch minus crushed concrete material from on-site sources. This layer was finer than the bottom layer and contained gravel and sand sized particles.

COMMENT/RESOLUTION FORM

Final Construction Completion Report Remedial Action at SWMU 101—Sewage Lagoons Cannon Air Force Base, New Mexico March 2005

ITEM NO.	PAGE NO.	REVIEWER'S COMMENT	COMMENT RESOLUTION
3. (Cont.)			<p>Using a two-layer approach to constructing the biota barrier layer allows the top layer to perform as a filter layer between the fine cover soil material and the lower layer of 3-inch to 6-inch crushed concrete. The upper portion of the biota barrier, because of its finer gradation and gravel and sand sized particles, will mitigate against infiltration of the soil cover into the bottom layer. Placement of the finer biota barrier layer material on top of the coarser material precluded the need for a filter material to be placed beneath the erosion/vegetation layer.</p> <p>Section 3 will be revised to include specific information on the construction of the soil cover system. Replacement pages will be included in the Comment Response package.</p>
4.		<p>Future inspection, maintenance and protection of the cover system are not addressed in the report. Periodic mowing is apparently already occurring (photographs of the mowed cover are included in Appendix C), but erosion repair is not addressed. Exposure of the biota barrier could result in increased infiltration, reduced vegetation growth, and decreased evapotranspiration. Access restrictions described in the report are limited to fencing. If additional restrictions are proposed or have been implemented, such as warning signs, Commander's Orders, or other forms of institutional controls, they must be identified and described.</p>	<p>Section 6 will be revised to include a prescribed post-construction maintenance plan to consist of specifications for soil cover inspection and maintenance. As part of the final construction efforts at the Sewage Lagoons, warning signs were installed at the time of fence construction.</p> <p>Replacement pages will be included in the Comment Response package.</p>
Specific Comments			
1	Page 3-1, paragraph 1	<p>Project Description (Section 3). This section states that "the Sewage Lagoons cover system was designed to minimize potential threat to human health and the environment..."</p> <p>NMED Comment: The statement in Section 3 indicates that a potential threat to human health would exist if the remedial action was not implemented. CAFB must identify the specific, ecological receptors at risk, in addition to addressing human health.</p>	<p>Referring to General Comment #1, Section 3.1 will be revised to present information on the ecological risk assessment results as they relate to the selection of the corrective measure. Replacement pages will be included in the Comment Response package.</p>
2.	Page 3-6	<p>NMED Comment: This section states that no nonconformance reports were filed in regards to this project. This statement conflicts with the description of construction of the biota barrier in Section 3.1.6 (page 3-4), which states that half of the crushed concrete (16,000 cubic yards) did not meet the grain size requirements of Specification 02115. The discussion in Section 3.1.6 does not explain whether the grain size of this concrete was smaller or</p>	<p>As stated in Section 3.2.7 and specified in the Design Specification of the project, there were no nonconformance reports filed in reference to this project. All deviations to the design and construction specifications of this projects were managed through the FCR and DCN process specified in Section 01451 of the Specifications for Sewage Lagoon Closure presented in Appendix A of the Final Work Plan (February 2003).</p>

COMMENT/RESOLUTION FORM

Final Construction Completion Report Remedial Action at SWMU 101—Sewage Lagoons Cannon Air Force Base, New Mexico March 2005

ITEM NO.	PAGE NO.	REVIEWER'S COMMENT	COMMENT RESOLUTION
		<p>larger than specification. The referenced Field Change Request (FCR) No. 6 (in Appendix B of the Report) indicates that "fine material in the crushed concrete stockpile at SWMU 97" did not meet the specifications, but does not mention any size problems with "Keel material" (left over from runway work), which is proposed for use in FCR No. 9. Finally, Design Change Notice (DCN) No. 2 (in Appendix B of the Report), approving use of the undersized material from SWMU 97, states that "Changed specification will be reflected in record drawings and completion report". The changed specification is not mentioned in Section 3.1.6 or on the drawings provided in the Report (Figure 3-1, page 3-9), or elsewhere in the Report. CAFB must clarify why the SWMU 97 and Keel materials did not meet specification 02115, and explain how the specification was changed and any potential effects from using off specification material.</p>	<p>Referring to General Comment #3, Section 3.1.6 will be revised to provide a clearer narrative of the construction of the biota barrier layer relative to FCRs #6, #9, and #10 and DCN #2.</p> <p>Replacement pages will be included in the Comment Response package.</p>
3.	Page 3-3	<p>NMED Comment: This section states that the first lift of the biota barrier layer consisted of the SWMU 97 and Keel materials, and the second lift was 3- to 6-inch crushed concrete from an unspecified offsite source. The Excavation and Handling Plan for Biota Barrier Layer (in Appendix A of the Report), however, states that the offsite material will be placed first, and the second lift will be the on-site (SWMU 97 and Keel) materials. This procedure is confirmed in DCN No. 2. CAFB must clarify the description of the upper and lower lifts of crushed concrete materials. If the current description in Section 3.1.6 is correct, this is an apparent nonconformance with the above plan and DCN No. 2. The offsite source of crushed concrete must also be identified.</p>	<p>Referring to Specific Comment #2, Section 3.1.6 will be revised to present a clearer narrative of the construction of the biota barrier layer.</p> <p>Replacement pages will be included in the Comment Response package.</p>
4.	Appendix B, page B-1	<p>NMED Comment: DCN Nos. 1 and 3 identify additional changes in the project specifications that are not mentioned in the Report. CAFB must identify and describe these changes (i.e., eliminating the berm between the North and South Lagoons, and modification of soil permeability test conditions), and provide the reasons for their implementation.</p>	<p>Section 3.2.3 will be revised to include a summary narrative of the FCRs and DCNs approved for this projects.</p> <p>Replacement pages will be included in the Comment Response package.</p>

COMMENT/RESOLUTION FORM

Final Construction Completion Report Remedial Action at SWMU 101—Sewage Lagoons Cannon Air Force Base, New Mexico March 2005

ITEM NO.	PAGE NO.	REVIEWER'S COMMENT	COMMENT RESOLUTION
5.	Page 2-2, paragraph 1	<p>The report states that "Currently, groundwater monitoring is conducted annually at the Sewage Lagoons to comply with RCRA requirements."</p> <p>NMED Comment: The last reported groundwater data was presented in the report entitled <i>October 2002 Cannon Air Force Base, New Mexico RCRA Ground Water Monitoring at Sewage Lagoons and at Landfill 5, Analytical Results of Samples Collected March 12-14, 2002 and February 2005 Cannon Air Force Base, New Mexico RCRA Ground-Water Monitoring at Sewage Lagoons, Landfill 5, and Perimeter Wells Analytical Results for Samples Collected June 14-16, 2004</i>. CAFB must explain why there was no data collected for 2003.</p>	<p>Groundwater monitoring has continued at the Sewage Lagoons. The groundwater monitoring reports for the time periods referenced in the comment were transmitted by Cannon AFB in early January immediately upon receiving the NOD.</p>

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LIST OF ACRONYMS AND ABBREVIATIONS

ACI	Arrowhead Contracting, Inc.
AFB	Air Force Base
Area A	South Lagoon Area
Area B	North Lagoon Area
CMS	Corrective Measures Study
COPEC	chemical of potential ecological concern
cy	cubic yards
DCN	Design Change Notice
DQCR	Daily Quality Control Report
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FCR	Field Change Request
Foster Wheeler Environmental ft	Foster Wheeler Environmental Corporation, Inc. foot, feet
IRP	Installation Restoration Program
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SBL	soil barrier layer
SWMU	Solid Waste Management Unit
SWPPP	Stormwater Pollution Prevention Plan
TtEC	Tetra Tech EC, Inc.
USACE	U.S. Army Corps of Engineers

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2. SITE HISTORY AND PREVIOUS INVESTIGATIONS

This section presents a brief description and history of Cannon AFB and SWMU 101, and summarizes the results of previous investigations conducted for the Sewage Lagoons.

2.1 Cannon AFB Description and History

Cannon AFB occupies approximately 4,000 acres south of U.S. Highway 60/84 in Curry County, New Mexico. The Base is 6 miles west of the city of Clovis, near the border between New Mexico and Texas (Figure 2-1). The area surrounding Cannon AFB is used mainly for farming and ranching. Cannon AFB also maintains several satellite facilities.

In 1942, the Department of Defense established Clovis Army Air Base, a training facility for B-17, B-24, and B-29 aircrews. In 1945, the Base was renamed Clovis Army Airfield, which was closed in 1947. The facility was reactivated in 1951 and reassigned to the Tactical Air Command; in 1957 it was renamed Cannon AFB. In 1975, the 27th Tactical Fighter Wing became the principal U.S. Air Force unit at Cannon AFB. In 1992, the Base was reassigned to the Air Combat Command, which currently maintains a combat-ready force and provides replacement training of combat aircrews for worldwide tactical organizations.

2.2 Sewage Lagoons Description and History

The Sewage Lagoons were identified as SWMU 101 in the Cannon AFB Hazardous Waste permit dated November 14, 1989. The Sewage Lagoons, which were constructed in 1966, consisted of two unlined surface impoundments, operating in series, that received combined sanitary and industrial wastewater from Base facilities. The north and south lagoon areas had concrete-lined banks and unlined earthen bottoms, operated in series, and had a combined surface area of approximately 39 acres (Figure 2-2). In 1998, a new wastewater treatment plant was put in operation at Cannon AFB. Although sewage discharge to the lagoons stopped in 1998, the Base continued to discharge treated wastewater to the lagoons in order to prevent direct exposure to the underlying sludge. In early 1998, the Base stopped discharging treated wastewater to the lagoons and allowed them to dry.

2.3 Previous Investigations and Evaluations

In 1992, SWMU 101 was investigated during the Appendix I RCRA Facility Investigation (RFI) (Woodward-Clyde, 1992). The results of the RFI indicated that the thickness of the sludge in the north and south lagoons was approximately 2 feet (ft) and the average water depth ranged from 3.5 to 4.5 ft (Woodward-Clyde, 1992; E&E, 1998).

Based on the results of the RFI, the Sewage Lagoons were recommended for continued annual groundwater monitoring for volatile organic compounds, metals, pesticides, nitrate, sulfate, and total dissolved solids. An interim monitoring program was implemented to support site closure until Cannon AFB, EPA, and the New Mexico Environment Department (NMED) could resolve the applicable regulatory framework. Even though SWMU 101 was not included on the Cannon AFB RCRA Part B permit (issued in 1989) at that time, Cannon AFB chose to carry SWMU 101 through the RCRA process. The Base understood that at some point the lagoons would be added to the permit. Currently, groundwater monitoring is conducted annually at the Sewage Lagoons to comply with RCRA requirements.

A Corrective Measures Study (CMS) for closure of SWMU 101 identified and evaluated potential corrective actions (Foster Wheeler Environmental, 2001). Human health and ecological risk assessments were conducted as part of the CMS to determine the requirements for contaminant containment and source control. An ecological survey was also conducted. No risk to human health was identified from exposure to surface or subsurface soil or sludge at the site. However, concentrations of inorganic chemicals produced elevated ecological screening values for potential ecological receptors. The results of the ecological risk characterization precluded the need to prevent exposure to lagoon sludge for ecological receptors. A summary of the ecological risk characterization is presented below:

- The ecological risk characterization for measurement receptors from potential exposure to COPECs in north lagoon sludge, south lagoon soil, and south lagoon sludge found that pesticides produced elevated risks for the deer mouse and least shrew. However, there were limited toxicity data available for terrestrial invertebrates and plants and risk could not be quantified for the majority of the pesticides (Foster Wheeler, Environmental 2001).
- Concentrations of VOCs did not produce elevated risk for any of the measurement receptors at any of the areas of concern. Concentrations of PCBs produced elevated risks for the deer mouse and least shrew in north lagoon sludge. This is the only area of concern in which PCBs were detected.
- Concentrations of metals produced elevated risks for all measurement receptors. Ecological screening quotients (ESQs) ranged from 1.1 for terrestrial invertebrates from lead exposure to 5,300 for plants from silver exposure. Many of these ESQs are likely overestimated because of the presence of naturally high concentrations of metals. Most of the metals were detected at concentrations only slightly higher than background and would pose risk to potential receptors even at background concentrations.

- The SLERA was designed to evaluate potential risk to representative receptors from multiple trophic levels present at the site as well as wildlife temporarily visiting the site. The risk characterization indicated that there might be risk for multiple trophic-level species from COPECs present in lagoon sludge and the underlying soil.

- To prevent exposure to ecological receptors, sludge removal from the former north lagoon, in-place consolidation in the former south lagoon, and closure using an engineered cover with a biotic barrier were selected as the corrective actions for closing the lagoons.

The Phase III Sludge Management, Compliance Evaluation, and Requirements Identification report (E&E, 1998) and the Sewage Lagoons Closure Final Specifications (USACE, 2002) concurred that dewatering, consolidation, and compaction of the contaminated material, followed by the placement of a protective cover, was an economical solution to close the lagoons permanently. The construction activities documented in this Construction Completion Report—excavation of contaminated sludge and soil, in-place consolidation of the material, and construction of an engineered cover—are considered a voluntary corrective measure. The cover design assumed that the contaminated media at the site consisted of approximately 2 ft of sludge overlying a 1-ft-thick layer of soil.

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3. PROJECT DESCRIPTION

The Sewage Lagoons cover system was designed to minimize potential threat to human health and the environment by removing the sludge and underlying contaminated soil from the former north lagoon, referred to as the North Lagoon Area, consolidating the excavated material into the former south lagoon, referred to as the South Lagoon Area, grading and compacting the sludge and soil material to prepare the substrate, and constructing a 42-inch-thick engineered earthen cover system. Specific results of the human health and ecological risk evaluations are presented in the CMS (Foster Wheeler Environmental, 2001). Section 2.3 of this report presents a summary of the ecological risk characterization.

Construction activities conducted for the remediation of the sewage lagoons included the following:

- Grading and drainage construction
- Demolition and removal of concrete and piping
- Excavation and handling of contaminated material from the North Lagoon Area
- In-place consolidation of excavated material, random fill, and grading in the South Lagoon Area
- Construction of a 20-acre, 42-inch-thick engineered earthen cover (soil barrier layer)
- Installation of the biota barrier and erosion/vegetation layers
- Site revegetation and fencing

In submittals and other interim deliverables referred to in this report, the South Lagoon Area is referred to as Area A and the North Lagoon Area, Area B.

Mobilization began on March 5, 2003, and the major field construction activities were completed on December 18, 2003. Temporary erosion control measures were implemented in early January 2004 and maintained until revegetation was accomplished in April 2004.

3.1 Construction Activities

The following subsections describe the construction activities that were performed at SWMU 101 by the TtEC subcontractor, Arrowhead Contracting Inc. (ACI) of Overland Park, Kansas. For this project, TtEC provided construction management support and did not self-perform any construction work. Table 3-1 presents a summary of the design specifications and criteria implemented on this project.

3.1.1 Grading and Drainage

ACI constructed temporary soil erosion control measures along the southern and southeastern borders of SWMU 101 to prevent storm water runoff from leaving the site. Additionally, temporary soil erosion and sediment control measures (i.e., straw bales and silt fences) were installed at two drop-inlets and one culvert on the east side of the entire unit during construction and post-construction activities.

3.1.2 Demolition and Removal

To prepare the site for demolition activities, ACI constructed access roads into the lagoons and trimmed tree limbs hanging over the perimeter fence to remove the safety hazard. The overburden (e.g., tumbleweeds, brush) was then removed and disposed along with the cleared tree limbs as clean construction waste at an approved offsite facility. Demolition involved removing concrete structures, slabs, steel and polyvinyl chloride (PVC) piping, and associated components from the North Lagoon Area. These materials were then used as fill in the South Lagoon Area.

The Work Plan (Foster Wheeler Environmental, 2003) required complete removal of the concrete-lined banks of the former south lagoon and removal of the piping only from the former north lagoon (i.e., the concrete-lined banks left intact). Instead, the concrete slabs covering the earthen banks of the southern half of the North Lagoon Area were also removed. Materials from the exposed earthen berms in the North Lagoon Area and the earthen berms surrounding the South Lagoon Area, approximately 20,000 cubic yards (cy), were used to construct the soil-barrier layer (SBL) of the cover system, resulting in cost savings to the project. The berm material was tested and approved using the same requirements as offsite materials. TtEC prepared Field Change Request (FCR) No. 3 (Appendix B) and Design Change Notice (DCN) No. 1 (Appendix B) to implement these changes. The USACE reviewed and approved all FCRs and DCNs prior to implementation. Due to the removal of the earthen berms, the resulting landfill cap is slightly smaller than shown on the original design drawings.

3.1.3 Excavation and Handling of Contaminated Material

According to the work plan (Foster Wheeler Environmental, 2003), approximately 70,000 cy of contaminated material was to be excavated from the North Lagoon Area and placed in the South Lagoon Area. However, the thickness of the sludge and the layers of underlying contaminated soil were less than anticipated, resulting in approximately 60,200 cy. The variance in depth was attributed to evaporation of the lagoons, beginning in 1999 through the initiation of construction. The sludge contained relatively little moisture and was consolidated without the need for dewatering. FCR No. 2 (Appendix B) was prepared to eliminate the task of drying the sludge.

Table 3-1. Design Criteria Summary

Specification	Design/Specification Summary*	Changes from Original Specification
Section 02111—Excavation and Handling of Contaminated Material		
General	The work shall consist of excavating approximately 70,000 cubic yards of sludge from the north lagoon and placing this material in the south lagoon. Depending on the moisture content and apparent shear strength of north lagoon sludge, tilling and drying of north lagoon sludge prior to placement in the south lagoon may be required.	FCRs No. 2, 4, and 7 approved for eliminating dewatering (sludge was dry), removing sludge encountered at below 1 ft, and backfilling over-excavated area to remove deeper sludge.
Existing Structures and Utilities	The Base Civil Engineering Office at Cannon AFB shall obtain all utility clearances and digging permits prior to construction. Take all necessary precautions to ensure no damage occurs to existing structures and utilities. Monitoring Wells F, G, and H and their associated purge tanks shall be protected from damage during construction.	No changes. Implemented as written.
Subgrade Preparation	Prior to receiving sludge from the north lagoon, sludge in the south lagoon shall be loosened to a depth of 24 inches and allowed to dry for a minimum period of 48 hours during dry weather conditions. After the upper 24 inches of sludge has been loosened and dried in the south lagoon, the subgrade shall be compacted by a minimum of 3 passes using a footed roller with a minimum weight of 40,000 pounds. Additional passes shall be made until the subgrade is firm, exhibiting not more than 1 inch of deflection during a pass of the footed roller. No density testing shall be performed.	No changes. Implemented as written.
Contaminated Material Removal	Sludge from the north lagoon shall be excavated and placed in the south lagoon after sludge in the south lagoon has been dried and compacted. Sludge from the north lagoon shall be allowed to dry before being removed and transported to the south lagoon. The drying process shall consist of using a tiller, or other approved equipment, to loosen the upper 12 inches of sludge in a given area. A 12-inch lift of the tilled area shall then be allowed to dry for a minimum period of 48 hours during dry weather conditions prior to removal and placement in the south lagoon. The maximum total depth of sludge to be removed from the north lagoon is approximately 24 inches.	No changes. Implemented as written.
Confirmation Sampling and Analysis	Confirmation samples shall be collected after all sludge and underlying subgrade material has been removed, and analyzed for contaminants. Confirmation samples shall be collected at a frequency of one per 40,000 square feet from the bottom and side slopes of the excavated area in the north lagoon.	No changes. Implemented as written.
Placement	No backfill material shall be placed in the north lagoon. Sludge from the north lagoon shall be placed in the south lagoon in 12-inch lifts. Sludge shall be compacted by 3 passes of a footed roller with a minimum weight of 40,000 lbs. No density testing shall be performed.	FCR #5 approved to allow backfilling of over-excavated areas in North Lagoon.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
Section 02115—Biota Barrier Layer		
General	Excavation of onsite recycled concrete and placement on the south lagoon for use as a biota barrier layer to discourage small, burrowing rodents from penetrating the soil barrier layer. <u>Addendum to Specification:</u> Under SD-06, Test Reports, the Contractor shall submit for approval a gradation curve and engineering description of all off-site materials proposed for use as biota barrier material, according to ASTM D 422 and ASTM D 2487, respectively.	Implemented as amended.
Biota Barrier Material	Biota barrier layer material shall consist of crushed (recycled) concrete obtained from onsite sources, or may consist of rock or stones obtained from off-site sources with a minimum dimension of 3 inches and a maximum dimension of 6 inches. Crushed concrete shall be obtained from the stockpile located east of the lagoons, consisting of crushed concrete from the former Landfill 25. Recycled concrete used for the biota barrier shall consist of reasonably clean; durable; angular particles that are reasonably free of organic matter; soft particles; friable particles; and other objectionable materials.	FCRs #6 and #8, and DCN #2 approve to allow offsite materials to be used.
Existing Structures and Placement	Site utilities shall be field located prior to construction. Damage to existing structures and utilities are not allowed.	No changes. Implemented as written.
Placement	Biota barrier layer material shall be placed in a single lift above the soil barrier layer. The completed biota barrier layer shall be a minimum of 15 inches and a maximum of 18 inches in thickness.	FCRs #6 and #8, and DCN #2 approved to allow offsite materials to be used.
Compaction	Biota barrier material shall be compacted using a 10-ton smooth drum roller. Compaction shall consist of 2 passes over all areas.	No changes. Implemented as written.
Section 02140—Erosion/Vegetation Layer		
Erosion/Vegetation Layer Soil Product	Erosion/vegetation layer soil shall consist of natural, friable soil that is representative of soils in the vicinity that produce heavy growths of crops, grass, or other vegetation. In addition, erosion/vegetation layer soil shall be reasonably free from underlying subsoil; clay lumps; weeds; brush; litter; matted roots; toxic substances; or any material that might be harmful to plant growth or be a hindrance to grading, planting, or maintenance operations. Erosion/vegetation layer soil shall comply with criteria listed in Table 1 of the specification.	No changes. Implemented as written.
Borrow Source Assessment	Assessment tests shall be performed on each principal type or combination of materials proposed for use to ensure compliance with specified requirements. At least one set of tests shall be performed on each borrow source proposed. <u>Classification Testing:</u> A set of borrow source assessment tests shall consist of Atterberg limits, particle size analysis excluding hydrometer, and moisture content. <u>Erosion/Vegetation Layer Material:</u> Testing shall consist of grain-size analysis, pH, and organic content.	FCR #11 approved to delay testing for moisture content until reseeding in Spring 2004.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
	<u>Chemical Contamination Testing:</u> Borrow used for the erosion/vegetation layer shall be free of contamination. Each borrow source shall be sampled and analyzed for chemical contamination.	
Installation	Erosion/vegetation layer material shall be uniformly placed in a single lift and traffic compacted by 1 pass of compaction equipment. The completed thickness shall be 6 inches. Soil shall be placed within a range of 2 percent dry to 3 percent wet of optimum moisture content.	No changes. Implemented as written.
Construction Tolerances	Finished surfaces shall be uniformly graded and shall be free from depressions, mounds, or windrows. The top surface of the erosion/vegetation layer shall be no greater than 0.15 feet above the grades shown on the drawings.	No changes. Implemented as written.
Construction Tests	Each day that material is placed, a minimum of 3 standard moisture content tests shall be performed for correlation with nuclear moisture test data. Standard tests shall be performed at locations that are as close as possible to nuclear density test locations. <u>Erosion/Vegetation Layer Material:</u> During construction, representative samples shall be taken for testing from the borrow source at the frequencies listed in Table 2 of the specification. <u>Moisture Content of In-Place Erosion/Vegetation Layer Material:</u> Moisture content tests shall be performed in accordance with Table 3 of the specification. <u>Nuclear Moisture Content Tests:</u> The nuclear gauge calibration checks shall be made at the beginning of a job, on each different type of placement material. Nuclear moisture content gauges shall be standardized daily.	No changes. Implemented as written.
Protection	Erosion rills that exceed 1 inch in depth or other damage resulting in depressions that exceed 1 inch in depth shall be repaired and grades re-established until the time of seed placement.	No changes. Implemented as written.
Section 02210—Earthwork/Grading		
General	Includes removal of the existing soil berm surrounding the south lagoon and placement of random fill within the south lagoon.	FCR #3 and DCN #1 approved to allow demolition of the central berm on the north side of the south lagoon to facilitate construction of the soil cover.
Borrow Material	Borrow material shall be selected to meet requirements and conditions of the particular fill for which it is to be used. Necessary clearing, grubbing, disposal of debris, and satisfactory drainage of borrow pits shall be performed as incidental operations to the borrow excavation.	No changes. Implemented as written.
Excavation	Excavation shall be performed to the lines and grades shown on construction drawings. Suitable excavated material shall be transported to and placed in fill areas within the limits of the work. Satisfactory drainage shall be provided at all times.	FCR #5 approved to remove sludge encountered deeper than planned.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
	Following excavation and removal of north lagoon sludge, the subgrade in the north lagoon shall be graded to minimize ponding of water.	
Utilization of Excavated Materials	Suitable material removed from required excavation under this section shall be utilized in the formation of the cover system provided the material complies with all specification requirements. Material authorized to be wasted shall be disposed of in such manner as not to obstruct the flow characteristics of any existing ditch or channel, or impair the efficiency or appearance of any structure.	No changes. Implemented as written.
Preparation of Ground Surface for Random Fill	All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsuitable material within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. Stumps, logs and roots more than 1-1/2 inch in diameter shall be excavated and removed to a depth not less than 18 inches below the original ground surface. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be uniformly scarified to a depth of 1-2 inches to promote bonding of fill material with the existing subgrade. The subgrade shall be wetted or dried to obtain the specified moisture content and density prior to placement of fill.	No changes. Implemented as written.
Random Fill	Random fill shall be placed within the south lagoon as shown on construction drawings. Suitable material removed from excavation areas may be used as random fill. Material shall be placed in loose lifts not to exceed 8 inches in thickness for the full width of the cross section. Each layer shall be compacted before placing the next (overlying) lift.	No changes. Implemented as written.
Compaction	Each layer of fills constructed shall be compacted to at least 90 percent of maximum density. Cohesive soils shall be at a moisture content between 1 percent below and 4 percent above optimum moisture when compacted, without the occurrence of bulking.	No changes. Implemented as written.
Placing Topsoil	Reference specification section 02140, Erosion/Vegetation Layer.	No changes. Implemented as written.
Field Testing Control	Quality control sampling and testing shall be performed in accordance with specification section 01451, Contractor Quality Control. <u>Moisture-Density Determinations:</u> Testing shall include Atterberg limits, grain size determinations and specific gravity. <u>Density Control:</u> One test shall be made for each 1,500 square yards or less for each layer of specified depth.	No changes. Implemented as written.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
Finished Excavation and Fill Areas	All areas covered by the project shall be uniformly smooth graded. The finished surface shall be compacted and free from irregular surface changes. The finished surface shall be not more than 0.15 foot above or below the established grade and shall be free of depressed areas where water would pond. All ditches shall drain readily.	No changes. Implemented as written.
Protection	During construction, embankments and excavations shall be kept shaped and drained. Existing ditches and channels shall be maintained to drain effectively at all times. The subgrade shall be brought to grade where ruts exceed 1 inch in depth occur and recompacted prior to placement of overlying materials. Newly graded areas shall be protected from traffic and from erosion.	No changes. Implemented as written.
Section 02220—Demolition		
General South Lagoon Items	<ol style="list-style-type: none"> 1. Concrete dike surrounding the lagoon on all 4 sides 2. Concrete gate structure, associated piping, water valves and meters in the southeast corner 3. 15-inch diameter steel discharge pipe-northwest corner 4. 15-inch diameter steel overflow pipe-northwest corner 5. 15-inch diameter steel overflow pipe-northeast corner 6. 6-inch diameter PVC diffuser pipe located adjacent to concrete gate structure, southeast corner 7. Concrete slab approximately 12 feet by 10 feet, 6-inches thick, with No. 8 reinforcing steel 12" on center each face-northwest corner 8. Five soil access roads shall be pushed into the south lagoon and used as random fill beneath the cover system 	No changes. Implemented as written.
General North Lagoon Items	15-inch diameter steel discharge pipe located at the north end	No changes. Implemented as written.
Dust Control	The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area.	No changes. Implemented as written.
Protection	<p><u>Protection of Personnel:</u> Evaluate site conditions prior to and during demolition work and take necessary precautions to protect personnel working in and around the demolition area at all times.</p> <p><u>Protection of Existing Structures:</u> Avoid damage to Monitoring Wells F, G, and H during construction. Purge tanks, located adjacent to these wells, shall be removed prior to construction. These tanks shall be replaced in their original locations after construction.</p> <p><u>Protection of Existing Trees:</u> One Elm tree is located along the west side of the south lagoon, along the fence separating the lagoons from the abandoned runway.</p>	No changes. Implemented as written.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
Existing Fence	Sections of the existing fence along the south and west sides of the lagoons may be removed to provide access to the site. Sections of fence removed shall be reinstalled in their original locations at completion of the project.	FCR #8 approved to construct a fence around the perimeter of the south lagoon soil cover.
Disposition of Material	All removal items shall be placed in random fill areas of the south lagoon. Concrete dikes shall be broken into pieces not to exceed 36 inches in any dimension. Removal items shall be covered with at least 24 inches of random fill prior to placement of the soil barrier layer.	No changes. Implemented as written.
Section 02377—Soil Barrier Layer		
General	Soil barrier layer material shall be obtained from an offsite source. Alternatively, native soil excavated beneath the keel section for the runway improvement project at Cannon AFB may be used. Keel subgrade material grain-size distribution is approximately between 5 and 15 percent passing the No. 200 sieve. The layer shall provide an in-place hydraulic conductivity of 1.5×10^{-4} centimeters per second (cm/s), or less.	FCRs #3 and #10 and DCN #3 approved to allow use of central berm material based on meeting testing criteria. Based on testing, Keel material did not meet specification and was used for the biota barrier instead.
Soil Barrier Layer Product	Soil shall be free of roots, debris, organic or frozen material, and shall have a maximum clod size of 2 inches at the time of compaction. Soil barrier layer material shall comply with criteria listed in Table 1 of the specification.	No changes. Implemented as written.
Borrow Source Assessment	Tests shall be performed on each principal type or combination of materials from all sources proposed for use in the soil barrier layer. A minimum of one set borrow assessment tests shall be performed for each borrow source proposed. A set of borrow source assessment tests shall consist of classification testing, moisture-density (compaction) testing, and hydraulic conductivity testing.	No changes. Implemented as written.
Installation	<p><u>Soil Barrier Placement:</u> Soil shall be placed in 2 equal loose lifts, resulting in a thickness of 18 inches after compaction. Where hand operated tampers are used, the loose lift thickness shall not exceed 4 inches. Holes left by grade stakes shall be backfilled and compacted.</p> <p><u>Moisture Control:</u> The minimum allowable moisture content shall be no less than optimum moisture content. The moisture content shall be maintained uniform throughout each lift.</p> <p><u>Compaction:</u> Soil shall be compacted by at least 3 passes of the equipment to meet the density requirements of each lift.</p> <p><u>Scarification:</u> Uniformly scarify each lift to a depth of 2 inches. The final lift of soil barrier layer material shall not be scarified.</p> <p><u>Repair of Voids:</u> Voids created in the soil barrier layer during construction shall be repaired by removing sand or other non-cohesive material, placing soil infiltration layer backfill in lifts no thicker than 3 inches and tamping each lift with a steel rod.</p>	No changes. Implemented as written.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
	Each lift shall be tamped a minimum of 25 times altering the location of the rod within the void for each blow. Other ruts and depressions in the surface of the lifts shall be scarified, filled, and then compacted to grade.	
Construction Tolerances	The top surface of the soil barrier layer shall be no greater than 2 inches above the grades shown on the drawings. No minus tolerance will be permitted.	FCR #10 approved to allow 2-inch (+/-) for soil barrier layer.
Construction Tests	<p><u>Soil Barrier Layer Material Tests:</u> Samples shall be taken at frequencies listed in Table 2 of the specification from onsite stockpiles or after a loose lift of soil barrier layer material has been placed.</p> <p><u>Moisture Content and Density Tests of In-Place Soil Barrier Layer:</u> Testing shall be performed in a grid pattern that is staggered for successive lifts so that sampling points are not at the same location in each lift. Moisture content and density tests shall be performed in accordance with Table 3 of the specification.</p> <p><u>Rapid Tests:</u> Each day that soil barrier layer material is compacted, a minimum of one set of moisture content and density tests shall be performed using standard procedures. Rapid tests shall be checked at the frequencies shown in Table 3 of the specification. Standard tests shall be performed at locations that are as close as possible to the location of rapid tests being checked.</p> <p><u>Nuclear Density and Moisture Content Tests:</u> Nuclear density readings shall be taken in the direct transmission mode. The nuclear gauge calibration checks shall be made at the beginning of a job, on each different type of placement material. Nuclear density and moisture content gauges shall be standardized daily.</p> <p><u>Hydraulic Conductivity Tests of In-Place Soil Barrier Layer Material:</u> A minimum of 5 undisturbed samples shall be taken for hydraulic conductivity testing for each lift of soil barrier layer material placed and compacted. Each undisturbed sample shall be tested for hydraulic conductivity. If any test result is greater than 1.5×10^{-4} cm/s, modifications shall be proposed and approved prior to placement of additional soil barrier layer material of that type. If the hydraulic conductivity of any test is more than 7.5×10^{-4} cm/s, 3 additional tests shall be performed near the location of the original failed test. If any of the retests fail, the area shall be repaired out to the limits defined by passing hydraulic conductivity tests. The area shall then be retested as directed.</p>	No changes. Implemented as written.
Protection	<p><u>Moisture Content:</u> After placement, moisture content shall be maintained or adjusted to comply with acceptable zone criteria.</p> <p><u>Erosion:</u> Erosion rills in excess of 1 inch in depth that occur in the soil barrier layer shall be repaired and grades re-established. The method of repair shall not decrease the minimum required thickness of the soil barrier layer.</p> <p><u>Retests:</u> Areas that require repair shall be retested as directed.</p>	No changes. Implemented as written.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
Section 02921—Seeding		
Seed Product	<p><u>Seed Classification:</u> State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material.</p> <p><u>Permanent Seed Species and Mixtures:</u> Permanent seed species shall be proportioned by weight.</p> <p><u>Quality:</u> Weed seed shall be a maximum 1 percent by weight of the total mixture.</p> <p><u>Seed Mixing:</u> The seed supplier may mix the seed prior to delivery or on site, if directed.</p> <p><u>Substitutions:</u> Substitutions will not be allowed without written request and approval.</p>	FCRs #11, #12, and #13 approved to delay seeding effort, install erosion protection, and revise the seed mix.
Fertilizer Product	Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. Fertilizer shall be derived from sulphur-coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea. Fertilizer shall be balanced with the inclusion of trace minerals and micronutrients.	No changes. Implemented as written.
Mulch Product	Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. The material selected for mulch shall be either straw, hay, wood cellulose fiber or paper fiber	No changes. Implemented as written.
Water	Water shall not contain elements toxic to plant life.	No changes. Implemented as written.
Installing Seed Time and Conditions	Seeding shall occur between 1 June and 1 September. Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed.	FCR #11 approved on 9/26/2003 to delay seeding until Spring 2004.
Site Preparation	<p><u>Finished Grade:</u> Verify that finished grades for the erosion/ vegetation layer are as shown on the drawings prior to seeding.</p> <p><u>Application of Fertilizer:</u> Fertilizer shall be incorporated into the soil to a maximum 4-inch depth or may be incorporated as part of the tillage or hydroseeding operation.</p> <p><u>Prepared Surface:</u> The prepared surface shall be a maximum 1-inch below the adjoining grade. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris and protected from compaction or damage by vehicular or pedestrian traffic and surface erosion. Debris and stones larger than 1-inch in any dimension shall be removed. Erosion rills greater than 1-inch in depth shall be repaired prior to seeding.</p>	No changes. Implemented as written.

Table 3-1. Design Criteria Summary (Continued)

Specification	Design/Specification Summary*	Changes from Original Specification
Installation	Seeding method shall be drill seeding or hydroseeding and result in uniform coverage over the entire area to be seeded. Gravity feed applicators that drop seed directly from a hopper onto the prepared soil shall not be used.	No changes. Implemented as written.
Restoration and Cleanup	Existing turf areas and pavements that have been damaged from the seeding operation shall be restored. Excess and waste material shall be removed and disposed of offsite. Adjacent paved areas shall be clean.	No changes. Implemented as written.
Protection of Installed Areas	The area shall be protected against traffic or other use upon completion of seeding by erecting barricades and providing signage.	No changes. Implemented as written.
Seed Establishment Period	The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of work and end 60 days after the last day of seeding. The seed establishment period may be modified for inclement weather, shut down periods, or for other reasons as directed.	No changes. Implemented as written.

* Specifications and design criteria are provided for Division 2 of the project specifications presented in the Final Work Plan for the Closure of SWMU 101, Sewage Lagoons Cannon Air Force Base (Foster Wheeler Environmental 2003).

During the excavation of the southern section of the North Lagoon Area, a subgrade “trench” of sludge trending east-west was discovered below the established limits of the contaminated soil layer. This material, approximately 13,200 cy, was placed in the South Lagoon Area at no additional cost to the project under FCR No. 5 (Appendix B). The over-excavated area was backfilled with stockpiled material left over from former runway work under FCR No. 7 (Appendix B). This stockpile is commonly referred to as the Keel material and was located adjacent and west of SWMU 101. TtEC conducted post-excavation confirmation soil sampling. Hagar & Associates, P.C. Land Surveyors completed the post-excavation topographical and sample location surveys. According to the sludge layer as-built survey, the total amount of fill materials placed in the South Lagoon Area, including concrete rubble, piping, sludge and contaminated sludge and soil, was 73,400 cy.

3.1.4 Sludge Consolidation and Random Fill

ACI excavated approximately 60,200 cy of sludge and contaminated soil materials from the North Lagoon Area and consolidated this with the South Lagoon Area material, as illustrated in Figure 3-1. The 13,200 cy of additional sludge material excavated from the North Lagoon Area (Section 3.1.3) was used as random fill in the South Lagoon Area in place of the Keel material specified in the final Work Plan (Foster Wheeler Environmental, 2003) and resulted in cost savings to the project. The consolidated material and random fill was graded from 1 to 3 percent, per DCN No. 3 (Appendix B), and surveyed to document as-built conditions. The Record Drawings document the final contours and grade of the consolidated material and random fill.

3.1.5 Soil Barrier Layer Construction

The SBL is approximately 43,500 cy of an 18- to 21-inch-thick earthen cover system composed of clean, approved soil, that was placed on top of the sludge and random fill layer (Figure 3-1). The purpose of the SBL is to reduce infiltration of moisture into the underlying layer of contaminated material. Both onsite (20,000 cy) and offsite (23,500 cy) sources were used for the SBL; all source material was tested in accordance with Specification 02377 (Appendix A). To limit infiltration, the permeability criteria for the SBL required in Specification 02377 is 1.5×10^{-4} centimeters per second. The onsite soils came from the former earthen berms around the southern half of the North Lagoon Area and the berms surrounding the South Lagoon Area (Section 3.1.2). The remaining soils came from an approved offsite source located near Melrose, New Mexico, approximately 20 miles west of the Base. A post-construction survey completed on the SBL by Lydick Engineers and Surveyors (Appendix A) indicated that subcontractor miscalculations had caused the cover to be thicker (up to 21 inches) than the requirements in Specification 02377, which calls for only 18 inches. The additional material was approved in FCR No. 10 (Appendix B).

3.1.6 Biota Barrier Construction

The biota barrier consists of 18 inches of recycled, crushed concrete placed on top of the SBL (Figure 3-1). The purpose of this layer is to prevent animals from burrowing into the SBL. Three sources were used to provide the material required to construct the biota barrier. Approximately 8,000 cy of material came from the crushed concrete stockpile at SWMU 97, Landfill 25; an additional 8,000 cy consisted of extra, unused Keel material (FCR No. 9, Appendix B); and another 16,000 cy of 3- to 6-inch crushed concrete from an offsite source (FCR No. 6 and DCN No. 2, Appendix B). Because the grain size of the SWMU 97 and Keel material sources did not meet the requirements of Specification 02115 (Appendix A), DCN No. 2 was submitted for approval. The design change revised the placement of materials for the biota barrier layer in two lifts. The first (bottom) lift consisted of 9 inches of 3- to 6-inch crushed concrete from an offsite source (FCR No. 6 and DCN No. 2, Appendix B). The second (top) lift consisted of the finer SWMU 97 and Keel material. Using a two-layer approach to constructing the biota barrier layer allows the top layer to perform as a filter layer between the topsoil cover material and the lower layer of 3-inch to 6-inch crushed concrete. The upper portion of the biota barrier, because of its finer gradation and gravel and sand sized particles, will mitigate against infiltration of the topsoil cover into the bottom of the biota barrier layer. Placement of the finer biota barrier layer material on top of the coarser material precluded the need for a filter material to be placed beneath the erosion/vegetation layer.

3.1.7 Erosion/Vegetation Layer Construction

The 6-inch erosion/vegetation layer was completed in mid-December 2003 (Figure 3-1). Approximately 12,800 cy of material was imported from a borrow area located 8 miles north of the Village of Melrose, New Mexico (Submittal 02140-2 in Appendix A) to construct this layer. Topsoil layer placement was not completed by the specified September 1, 2003, deadline necessary to ensure that seedlings are established before winter. This delay in the revegetation effort was addressed in FCRs No. 11 and No. 12. The USACE approved an interim soil stabilization plan to crimp-mulch the existing topsoil and implement erosion control measures specified in the Stormwater Pollution Prevention Plan (SWPPP). Rocky Mountain Reclamation crimp-mulched the site in early January 2004. A post-construction survey was completed prior to the crimp-mulch operations. A complete survey is presented in the Appendix A.

3.1.8 Site Revegetation and Fence Construction

Rocky Mountain Reclamation returned in April 2004 and revegetated the South Lagoon Area, 23 acres, by seeding with native species using an approved seed mix (see Table 3-2 and FCR No. 13, Appendix B). A copy of the seed mix certification is provided in Appendix A. TtEC installed a five-strand barbed-wire fence on the northern boundary of the capped area to separate the North and South Lagoon Areas and to

prohibit access (FCR No. 8, Appendix B). This fence was tied-in with the existing fencing that was around the other sides of the site.

Table 3-2. Seed Mix Details

Common Name Seed Mix (Botanical Name)	Pounds Pure Live Seed per Acre	Total Pounds Seed Mix Used
Sideouts gramma (Vaughn variety) (<i>Bouteloua curtipendula</i>)	1.75	40.25
Blue gramma (Halchita variety) (<i>Bouteloua gracilis</i>)	0.50	11.50
Little bluestem (Pastura variety) (<i>Schizachyrium scoparium</i>)	1.35	31.05
Indiangrass (Lanno variety) (<i>Sorghastrum nutans</i>)	2.00	46.00
Switchgrass (Blackwell variety) (<i>Panicum virgatum</i>)	1.00	23.00
Purple prairie clover (<i>Petalostemum purpureum</i>)	1.50	34.50
Fourwing Saltbrush (<i>Atriplex confertifolia</i>)	3.90	89.70
Total:	12 pounds per acre	276 pounds used

3.2 Construction Documentation

3.2.1 Record Drawings

The Record Drawings for this project are presented on Figures 3-2 through 3-4. Figures 3-2 and 3-3 illustrate the pre-construction topography of the South and North Lagoon Areas, respectively. Figure 3-4 illustrates the final topography of the site after completion of construction activities. All other approved interim drawings are presented in Appendix A as submittals. Several partial surveys were performed to allow concurrent construction activities.

3.2.2 Health and Safety Inspections

The Site Superintendent performed weekly health and safety inspections. Periodic inspections were also conducted by the Project Manager (or designee) or the Project Environmental Safety Manager per TtEC standard operating procedures. Copies of all these inspections and final inspection report are retained in the project files.

3.2.3 FCRs and DCNs

There were 13 FCRs and 3 associated DCNs generated during the construction project. Table 3-3 presents a summary of the FCRs and DCNs submitted for approval by USACE relative to Divisions 1 and 2 of the project specifications. All FCRS and DCNs relate to changes required for Division 2 of the project

specifications regarding construction with the exception of FCR No. 1. FCR No. 1 was approved for Division 1, Specification 01351 requiring a change to the project health and safety plan clarifying project personnel responsibilities, personnel protection, and project duration.

Table 3-3. Field Change Requests and Design Change Notices

Number	Content	Date Approved
Field Change Requests		
1	Specification 01351—Revisions to Site Safety and Health Plan based on site conditions, duration of project, and personnel responsibilities.	3/19/03
2	Specification 02111—Modifications to eliminate sludge drying and subgrade preparation. Sludge was dry. Dewatering not necessary.	3/27/03
3	Specification 02377—Removal of central berm for use as soil barrier layer. Prepared in conjunction with DCN 1.	3/31/03
4	Specification 02111—Request to remove sludge outside of project boundary.	3/31/03 Rejected—No sludge removal outside project boundaries.
5	Specification 01450—Excavation of additional sludge material in North Lagoon. Sludge found deeper in some areas that required removal.	5/21/03
6	Specification 02115—Placement of offsite and onsite biota barrier materials in two lifts. Three sources of material available of different size. Prepared in conjunction with DCN 2.	6/18/03
7	Specification 02111—Backfill of North Lagoon. Backfill of over-excavated areas identified in FCR #5 required to bring area to grade.	6/18/03
8.	Fence installation. Cannon AFB requested construction of a fence surrounding the area of the south lagoon soil cover.	9/24/03
9	Specification 02115—Use of Keel material for biota barrier. Need for additional source of material for biota barrier with Keel Section material proposed for use.	8/21/03
10	Specification 02377—Adjust specification for thickness of soil barrier layer by allowing a 2-inch variance. Prepared in conjunction with DCN 3.	9/22/03
11	Specifications 02140 and 02921—Delay of reseeding effort and in soil moisture testing to encourage optimum growth with reseeding to take place in Spring 2004.	9/26/03
12	Specification 02921—Revision to reseeding specification and erosion protection over winter based on reseeding delay until Spring 2004.	12/2/03
13	Specification 02921—Revision to reseeding specification for amount of seeding and seed mix. Specification revised based on actual conditions of the site.	4/3/04
Design Change Notices		
1	Eliminate the berm between the north and south lagoons. Associated with FCR #3. Berms between south and north lagoon required removal to allow for construction of soil cover in area of south lagoon.	5/21/03
2	Specification 02115—Biota barrier, offsite and SWMU material placement, including lifts. Multiple sources of material approved for use. Coarser crushed concrete to be placed in first lift with finer Keel Section material to be placed in second lift in order to fill in voids left within the first lift. Onsite material included crushed concrete and Keel Section material. Offsite material included crushed concrete. Associated with FCR #6.	6/18/03
3	Specification 02377—Change wording of Specification 02377, Part 3, Section 3.1.3 regarding the testing required for soil barrier material at optimum moisture content and revising test for 1-3% of optimum moisture rather than a minimum of 2% optimum moisture. Associated with FCR #10.	9/19/03

A summary of the design specifications and criteria with their applicable FCRs and DCNs are presented in Table 3-1. Appendix B provides a copy of the FCRs and DCNs for this project.

3.2.4 Manufacturers' Certifications

Mulch and seed certifications are presented in the project submittals in Appendix A.

3.2.5 Laboratory Testing

Geotechnical and analytical soil test results are presented in Appendix A as part of the submittals. Submittal 01450 covers laboratory testing for the borrow materials. Submittal 02111 covers testing for confirmation sampling.

3.2.6 Site Inspection and Quality Control Reporting

All three-phase inspections (preparatory, initial, and follow-up) were performed for each definable feature of work and are presented in Appendix D. Completion inspections for major tasks are also included in Appendix D. TtEC prepared Daily Quality Control Reports (DQCRs) during construction. Copies of the DQCRs are available at the USACE Resident Engineer's office at Cannon AFB, and electronic files are available within the USACE Resident Management System. TtEC retains copies of all DQCRs in the project file.

3.2.7 Nonconformance

There were no nonconformance reports filed in regard to this construction project.

3.2.8 Site Photographs

Representative site photographs, which were taken during the course of construction, are presented in Appendix C.

3.2.9 Certified Payroll

Copies of the certified payroll are available at the USACE office at Cannon AFB. TtEC retains copies of the certified payroll in the project file.

3.3 Regulatory Framework

Cannon AFB is conducting an Environmental Restoration Program (ERP) at the Base, which was initially managed under the U.S. Air Force Installation Restoration Program (IRP). The IRP was subsequently integrated with the EPA RCRA corrective action program. This site has been included under the Base's ERP as SWMU 101, the Sewage Lagoons. ERP activities are implemented at the Base in accordance with

the Comprehensive Environmental Response, Compensation and Liability Act of 1980 and response procedures consistent with the National Contingency Plan.

3.3.1 Permits

The following permits were completed for construction activities at SWMU 101:

- National Pollutant Discharge Elimination System Stormwater Construction Permit (NPDES)—The construction area at SWMU 101 was greater than 5 acres, thus requiring a Title 40 Code of Federal Regulations 122.26 NPDES permit for construction activity, including clearing, grading, and excavation activities. Construction activities were performed under the NPDES permit No. NMR10B863.
- SWPPP—TtEC prepared an SWPPP specifically for the construction activities at SWMU 101. The plan was followed during construction. The SWPPP is presented in the final Work Plan (Foster Wheeler Environmental 2003). The NPDES permit and Notice of Intent and Notice of Termination are presented in Appendix E.

3.4 Project Waste Descriptions

This section describes the waste streams that were generated during corrective action activities and how the waste was managed. The waste streams included:

- Tumbleweeds and brush
- Concrete debris (slope slabs, gate structures, etc.)
- Demolition debris (PVC and steel piping)
- Personal protective equipment (PPE)

These waste streams and their ultimate disposal or recycling are described in the following subsections.

3.4.1 Tumbleweeds and Brush

Both lagoons contained an abundance of dried tumbleweeds and brush that had accumulated over time. ACI placed these items in roll-off containers and disposed them as clean construction waste at a local municipal landfill.

3.4.2 Concrete Debris

ACI removed, demolished and sized approximately 2,000 cy of concrete rubble from the lagoon berm slopes in accordance with Specification 02220, (Appendix A). They recycled this concrete as fill and stabilization material in the South Lagoon Area. The concrete material taken from the berms was not used as biota barrier material.

3.4.3 Demolition Debris

Approximately 20 tons of PVC and steel piping was removed from the North Lagoon Area and recycled as fill material in the South Lagoon Area in accordance with Specification 02220 (Appendix A). Offsite recycling of the piping was not feasible because the piping could have potentially been contaminated with sludge.

3.4.4 Personal Protective Equipment

PPE, such as gloves, were disposed as nonhazardous solid waste in a local municipal landfill.

3.5 Reporting Spills and Releases

Precautions were taken to prevent oil and fuel spills, including daily inspections by site personnel of equipment, structures, and containers. One reported spill and release occurred during the construction activities: A subcontractor vehicle leaked hydraulic fluid outside SWMU 101 on the former runway, adjacent to and west of the site. The spill was reported according to Base procedures and the material was picked up and disposed of by a subcontractor. The spill was not a state-reportable incident. A copy of the waste manifest is provided in Appendix F.

3.6 Training/Certification Requirements

TtEC field personnel, ACI field personnel, and craft labor completed Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operator training and annual updates. No additional training or certifications were required for field employees or craft labor.

3.7 Updates to the Regulatory Compliance Plan

No changes or updates were made to the Regulatory Compliance Plan.

6. INSPECTION AND MAINTENANCE

TtEC performed monthly SWPPP inspections until revegetation was completed and the Notice of Termination from EPA (Appendix F) was approved. Copies of SWPPP inspections are retained in the project files. Periodic maintenance of the soil cover and monitoring will continue as described below.

6.1 Cover Maintenance and Monitoring

Periodic visual inspections of the installed cover are proposed as part of the routine operations and maintenance program for the soil cover system at SWMU 101 to ensure that the cover integrity is maintained. Inspections consist of a site walkover and should occur a minimum of once every 6 months for the first 5 years, and then annually. Typical repairs may include cleaning drainage channels, replanting vegetation, and replacing cover soil. Side slopes should be inspected for erosion damage and repaired or fortified as needed. Additional inspection of the site should be performed after significant rainfall events, and inspection results will be documented and managed by Cannon AFB personnel. Inspection observations should note any differential settlement, surface cracking, erosion, ponding, biointrusion, or other potential concerns that could affect the integrity of the landfill cover.

6.2 Institutional Controls

Perimeter fencing around the soil cover was installed to prevent intrusion to the site. Groundwater monitoring is currently being conducted at SWMU 101 and will continue in accordance with long-term groundwater monitoring program requirements.

There is no anticipated future land use for the site and it will be withdrawn from future consideration. Site access will be limited to long-term groundwater monitoring program sampling and soil cover maintenance activities.

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