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REMOVAL ACTION CONSTRUCTION WORK PLAN
EASTERN DRAINAGE AREA
NORTHEAST CHURCH ROCK MINE SITE

August 2012

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1.0 INTRODUCTION

1.1 PURPOSE

This Removal Action (RA) Construction Work Plan presents the design, methods, and construction approach for implementing the actions necessary to complete the Eastern Drainage Time Critical Removal Action (TCRA) for the Northeast Church Rock Mine Site (NECR), as per the Environmental Protection Agency's (EPA) Administrative Order on Consent (AOC), CERCLA Docket No. 2012-02, dated July 27, 2012 (EPA, 2012). The Eastern Drainage area is within the area referred to as "Step-out Area No. 2" in the Scope of Work (SOW) included in the AOC, which is located on the east side of Red Water Pond Rd. northeast of NECR, McKinley County, New Mexico, as shown on Drawing 1, *Cover and Index Sheet.* The RA area is bordered by the Eastern Drainage channel to the south, Red Water Pond Rd. to the west, and the unnamed arroyo no. 2 to the north and east, as shown in Drawing 2, *Existing Conditions*.

The SOW included in the AOC indicates that there are two primary components to the TCRA:

(1) "*Excavating and transporting soil contaminated with Ra-226 from the Eastern Drainage Area to the Mine Site for temporary storage*"; and

(2) "*Excavating and transporting and installing and operating an active bio-venting system to treat areas containing diesel fuel constituents commingled with Ra-226 on lands within the Navajo Reservation*."

A separate work plan is being prepared for the bio-venting system and details of that work are not included in this plan.

This Work Plan describes the specific tasks required to implement the RA, including a description of the technical approach, personnel requirements, plans, specifications, submittals, and deliverables. It also provides a schedule for conducting all activities associated with the RA with the goal of submitting to the EPA the EDRA Final Construction Report within 90 days of receipt of validated analytical results.

1.2 SITE BACKGROUND

1.2.1 Ra-226 Impacted Soils

The areas of concern for this RA were part of the Eastern Drainage SRSE (MWH, 2011), which found elevated Ra-226 concentrations present in soils east of Red Water Pond Rd., both in the Eastern Drainage channel between Red Water Pond Rd. and unnamed arroyo no. 2, as well as the flats area to the north of this section of the channel. Ra-226 concentrations were screened against the field screening level (FSL) for Ra-226 (2.24 pCi/g), which is based on an average background concentration of 1.0 pCi/g plus the Derived Concentration Guidance Level ($DCGL_W$) of 1.24 pCi/g (MWH, 2006a), in accordance with MARSSIM (EPA, 2000). The results of this investigation were documented in the *Supplemental Removal Site Evaluation Report, Eastern Drainage Area* (MWH, 2011) and are summarized on Drawing 3, *Results of Supplemental Removal Site Evaluations*.

The Eastern Drainage SRSE was initially limited to the Eastern Drainage channel itself. However, during the gamma radiation survey of the north bank of the channel, it was observed that the flats area north of the channel received runoff from the channel and appeared to be impacted as well. Therefore, the Eastern Drainage SRSE was extended to the north into the flats area bounded by Red

Water Pond Rd., unnamed arroyo no. 2 and the Eastern Drainage channel. The results of the SRSE confirmed that the flats area contained elevated levels of Ra-226 in shallow soils.

Impacted soil was also discovered along Red Water Pond Rd. and in a drainage feature from the road near the Quivira Mine, as presented in the *Red Water Pond Road Removal Site Evaluation Report* (MWH, 2010a). Based on the distribution of locations with elevated Ra-226 concentrations, some observed impacts, including along the northern portion of the road and in some areas of the flats, are attributable at least in part to the Quivira Mine, likely due to its past use of Red Water Pond Rd. as a haul road.

EPA surveyed surface soil surrounding the home site located within Step-out Area No. 2, as shown on Drawing 3. A continuous walk-over gamma radiation survey of the area was conducted and readings ranged up to 65,000 cpm. Soil samples were then collected on an approximately 80-ft triangular grid and submitted to a laboratory for analysis of Ra-226 by EPA Method 903.1. Results ranged from non-detect (<0.03 pCi/g) to 9.16 pCi/g (see Drawing 3), as summarized in Table 1, *Soil Analytical Results, EPA Eastern Drainage Home Site Survey*.

Table 1
Soil Analytical Results, EPA Eastern Drainage Homesite Survey

Location ID	Ra-226 (pCi/g)
HS01-01	0.600
HS01-02	0.792
HS01-03	<0.03
HS01-903	0.714
HS01-04	2.480
HS01-07	1.91
HS01-06	0.792
HS01-05	0.248
HS01-08	0.744
HS01-13	0.629
HS01-11	9.16
HS01-09	0.634
HS01-10	1.62
HS01-12	<0.04
HS01-912	4.680
HS01-14	3.560
HS01-14-6	0.801
HS01-14-18"	0.559
HS01-914	3.30
HS01-07-6"	1.32
HS01-07-18"	0.610
HS01-04-6"	1.16
HS01-04-18"	0.414

Notes:
1. Soil samples collected 5/16/12 and analyzed by GEL Laboratories for Ra-226 using EPA Method 903.1

The majority of soil impacts above the FSL 2.24 pCi/g Ra-226 were determined to be at or near the ground surface (0 to 6 inches below ground surface (bgs)), as shown on Drawing 3, *Results of Supplemental RSEs*. Some impacts were detected in the subsurface from 0.5 to less than 2 feet bgs in the Eastern Drainage flats area and to less than seven feet bgs within the Eastern Drainage channel. Vertical impacts were evaluated in the field using ex-situ soils samples screened with a shielded 3x3

NaI gamma radiation meter. Soil samples were collected below 6 inches wherever surface static gamma measurements indicted Ra-226 activities above the FSL. Subsurface soil samples were collected at multiple depths in some locations in order to fully delineate the vertical extent of impacts.

1.2.2 Petroleum-impacted Soils

Petroleum impacted soils were encountered beneath the NECR-1 pad and north of the NECR-1 pad in the southern portion of Step-out Area (MWH, 2010b). Approximately 4,000 cubic yards of impacted soils were removed in connection with the effort to remove visibly impacted soil, obtain the proposed 2.5V:1H slope on the face of NECR-1, and identify the limits of the impacts. Excavated materials were placed on the mine in the Stockpile Area east of Pond 3. Excavation of the petroleum impacted soils was discontinued during the 2009 IRA due to the depth and to avoid causing instability to the slope of the NECR-1 pile. Consequently, these areas were covered with approximately six inches of clean borrow soil. Additional investigation into the extent of petroleum impact and alternatives for remediation was conducted in 2009 and described in the report *Petroleum Investigation Results and Remediation Plan* (MWH, 2010c)

1.3 SCOPE OF WORK ANDREMOVAL ACTION OBJECTIVES

The objectives of the RA, as presented in the SOW, are as follows.

- Conduct any additional baseline gamma surveying necessary to assess current site conditions prior to soil removal and placement on the mine site.

- Excavate impacted soil from the Eastern Drainage area based on historical SRSE results, EPA's 2012 survey of the home site located in the area and any additional gamma measurements; place on the NECR-1 pad; and cover with six inches of clean soil.

- Conduct confirmation scanning, sampling and analysis.

- Continue excavations until confirmation scanning confirms that the impacted soil has been removed.

- Conduct interim status surveys, sampling, and analysis to confirm that soils have been sufficiently excavated in accordance with MARSSIM.

- Excavate soils containing commingled Ra-226 and diesel fuel from the area north of the NECR-1 pad, place on the NECR mine with the commingled soils currently stockpiled on the Site, and cover with six inches of clean soil or the existing synthetic cover.

- Restore the site to pre-removal conditions including backfilling excavations greater than one-foot deep as necessary, re-grading, amending surface soils, and reseeding with native species in excavation areas.

- Implement structural (e.g., erosion control blankets) and non-structural (e.g., inspection and monitoring plan) Best Management Practices for erosion and storm water control until the area achieves final stabilization.

- Provide site security to restrict access 24 hours/day to the Eastern Drainage RA Area during field operations, drive by vacated homes twice per day, and notify US EPA, as needed, of any irregularities or suspicious activity.

1.4 ENGINEERING DESIGN SUMMARY

This RA has been designed using applicable aspects of the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM, EPA, 2000), as well as other applicable guidance documents and regulations. Applicable guidance documents and regulations include the Clean Water Act, the National Pollution Discharge Elimination System, and the Manual on Uniform Traffic Safety Devices. The Revised Universal Soil Loss Equation was used to calculate erosion of cover material from the Soil Consolidation Area to be constructed on the NECR-1 pile. Engineering calculations for the design of storm water control elements that will be implemented during implementation and maintained pending implementation of the RA were conducted using Army Corps of Engineers HEC-HMS model simulating the 100 yr, 24 hr storm event based on a NOAA Atlas 14, type II storm.

1.5 PROJECT SCHEDULE

Assuming this RA Construction Work Plan is approved by EPA by July 22, 2012, construction work is anticipated to begin in late August or early September. The actual start date will depend on construction contractor selection; the contractor's detailed construction plan; and the availability of required resources. Based on the scope of work, it is anticipated that construction will require approximately 80 calendar days from construction mobilization through final inspection, which is anticipated to occur in November 2012 if construction mobilization occurs in late August or early September. A draft Final Construction Report will be submitted to EPA for review within 90 days of completion of construction and receipt of all validated analytical results.

2.0 DESIGN COMPONENTS

2.1 REGULATORY COMPLIANCE

The construction activities work will be conducted consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), substantive requirements of Section 404 of the Clean Water Act (CWA), substantive requirements of the National Pollutant Discharge Elimination System (NPDES) Storm Water Multi-Sector General Permit for Industrial Activities (MSGP) (73 Federal Register 56572, 2008), and substantive provisions of the National Historic Preservation Act. As provided by section 121(e) of CERCLA, permits will not be required for activities conducted entirely on-site. All activities included in this plan are "on-site" as that term is defined in CERCLA, its implementing regulations, USEPA and judicial interpretations, and USEPA guidance. As part of the MSGP requirements for areas on NECR, UNC maintains a Storm Water Pollution Prevention Plan (SWPPP, MWH, 2009), which incorporate the 2008 MSGP requirements. The 2008 MSGP is currently undergoing revisions to ensure compliance with the 2012 MSGP requirements. Erosion control measures will be implemented, inspected, and maintained during construction and until final stabilization is achieved, which will be documented as part of the annual vegetation inspections..

A Construction SWPPP has been prepared for construction activities in accordance with the 2012 Construction General Permit (CGP) requirements, as discussed in Section 3.4.1.

2.2 CULTURAL RESOURCES

Cultural resource inventories were conducted within Step-out Area No. 2 by Dinetahdoo Cultural Resources Management (Dinetahdoo) in March 2011 and July 2012. The approximate area within the Eastern Drainage area that was surveyed is shown on Drawing 3. The survey identified no significant cultural resources within the Removal Action area. However, two archaeological sites (NM-Q-21-100 and NM-Q-20-50), were identified to the south of the Removal Action area. On April 29, 2011 the Navajo Nation Historic Preservation Office issued a compliance form requiring that as a condition of compliance, "Site NM-Q-21-100 site boundary must be flagged by a qualified archaeologist prior to ground disturbing activities and all reclamation activities must avoid the site by at least 50 feet from the site boundary". The northern side of this site is less than 50 feet from the southern edge of the Eastern Drainage channel excavation area, and so construction will need to occur less than 50 feet from the site. The site will be well fenced and flagged, and construction activities will be managed so that no impacts occur to the site.

"Site NM-Q-20-50" was determined to be insignificant by Dinetahdoo, but the local resident requested that "Feature 3" be preserved. Therefore, Feature 3 of "Site NM-Q-20-50" will be flagged by a qualified archaeologist prior to ground disturbing activities and commencement of reclamation activities within the site boundary."

A supplemental survey will be conducted prior to the start of construction in order to confirm the location of cultural resources within the Removal Action area, including a small portion of the excavation area that was not included in the previous survey.

2.3 LIMITS OF EXCAVATION

2.3.1 Eastern Drainage Area

Soils within the Eastern Drainage Area that contain Ra-226 in excess of the RA Action Level (2.24 pCi/g) will be excavated during the RA consistent with MARSSIM, as described in Section 3.0. Based on the results of the Eastern Drainage SRSE (MWH, 2011), and as summarized on Drawing 3, the RA Action Level is expected to be reached within the following depths:

- Flats area: 0.5 to 2 ft
- Eastern Drainage channel: 3 to 7 ft

Within the flats area, the RA Action Level extends less than one ft bgs over most of the area, except for a small area in the southern portion between the Eastern Drainage channel and the head cut erosion gulley (see Drawings 2 and 3) where it extends up to 2 ft bgs. Within the Eastern Drainage channel, the RA Action level extends to approximately 7 feet bgs along a short section of the channel downstream of Red Water Pond Rd., and extends to 2 to 3 feet bgs along the remainder of the channel to unnamed arroyo no. 2. The anticipated limits of excavation are shown on Drawing 4, *Excavation Plan*.

Absent any practicability or safety issues, the soils within the Eastern Drainage channel will be excavated within the confines of the channel until the Action Level is reached, which is expected to occur between 2 and 7 ft bgs. The excavation will extend laterally out to the edges of the existing channel banks. Excavation will extend from the outlet at the east end of the drain pipe under the shoulder of Red Water Pond Rd. downstream to where the Eastern Drainage meets unnamed arroyo no. 2.

Ra-226 activity levels will be determined in the field using direct gamma radiation surveys correlated to Ra-226 activity levels based on site-specific conditions, as described in Section 3.5.

2.3.2 Area North of NECR-1

Soils containing Ra-226 above the Action Level and soils commingled with Ra-226 above the Action Level and TPH will be excavated, as shown on Drawing 4.2. Shallow soils (less than two ft bgs) within this area containing TPH will also be excavated. Ra-226 activity levels will be determined in the field using direct gamma radiation surveys correlated to measured Ra-226 activity levels based on site-specific conditions, as described in Section 3.5. The presence of TPH will be assessed using field observations (e.g., visual), as well as the use of a photo-ionization detector (PID) to screen the soils for organic compounds.

2.4 ENGINEERING DESIGN

2.4.1 Excavation

The areas to be excavated and the anticipated depths of excavation are shown on Drawings 4.1 and 4.2, *Excavation Plan*. The excavation areas and depths presented in these drawings were established using the radiological characterization information outlined in the Eastern Drainage *SRSE Report* (MWH, 2011). Based on the results of the background survey (MWH, 2006b), MWH established a Field Screening Level (FSL) of 2.24 pCi/g. Ra-226 is used as a marker for impacts from mine spoils and was shown in the Removal Site Evaluation (MWH, 2006a) to be the risk driver. This FSL was used with the results of the SRSE to estimate the Action Level boundaries within the Eastern Drainage area. MWH prepared quantity estimates for materials to be removed and placed in the Soil

Consolidation Area based on the Action Level. The estimated volume of soils exceeding the Action Level is approximately 30,000 cubic yards and is subdivided as follows (see Drawing 4.1):

- 1,200 to 2,000 cy in the Eastern Drainage
- 27,000 to 28,000 cy in the flats area

It is estimated that approximately 1,000 cy of soil will need to be excavated from the area north of NECR-1 (see Drawing 4.2)

There is a degree of uncertainty in these numbers due to the variability of depths to the Action Level across the site, and therefore actual excavation volumes may be different than these values.

The impacted soils will be excavated from the Eastern Drainage area and transported to the NECR-1 Soil Consolidation Area for spreading and compaction (see Section 2.4.3). Soils excavated from the Area North of the NECR-1 pad containing TPH will be transported to and placed on the existing Commingled TPH and Ra-226 Stockpile (see Section 2.4.4).

The excavated areas will be regraded and areas excavated greater than 1 foot will be backfilled, as necessary, to return the ground surface to approximately the original topographic configuration. All RA areas will then be revegetated, as described in Section 3.1. Erosion and sedimentation controls to address potential transport of impacted soils onto the reservation and to maintain stability of the excavated areas will be in place during and after construction (see Section 3.4).

2.4.2 Surface Water Hydrology and Site Drainage

The overall Site drainage concept includes design components to minimize run-on from the Eastern Drainage channel out onto the flats area north of the drainage, and to direct surface water across the Eastern Drainage area to the east into unnamed arroyo no. 2. Following excavation of impacted soils and sediments from the Eastern Drainage channel, the channel will be constructed to the specified geometry and lined with filter and riprap material. The hydrologic analyses performed to design the Eastern Drainage channel are included in Appendix B, *Hydrology and Hydraulic Calculations* and summarized below.

The 100-year, 24-hour storm event was used as the design storm event to size the Eastern Drainage channel. The NOAA Atlas 14, Type II precipitation distribution was selected for rainfall-runoff analysis to appropriately size the channel for the magnitude of storms expected for this geographic region. The design flows were estimated using the HEC-HMS program (U.S. Army Corps of Engineers, 2010), using basin parameters and soil moisture conditions consistent with an extreme storm event (the design storm event).

Four drainage sub-basins exist at the Site:

- the Trailer Park area near the mine site
- the area between Red Water Pond Rd. and Highway 566
- the area that extends into the hills above the Eastern Drainage
- a portion of the area around the Home Sites west of Red Water Pond Rd. (the southeastern portion that does not drain into unnamed arroyo no. 1).

Additional information on the sub-basins is provided in Appendix B.

The highest peak discharge of the design event was used to evaluate the erosional stability and size of the Eastern Drainage channel. Peak discharge in the Eastern Drainage channel was determined to be

65.2 cubic feet per second (cfs). Peak discharge within the channel where it crosses under Red Water Pond Rd., through a culvert here referred to as the south culvert (see Drawing 2) was determined to be 53.7 cfs. Peak discharge in the small channel that crosses under Red Water Pond Rd. through the north culvert (see Drawing 2) was determined to be 19.6 cfs.

Using this peak flow values stated above, the minimum required dimensions of the Eastern Drainage channel was established. The Eastern Drainage channel will be trapezoidal with side slopes of 2H:1V, a depth of 2 feet, and a bottom width of 5 feet. The channel will be lined with riprap (with a D_{50} of 6 inches) to ensure erosional stability. The detail for the typical Eastern Drainage channel is presented on Drawing 8, *Drainage Excavation Plan Detail.*

Erosion and sedimentation controls to prevent transport of impacted soils into the arroyo will be in place during and after construction, as discussed in Section 3.4.

2.4.3 Soil Consolidation Area

The Soil Consolidation Area will be located on the south side of the existing NECR-1 pile, as shown on Drawing 7, *Soil Consolidation Area Grading Plan and Profile*. Soils excavated during the RA will be placed at the Soil Consolidation Area. The top surface of the pile will be regraded and tied into the existing pile and then covered with clean soil and revegetated. The side-slopes of the Soil Consolidation Area will be regraded to no steeper than 3:1 (horizontal to vertical) for erosional and slope stability considerations. The top surface of the pile will be minimally graded (approximately 7.5%) to slope downward toward the existing channel and convey surface water drainage into the channel.

The top surface of the Soil Consolidation Area will be covered with six inches of clean soil. Once the soil has been placed on the Soil Consolidation Area, sterilized manure will be applied and the entire area will be revegetated, as described in Section 2.6. Additional erosion and sedimentation controls to address potential transport of impacted soils will be utilized during and after construction, as needed (see Section 2.1).

2.4.4 Commingled TPH and Ra-226 Soil Stockpile

The Commingled TPH and Ra-226 Soil Stockpile is located south of the NECR-1 pile, as shown on Drawing 7. TPH-impacted soils excavated during the RA will be placed on the stockpile. The top surface of the pile will be regraded, as needed, to match the configuration of the existing pile and direct runoff to Pond 3. The top surface will be covered with 6-inches of soil or the existing synthetic cover (plastic sheeting) and augmented as needed. Erosion and sedimentation controls to address potential transport of impacted soils will be utilized during and after construction, as needed (see Section 2.1).

2.4.5 Backfilling Excavations

The excavation created from removing impacted soils from the Eastern Drainage will be backfilled, as necessary, where it was excavated greater than one foot, to the specified elevation to ensure positive drainage to unnamed arroyo no. 2, as discussed in Section 3.7. It is estimated, based on the expected depths of excavation that up to 1,600 cubic yards of backfill soil will be required to backfill the channel. Additionally, some borrow material may be used to backfill isolated areas excavated greater than 1 foot deep within the Eastern Drainage area to ensure positive drainage. All backfilled areas will be regarded to ensure positive drainage and no ponding of water.

2.5 BORROW SOURCES

The borrow material that will be used over the Soil Consolidation Area and to backfill excavations, including the Eastern Drainage Channel, will come from one of three sources: 2009 IRA borrow pit and Borrow Areas 1 and 2 at the Church Rock Mill Site. The preferred source will be the 2009 IRA borrow pit, which will be surveyed prior to the start of construction to determine available volume.

The 2009 IRA borrow source was sampled and analyzed in 2009 for Ra-226; the results of which showed the material to be acceptable, as shown in Appendix C *Borrow Area Information*. The two borrow sources at the Mill Site (Borrow Areas 1 and 2) will only be used if insufficient volume of soil; is present in the 2009 IRA borrow pit. A description of Borrow Areas 1 and 2 is included in Appendix C. Samples of the soils from Borrow Areas 1 and 2 were collected and tested for geotechnical properties and were classified as clay loam (Borrow Area 1) and sandy clay loam (Borrow Area 2), as presented in Appendix C. Soil samples will be collected from one or both of these borrow sources prior to construction for analysis of Ra-226 by EPA Method 901.1 in 2012. One 8-point composite sample homogenized into one sample for analysis by the laboratory will be collected from each borrow area. Additionally, a gamma scan will be conducted over each are to check for elevated readings.

2.6 REVEGETATION AND SOIL LOSS

The RA excavation areas, Area North of NECR-1 and the Soil Consolidation Area, not including the Eastern Drainage channel, will be revegetated following construction, in accordance with the *NECR Revegetation and Monitoring Plan* prepared by Cedar Creek Associates, which will be prepared based on the results of the baseline vegetation survey described in Section 3.11). Revegetation will provide erosional stability at the Site, and will restrict the transport of sediments. Revegetation is designed to provide long-term stability and sustainability; however impacts to the revegetated areas may occur during subsequent removal action(s), similar to the situation in the Area North of NECR-1, which was revegetated following the 2009 IRA and will need to be revegetated again following the EDRA. All areas that have undergone (interim) removal actions will be inspected during the Final Removal Action for the mine site, and further revegetated if needed.

Plant species for the RA area will consist of native perennial grasses and forbs. Specific species, composition percentages, and seeding rates will be provided in the *Revegetation and Monitoring Plan*. Use of these species after completion of the RA will provide a permanent and sustainable plant cover because the species exhibit a highly adapted nature to the existing Site, a high tolerance to environmental stresses including drought and grazing, and an ability to effectively reproduce over time. The species that will be selected can coexist and utilize plant resources to restrict invasive weeds and deep-rooted species from colonizing the Site. Once established, the vegetated surfaces can successfully compete with undesired species, including trees and shrubs, and provide enough coverage for proper grazing intensity.

Calculations of the estimated soil loss from the Soil Consolidation Area and side slopes due to erosion are included in Appendix D, *Soil Loss Calculations*. Soil loss was estimated using the Revised Universal Soil Loss Equation 2 (RUSLE2) version 1.26.6.4 (Foster and Yoder, 2006). RUSLE2 software is the primary tool used in erosion modeling by federal agencies (e.g., Office of Surface Mines and U.S. Forest Service) to assess soil loss for mine reclamation applications. Based on RUSLE2 modeling, 6 inches of cover material will be sufficient to prevent exposure of underlying material due to sheet erosion.

2.7 SITE ACCESS

Access to the RA site is via a locked gate north of the home site on Red Water Pond Rd. Red Water Pond Rd. is located along Highway 566, east of the NECR mine site. An additional temporary entrance may be added during construction, near the Eastern Drainage channel. Primary access to the NECR mine site is a dirt road that extends from the end of Highway 566 and crosses the mine site. This dirt road accesses the NECR-1 pile and, therefore, the soil consolidation area. See also section 3.1.

3.0 CONSTRUCTION APPROACH

3.1 CONSTRUCTION QUALITY ASSURANCE PLAN

Construction of the Eastern Drainage RA will be executed following standard construction quality assurance (CQA), as described in Appendix E, *Construction Quality Assurance Plan (CQAP)*. The CQAP explains the CQA procedures and requirements to be used during reclamation activities at the site in order to assure that the project is constructed in conformance with the specifications of this Construction Work Plan and applicable regulatory requirements. The CQAP defines:

1) the individuals and parties who will be involved in reclamation activities and their respective roles, responsibilities and qualifications;

2) guidelines for the flow of information and project communication;

3) procedures for inspection activities; and

4) protocols for project documentation.

A site-specific Quality Assurance Project Plan (QAPP) for chemical analysis of soil samples to ensure that the data are of sufficient quality to support the project Data Quality Objectives (DQOs) was included in the *Removal Site Evaluation Work Plan* (MWH, 2006a). The RSE work plan also included SOPs for the various field activities associated with the site evaluations, including sampling and analysis associated with the MARSSIM status surveys. The RSE QAPP and SOPs are applicable to the Eastern Drainage RA; no changes to those methods and procedures have been made. Additional methods and procedures are being used for the Eastern Drainage RA, such as excavation control surveying in deeper excavations; these methods and procedures are described in the CQAP.

3.2 SITE ACCESS CONTROL, SECURITY AND TRAFFIC CONTROL

Public access to the Site will be limited during the RA construction and public access to the exclusion zone will be prohibited. Temporary signage prohibiting access will be posted prior to construction at the Site. An access point at the entrance to the Site will be set up prior to construction, and site access will be monitored during the RA. Any visitors to the Site will need to be authorized, logged into a visitor's log, and any visitors accessing the exclusion area will need to be trained in site-specific radiation hazards and construction safety precautions. Visitors to the site will also be required to wear the appropriate personal protection equipment (PPE), as dictated by the construction oversight *Health and Safety Plan* (MWH, 2012). The entire site is contained by a fence that will be maintained during the RA.

UNC/GE will retain security personnel that will provide site security to restrict access 24 hours/day to the RA area during field operations and will drive by vacated homes twice per day. Security will notify UNC/GE (who will notify US EPA) of any irregularities or suspicious activity.

During work within 10 feet of the road, traffic flow along Red Water Pond Rd. will be restricted to one lane. Traffic control procedures that will be used during the RA are provided in Appendix F, *Traffic Control Plan.*

3.3 HEALTH AND SAFETY

3.3.1 Construction Oversight Health and Safety Plan

A site-specific construction oversight Health and Safety Plan (HASP) was prepared for MWH's oversight, monitoring and sampling activities associated with the Eastern Drainage RA (MWH, 2012). The construction contractor will be required to follow its own health and safety program for its workers and subcontractors that at a minimum follow the requirements described in the construction oversight HASP. The HASP was developed in accordance with relevant occupational safety and health regulations and requirements, and applies to all field sites and workplaces established during the RA site activities at NECR. The construction oversight HASP includes a radiation protection plan (RPP) that will be followed by MWH and their subcontractors; the construction contractor will be responsible for their own RPP.

The purpose of the HASP is to provide information to MWH personnel and all subcontractors working on site so that they can complete the project objectives in a safe and healthful manner. The information provided in the HASP includes the following:

- health and safety requirements, including training
- standard operating procedures
- required meetings
- site specific hazards and their control
- personal protective equipment (PPE)
- personnel and equipment decontamination
- medical surveillance
- emergency contact information

The evaluation of hazards, levels of protection, and procedures specified in the HASP are based on the best information available during the writing of the plan. It is recognized that every hazard may not be contained in the HASP and that site conditions change. Therefore, it is part of every employee's job to continuously assess site conditions in relation to his/her own knowledge of how to do a task safely. The HASP must be modified if new hazards are identified, the scope of work is revised, or the provisions specified in the HASP are not adequate to protect the health and safety of all personnel. All HASP modifications must be approved by the MWH Project Manager or his/her designee, and be documented on the form included at the beginning of the HASP (HASP Change Summary Page).

Prior to mobilization to the Site, the Contractor will designate the boundaries of the RA construction areas, access to which will be restricted. No smoking, eating or drinking will be allowed within the RA construction area. The Contractor will also designate a Contamination Reduction Areas prior to mobilization. Any vehicles or personnel that exit the Restricted Areas must enter the Contamination Reduction Areas and will be scanned out to verify that no radiological contamination exists on the vehicle or personal clothing. A portable alpha radiation detector and/or a beta/gamma detector will be used for personnel and vehicle contamination monitoring. Field personnel will remove any contaminated disposable PPE, such as gloves, boot covers, and coveralls. Disposable PPE will be placed in a designated radioactive waste container for appropriate disposal. Non-disposable PPE or outer layers of work clothing will be removed prior to entry into the Contamination Reduction Area for use at a later time. The specific limits for radiological contamination are presented in the *Construction Oversight Health and Safety Plan*.

The specific method of decontamination will be based on the type and extent of contamination of the equipment or material. Vehicle decontamination will be achieved by wet methods, such as high

pressure washing, steam cleaning, or wet scrubbing of elevated areas. Personal clothing decontamination will be achieved by dry brushing or wet methods. All decontaminated equipment or material will be allowed to dry prior to the surface contamination survey. Equipment or material will be released from the Contamination Reduction Area only after it has been surveyed for contamination.

3.3.2 Dust Control and Air Monitoring

Measures will be taken by the construction contractor throughout the RA to control dust. The construction contractor is required to implement a dust control plan during construction, as summarized in Appendix G, *Dust Control Plan*. Prior to any earthwork activities at the Site, including borrow area(s), the Contractor will be required to implement a dust control program that identifies methods and equipment to minimize and control dust generation during all earthwork operations and including some or all of the measures included in the Dust Control Plan. Some control measures that may be used by the Contractor as needed to control dust during construction include:

- Applying water to areas to be excavated
- Spraying water during excavation and material handling operations
- Modifying or stopping work during windy conditions (presence of visible dust)
- Controlling locations of work stations relative to wind direction
- Conducting any intrusive work during low wind conditions (normally in the morning)

Additionally, all trucks will be covered with tarps or other means during travel, if possible, as discussed in Appendix G. If trucks cannot be covered, a minimum freeboard of one foot will be maintained above the loaded soil. Any truck that does not have adequate means to be covered will be required to limit travel speeds to no more than 10 mph.

The Contractor will be required to have a dedicated water truck on-site to spray haul roads, excavation areas, and borrow pits. Because of the contaminated soils and the potential for dry and windy conditions, the work areas may need to be wetted regularly for dust control.

In order to ensure a high level of protection of the public, MWH will perform perimeter air monitoring along the boundaries of the RA construction areas. Both internal and external radiation exposures will be monitored. Based on the SRSE results and the results of perimeter air monitoring that was conducted during the 2009 RA (MWH, 2010), exposures are expected to be less than 10% of the allowable limit for both external and internal exposures with adequate dust control during the RA. The methods that will be used to monitor internal and external radiation exposure are described in Appendix H, *Perimeter Air Monitoring Plan*. The Contractor will be responsible for dust control and air monitoring within the construction zones, in compliance with the exposure limits listed in Appendix H.

3.4 CLEARING AND GRUBBING

Within material removal areas, some vegetation will have to be cleared and grubbed, the extent of which will be determined in the field based on the depth of soil impacts. Grubbing of excavation areas will not be conducted until erosion and sedimentation controls have been installed. Grasses and small woody vegetation with diameters less than one inch may be mixed with excavated soils and stockpiled with excavated material on the Soil Consolidation Area. Material larger than 1-inch diameter will be stockpiled on the top surface of the mine site.

3.5 SOIL EROSION AND SEDIMENTATION CONTROL

3.5.1 Summary of E&S Controls

Water management and sediment collection methods will be implemented during and after the RA construction in order to isolate and control water at the source and minimize sediment transport offsite during construction activities. Surface water will be controlled to limit flow velocities and route runoff away from regraded and revegetated slopes.

A Construction Storm Water Pollution Prevention Plan (SWPPP) has been prepared for the site and is included in Appendix I, *Construction Storm Water Pollution Prevention Plan*. The Construction SWPPP was prepared based on anticipated construction sequencing and methods. Prior to any earthwork activities at the Site, including borrow area(s), it will be the responsibility of the Contractor to implement a Construction SWPPP program, based on their own planned construction sequencing and methods. Anticipated erosion and sediment control measures are shown on Drawing 5, *Erosion Control Plan* and erosion control details are shown on Drawing 6, *Erosion Control Details*.

3.5.2 Flats Step-out Area

Prior to excavation and grading work, silt fencing or other appropriate BMPs will be installed along sections of the flats area perimeter in order to prevent sediment migration into areas outside the project area. The approximate locations of the E&S controls are shown on Drawing 5.

3.5.3 Eastern Drainage Channel

Excavation of the Eastern Drainage Channel will be phased from upgradient to downgradient to minimize recontamination of remediated areas by sediment transport. Crest control measures will be implemented along the Eastern Drainage where construction activities are occurring in order to minimize run-on during storm events. The construction contractor may implement additional controls to protect the excavation. Sediment ponds, hay bales and other control measures will be implemented upstream from construction activities in an effort to mitigate sediment transport into work areas during excavation.

3.5.4 Secondary Drainage

Excavation of the secondary drainage (Zone 4, as shown on Drawing 4) will be phased from upgradient to downgradient to minimize recontamination of remediated areas by sediment transport. The construction contractor may implement additional controls to protect the excavation. Sediment ponds, hay bales and other control measures will be implemented upstream from construction activities in an effort to mitigate sediment transport into work areas during excavation.

3.5.5 Soil Consolidation Area

The Soil Consolidation Area will be constructed on top of the NECR-1 pile, which was regraded and protected from erosion and sedimentation during the 2009 IRA (MWH, 2010b). Runoff from the top surface of the NECR pile flows to the central channel which discharges into Pond 3, as shown on Drawing 7, *Soil Consolidation Area Grading Plan and Profile*. Runoff that enters Pond 3 is contained onsite. Additionally, E&S controls such as silt fencing will be added to the Soil Consolidation Area, as needed.

3.5.6 Commingled TPH and Ra-226 Soil Stockpile

The existing Commingled TPH and Ra-226 Soil Stockpile will be used to temporarily store TPH-impacted soil excavated during the RA (see Drawing 7). The stockpile was graded and protected from erosion and sedimentation during the 2009 IRA (MWH, 2010). Runoff from the stockpile flows into Pond 3, as shown on Drawing 7. Runoff that enters Pond 3 is contained onsite.

3.5.7 Inspections and Good Housekeeping: Best Management Practices

To maintain compliance with 2012 Construction General Permit requirements, site personnel will conduct monthly inspections of all BMPs during construction (see Appendix I). In addition, inspections will be conducted following any significant storm events that occur. If required, the Construction SWPPP may be modified to include additional or modified BMPs. Housekeeping BMPs will be implemented to address material handling, waste management, material storage, vehicle and equipment maintenance, fueling and washing, and spill prevention. Additional housekeeping BMPs will be implemented as required by the work.

3.6 EXCAVATION CONTROL SURVEYING

Radiological surveys will be conducted during soil removal for the RA in a manner consistent with MARSSIM guidance (EPA, 2000). The radiological surveys will consist of excavation control surveys during construction, followed by interim and final status surveys. This section summarizes the excavation control surveying; the Interim Status Survey is summarized in Section 4.1.

A detailed plan for conducting excavation control surveying is included in Appendix E. The objective of the excavation control survey will be to support and guide soil excavation and removal of impacted soils to confirm that soils have been sufficiently excavated in accordance with MARSSIM, and to provide initial radiological data for the status surveys.

The excavation control survey is designed for expediency so as to guide the excavation activities in real-time. In order to provide real-time excavation guidance, the excavation control survey will consist of direct gamma radiation level measurements in the field, as described in Section 5.4 of MARSSIM (EPA, 2000) for remedial action support surveys. The excavation control surveying will be conducted within the shallow areas (i.e., not within the Eastern Drainage channel or any excavations deeper than approximately two feet) using a 2x2-inch Sodium Iodide NaI gamma scintillation detector (see Appendix E).

The gamma radiation level in counts per minute (cpm) that is equivalent to the RA Action Level will be based on the site-specific correlation that was developed during the Supplemental RSE and is presented in the Eastern Drainage SRSE report (MWH, 2011), as discussed in Appendix E. The interim removal activities will result in changes from the pre-removal distribution of Ra-226 in soil, which could change the site-specific correlation between direct gamma radiation levels and Ra-226 concentrations in soil. The correlation will be updated as necessary as described in Appendix E during the construction activities and revised for the Interim Status Survey.

An ex-situ gamma radiation survey will not be used for excavation control in the Eastern Drainage channel or any deeper excavations due to radiation shine interferences from the channel banks. Instead, ex-situ field soil screening will be performed for excavation control. Once the excavation of impacted channel bed sediments is completed to the depths estimated from the SRSE results (MWH, 2011), a soil sample will be collected from the base of the excavation and screened in the field using a 3x3 NaI detector fitted with a 1.5 inch lead collimator, as described in Appendix E. Subsurface soil samples will be collected for screening continuously during excavation, as needed, based on the

results of the Supplemental RSE, field observations (e.g., soil color and texture) and the requirements of the excavator.

Excavation of the channel bed, collection of soil samples, and ex-situ screening of soil will continue at each location to confirm that soils have been sufficiently excavated in accordance with MARSSIM. Once this is complete for the length of the channel within the RA Action Level boundary, confirmation soil samples will be collected every 50 feet along the channel bed and submitted to the laboratory for Ra-226 analysis, as described in Appendix E. The results of the laboratory analyses will be used for confirmation that the MARSSIM release criterion has been met. The results of the ex-situ field screening measurements and the laboratory analyses will constitute the Final Status Survey for the Eastern Drainage channel or any deeper excavations, as discussed in Section 4.1.

The limits of excavation of soils from the Area North of NECR-1 will be determined in the field based on gamma surveying, as discussed above, for the areas containing commingled TPH and Ra-226. For shallow soils (less than two feet bgs) containing only TPH, the excavation limits will be determined by visual observation (e.g., dark staining) and the use of a PID. No sampling and analysis for TPH will be conducted. TPH-impacted shallow soil that is shown by excavation control surveying to not contain Ra-226 above the Action Level, and is excavated as part of this RA, will be segregated from the TPH/Ra-226 commingled soils (i.e., placed in a distinct or separate part of the stockpile). Depending on the size of the pile, it will be covered with six-inches of borrow soil or a plastic cover.

3.7 EXCAVATION AND BACKFILLING OF THE FLATS AREA

Prior to any excavation, a utility location service will mark the location of utilities in the work areas. Approximately 18 acres within the flats area and the area north of the NECR-1 pile (zone 6) have been identified as requiring removal of contaminated soils. The areas have been broken into six zones, as shown on Drawing 4. Estimated excavation volumes are shown in Table 2. The excavation depth for these volume estimates is conservatively estimated as one foot, with a small section (Zone 5) estimated at two feet. The excavation depth for the Eastern Drainage channel (zone 1) is estimated to be between three and seven feet. It is anticipated that zones 1 through 5 will be excavated first, followed by 6; however this will depend on the construction contractor's plan.

TABLE 2
NECR-1 STEP-OUT AREA
EXCAVATION VOLUMES BY PARCEL

Parcel	Area (acres)	Volume (cy)
Zone 1	0.45	1,200
Zone 2	11.7	18,900
Zone 3	1.6	2,600
Zone 4	0.8	1,300
Zone 5	1.5	5,000
Zone 6	0.5	800

Material in the designated removal areas will be excavated in accordance with the CQAP included in Appendix E. Following removal of each lift, quality control personnel will perform a gamma scan of the area to determine if additional material needs to be removed.

Excavated material will be transported either to the Soil Consolidation Area or the Commingled TPH and Ra-226 Soil Stockpile, as shown on Drawing 7. The construction contractor will be responsible for transporting materials to ensure that areas that have been cleaned are not re-contaminated by transport operations. Additionally, as discussed in Section 3.4, the contractor will

be required to implement E&S control measures to ensure that cleaned areas are not re-contaminated by storm water or wind erosion.

Within the construction areas, separation will exist between excavated areas that have been determined to be "clean" and those that have not yet been designated as "clean." Areas designated as clean will increase in size throughout the RA construction. The Contractor will be required to sequence work to control cross-contamination of previously cleaned areas. Methods of separation of areas can include BMPs to eliminate run-on to areas that have been designated as "clean", traffic planning such that vehicles hauling contaminated mine waste do not drive across "clean" areas, and dust suppression methods described below to minimize airborne particulates

Excavation areas will be graded to provide positive drainage. Any areas of excavation greater than one foot deep that cannot be graded to drain will be backfilled with clean well-graded soil with a texture similar to the surrounding soils.

3.8 EXCAVATION AND RESTORATION OF THE DRAINAGES

Channel bottom soils will be excavated from the bottom of the Eastern Drainage channel to a depth of approximately 2 to 7 feet. Drawing 8 shows the estimated depth of excavation along the Eastern Drainage channel. The channel bottom will be determined by the engineer prior to excavation. Actual depth of excavation will be determined by QCA personnel as described in Appendix E. Side slopes of the channel will not be disturbed unless required to remove impacted soils, for safety, equipment access, or stability of the channel bottom excavation. When side slopes are disturbed, they will be restored to no steeper than 2H:1V. Material removed from the slope, and determined based on gamma measurements to contain Ra-226 below the RA Action Level, will be used to backfill the excavated channel. The estimated volume to be removed from the Eastern Drainage is approximately 1,200 cubic yards.

Following excavation of soils from the bottom of the Eastern Drainage channel, the channel will be backfilled with fill material taken from a borrow source (see Section 2.5) to within 1.5 feet of the original channel bottom. Fill material will be a clean, well-graded soil approved by the Project Engineer. The backfill will be placed in lifts and compacted using following the same methods used during the 2009 IRA (MWH, 2010), which underwent a compaction method specification test, the results of which indicated that it is sufficient for use during the Eastern Drainage RA (MWH, 2010). The Eastern Drainage channel excavation will be backfilled and compacted in place using a John Deere 850 bulldozer or equivalent using the following criteria (see Appendix E):

- lift thickness not greater than 12 inches;
- four passes with a water truck, or as necessary for a moisture content approximately between 8 and 14 percent; and
- four passes of the tracks (two forward and two backward) over all areas of the backfill.

If the bulldozer is too large to effectively work in the channel excavation, then the use of a smaller compactor or equivalent will be considered (e.g., a walk-behind compactor, small vibratory roller, or compacting excavator attachment).

Riprap will then be placed to bring the channel bottom back to original, pre-excavation grade. Riprap will be placed to form a trapezoidal channel 2 feet deep with side slopes no steeper than 2H:1V. Riprap will have a median grain size, D_{50}, of 6 inches and meet the gradation shown in Table 3 and material requirements in Table 4. A layer of bedding material meeting the gradation shown in Table 5 will underlie riprap. Drawing 8 shows a typical section through the reconstructed channel. The bottom width of the channel will vary depending on the original, pre-excavation, bottom width.

TABLE 3 RIPRAP GRADATION TABLE	
Rock Size	**Percent Finer**
1.5 * D_{50}	75 - 100
D_{50}	30 - 70
0.5* D_{50}	0 - 25

TABLE 4 RIPRAP MATERIAL PROPERTIES REQUIREMENTS		
Test	**Requirement**	**ASTM Designation**
Specific Gravity	greater than 2.5	C 127
L.A. Abrasion Test	less than 30%	C 535
Sodium Sulfate Soundness	less than 10%	D 5240

TABLE 5 BEDDING MATERIAL GRADATION TABLE	
U.S. Standard Sieve Size	Percent Finer
3”	100
1.5”	95 – 100
1”	60 – 100
# 4	15 – 55
# 10	0 – 15

Riprap will be obtained from an approved source, such as the General Rock Products quarry located in Thoreau, NM that was used during the 2009 IRA. Representative riprap samples were collected from this riprap source during the 2009 IRA and surveyed with a gamma meter (Ludlum 221); the results showed the material to have low activity (≤1,700 cpm), as shown in Appendix C.

A topographic survey will be performed of the Eastern Drainage area following restoration to document final conditions.

3.9 SOIL CONSOLIDATION AREA

The Soil Consolidation Area will be constructed on top of the NECR-1 pile where the 2009 RA soils were placed to provide a stockpile area for materials excavated during the RA. The Soil Consolidation Area will be graded as shown on Drawing 7. The side slopes will be graded to a slope of no steeper than 3H:1V. The top surface will be graded to flow to the existing channel along the axis of the NECR-1 pad (see Drawing 7). Due to uncertainty in the actual volume of soil that will be excavated during the RA, the included drawing sheet is intended only as a guide. The top surface will slope to the central channel at a grade of approximately 7.5 percent. Final elevations and grades of the top surface will be established in the field based on the quantity of material produced.

Following the consolidation of stockpiled material and grading of the Soil Consolidation Area, the area will be covered with six inches of clean soil. Approximately 4,000 cubic yards of soil will be required for the cover.

A topographic survey of the NECR-1 pile will be performed following placement of cover, to document final conditions.

3.10 COMMINGLED TPH AND RA-226 SOIL STOCKPIILE

As noted in Section 1.3, the soils containing commingled Ra-226 and diesel soil form the Area North of NECR-1 will be placed on the existing Commingled TPH and Ra-226 Soil Stockpile shown on Drawing 7. The material will be placed on the stockpile so as to maintain the existing pile configuration and ensure positive drainage towards Pond 3. The stockpiled soil will be covered with the existing synthetic cover. If the existing synthetic cover is unusable or not large enough, additional cover will be added.

3.11 CHANNEL CONSTRUCTION

The Eastern Drainage channel will be constructed and re-graded within the limits of the existing channel, as shown on Drawing 8. Re-grading will minimize run-on from the Eastern Drainage channel out onto the flats area north of the drainage, as well as direct the flow east, into the unnamed arroyo no. 2. The trapezoidal-shaped channel will be constructed after completion of excavating contaminated soils and backfilling the channel with clean soil. A filter/bedding gravel material will be used between the native subgrade and the riprap, which will be placed for erosion protection. The filter gravel will be imported from offsite and should be tracked into place, 6-inches thick, prior to spreading of the 12-inch riprap channel lining. Prior to utilizing the filter rock material, the material will be scanned with a gamma meter to evaluate whether it is adequate for use in the RA (e.g., does not exhibit elevated gamma levels compared to the typical background value for the area).

3.12 CULTURAL RESOURCE SITE PROTECTION

Two cultural resource sites, both of which are outside the Removal Action area, will be protected during construction, as discussed in Section 2.2. Site NM-Q-21-100 will be fenced off including a five foot buffer and not disturbed during construction. Feature 3 of site NM-Q-20-50 will be protected during construction, as per the family's request, by establishment of a five-foot buffer with construction fencing. Both archaeological sites will be avoided during construction.

Prior to the start of construction, an approved archaeologist will be present to ensure that both sites (NM-Q-21-100 and NM-Q-20-50) are identified and adequately marked, fenced off and protected. The archeologist may also be present while excavation is occurring near site NM-Q-21-100 to help ensure its protection.

3.13 REVEGETATION

Areas impacted by the RA activities will be revegetated, including the excavation areas, the Soil Consolidation Area, and the borrow area. The approximate areas to be revegetated within the Eastern Drainage excavation areas are shown on Drawing 9, *Revegetation Plan*. Revegetation is intended to reduce impacts to surface water by establishing a self-sustaining plant community that provides erosional stability. Prior to seeding, sterile organic mulch (sterile cow manure) will be applied to removal areas of the RA requiring seeding to increase organic content and improve agronomic properties of the soils. The mulch will be applied at a rate of approximately 4 tons/acre by spreading uniformly across the area immediately prior to discing and seeding. Revegetation will take place between September and December, if possible. Regraded areas will be seeded with a mixture containing native grasses and forbs that will not depend on external inputs of water or fertilizer. Specific species, composition percentages and seeding rates will be determined by a baseline vegetation survey and also will be selected to provide erosional stability.

A baseline vegetation survey will be conducted prior to the start of construction, as described in detail in Appendix J, *Vegetation Baseline Sampling Plan*. The purpose of the survey will be to inventory the species, size and distribution of any native woody plants, including but not limited to trees. An inventory of any trees that are removed will be maintained; although to the extent practical, trees will be left in place and not disturbed during the RA. This information will be used to determine the final seed mix for the RA and develop a vegetation restoration plan that will be implemented as part of the final action. The results of the baseline vegetation survey and any proposed changes to the final seed mix for the RA will be submitted for EPA review and approval a minimum of two-weeks prior to seeding.

Table 6 presents an estimate of the species to be planted based on the 2009 RA and vegetation survey. Species and application rates may change depending on the results of the baseline vegetation survey and seed availability.

Broadcast seed will be applied first followed by drilled seed. Where drill seeding follows broadcast seeding, drill seeding will be acceptable in place of dragging or harrowing. All areas that are broadcast seeded only shall be dragged with a harrow or similar implement to lightly cover the seed with soil.

Soil amendments will be applied to excavated areas on the Navajo reservation prior to seeding. Weed free straw mulch will be applied to the side slopes of the Soil Consolidation Area at a rate of 2 tons per acre and crimped using equipment tracks.

TABLE 6
ESTIMATE OF SEED MIX FOR DISTURBED AREAS

Common Name	Scientific Nomenclature	Recommended PLS lbs/ac	Preferred Seeding Method
Western wheatgrass	Agropyron smithii	1.50	Drill
Alkali Sacaton	Sporobolus airoides	0.75	Drill
Blue Grama	Bouteloua gracilis	0.50	Drill
Galleta	Hiliaria jamesii	0.50	Drill
Thickspike Wheatgrass	Agropyron dasystachyum	0.75	Drill
Indian Ricegrass	Oryzopsis hymenoides	1.00	Drill
Sideoats Grama	Bouteloua curtipendula	1.00	Drill
Bottlebrush Squirreltail	Sitanion hystrix	0.25	Drill
Desert Globemallow	Sphaeralcea ambigua	0.75	Broadcast
Palmer Penstemon	Penstemon palmeri	0.50	Broadcast
Rocky Mountain Penstemon	Penstemon strictus	0.25	Broadcast
Lewis Flax	Linum lewisii	1.00	Broadcast
Fourwing Saltbush	Atriplex canescens	1.00	Drill
Wyoming Big Sagebrush	Artemisia tridentata wyo.	0.25	Broadcast
Cliffrose	Purshia Mexicana	1.00	Broadcast
Winterfat	Ceratoides lanata	1.00	Drill
	Total	12.00	

Notes:
- PLS = Pure Live Seed
- Multiply application rate of drill seeded species by 1.5 if all seed is broadcast
- Multiply application rate for all species by 2 for hydroseeding.

3.14 SITE SURVEY

The Contractor will hire or have on staff for the project, a professional land surveyor registered in the State of New Mexico. The Contractor will be responsible for (1) establishing proper elevation and grade control for all aspects of the project; (2) surveying for verification of excavation quantities, regrading quantities, cover material quantities, and rock placement quantities; and (3) completing an as-built survey of the project.

4.0 POST-CONSTRUCTION TASKS

4.1 INTERIM AND FINAL STATUS SURVEYS

Compliance with the cleanup performance standard will be demonstrated by conducting an Interim Status Survey following completion of excavation of the soils in accordance with MARSSIM (EPA, 2000), as described in detail in Appendix E. The objective of the Interim Status Survey will be to confirm that soils have been sufficiently excavated in accordance with MARSSIM (EPA, 2000). The Interim Status Survey within the excavation areas, not including the Eastern Drainage, will consist of a static direct gamma radiation level survey performed on an 80-foot triangular grid (see Appendix E). The surveying conducted during excavation, which will have been conducted at 100% coverage, will be used to augment the Interim Status Survey data and will constitute the 100% gamma scan guideline included in MARSSIM. Any areas that were not scanned at 100% during excavation control surveying, will be 100% scanned during the Interim Status Survey. The Interim Status Survey will also include confirmation surface soil samples collected at five percent of the static gamma radiation survey locations and submitted to the laboratory for analysis of Ra-226 using EPA Method 901.1.

Within the Eastern Drainage channel excavation, because the area will be backfilled and restored, a Final Status Survey will be conducted. The Final Status Survey will consist of the results of the ex-situ soil screening (see Section 3.5) and soil samples submitted for laboratory analysis of Ra-226. Ex-situ field screening is summarized in Section 3.5, and presented in Appendix E. Once ex-situ field screening results indicate the cleanup performance standard has been achieved consistent with MARSSIM, soil samples will be collected every 50 feet along the length of the channel excavation, as well as from the banks of the channel alternating between the north and south banks every 50 feet. The soil samples will be submitted to the laboratory, and analyzed for Ra-226 using EPA Method 901.1. Once samples are collected, each segment will be backfilled to reduce safety risks.

4.2 FENCING

Temporary range fencing will be placed around the revegetation areas in accordance with the Bureau of Land Management guidelines (BLM, 1986). The approved fence material will be placed to ensure grazing and other incompatible land use does not occur until vegetation is fully established. Fencing will consist of metal t-posts and four strands of wire, three barbed and one smooth (top). The temporary range fence will be installed around the perimeter of the revegetated areas per Bureau of Land Management guidelines (BLM, 1986), and are based on the multiple use standard for "cattle and sheep (requires extreme restriction of livestock movements)" with deer being the predominant game species.

The range fence will include the following:

- Maximum height.: 40 inches
- Post spacing: 16.5 to 30 ft
- No. of stays between line posts: 1-4 (spaced equidistant)
- No. of wires: 4
- Wire spacing: 16 inches, 22 inches, 28 inches, and 40 inches above ground
- Wire type: top smooth, others barbed

4.3 EROSION AND SEDIMENTATION CONTROL

Following completion of RA activities, the RA areas will be monitored under the inspection schedule that is included in the Construction SWPPP (Appendix I). UNC/GE may preserve some of the storm water BMPs implemented during RA activities.

Erosional features will be visually classified using the Bureau of Land Management (BLM) Erosion Classification System, shown on Table 7 (BLM, 1986). Class 3 erosion features will be evaluated on an individual basis to determine if corrective actions are needed. Corrective actions will be taken for all Class 4 and Class 5 erosion features.

TABLE 7
BLM EROSION CLASSIFICATION SYSTEM

Classification	Description
Class 1:	No soil loss or erosion; top soil layer intact, well-dispersed accumulation of litter from past year's growth plus smaller amounts of older litter.
Class 2:	Soil movement slight and difficult to recognize; small deposits of soil in form of fans or cones at end of small gullies or rills, or as accumulations behind plant crowns or behind litter, litter not well dispersed or no accumulation from past year's growth obvious.
Class 3:	Soil movement or loss more noticeable; topsoil loss evident, may be some pedestaled or hummocky plants; rill marks evident, poorly dispersed litter and bare spots not protected by litter.
Class 4:	Soil movement and loss readily recognizable; topsoil remnants with vertical sides and exposed plant roots, roots frequently exposed, litter in relatively small amounts and washed into erosion protected patches.
Class 5:	Advanced erosion; active gullies, steep sidewalls on active gullies; well-developed erosion pavement on gravely soils, litter mostly washed away.

Excavated slopes steeper than 10% will be assessed for erosion protection based on surface conditions and contributing drainage areas. The slopes steeper than 10% within the Eastern Drainage channel will be riprapped. The reconstructed Head Cut erosion channel side slopes may exceed 10% depending on the results of excavation and removal of the debris that is currently present in the gully. The intent is to minimize the slopes in the head cut to the extent possible. The Soil Consolidation Area and TPH stockpile have slopes ≤7.5%, with the exception of one small side slope (approximately 75-100 feet long) on the north end of the Soil Consolidation Area, which will be ≤3:1 and depending upon final grading requirements, may be less than 10%. Based on the uncertainty of the final slopes in the few small areas described above, measures to prevent erosion will be determined during construction based on the final configuration and discussed with EPA. The location and specifications of the actual erosion controls will be shown on the completion drawings.

4.4 MONITORING AND MAINTENANCE

Monitoring of the RA area will be performed monthly for six months after completion of construction activities or after significant rainfall events (e.g., greater than one inch per hour) and quarterly thereafter.

4.5 FINAL CONSTRUCTION REPORT

The Final Construction Report will provide information on the removal action and results of sampling and testing completed as part of RA activities. This report will describe the activities performed to comply with the AOC and referenced regulations and guidance documents. This report will include the following:

- Brief introduction to the project and the activities performed
- Description of RA activities
- Results of the Interim and Final Status Surveys
- Estimate of the total costs incurred implementing the AOC

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DRAWINGS

APPENDICES