

ADDENDUM B

Final Remedial Action Plan DOE-EM/GJ1547

March 2024

Final Design Specifications

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MOAB UMTRA PROJECT MOAB, UTAH PROJECT NO: 35DJ2600	DOCUMENT NO.: 35DJ2600-056-SPEC-01-01-00
	SECTION NO.: 01-01-00
	SUMMARY OF WORK
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
0	03/13/2024	SFD			ALL	ISSUED FOR CONSTRUCTION

SECTION 01 01 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This Project is located at the Crescent Junction Disposal Site near Thompson Springs, Utah. A final cover system referred to as an Evapotranspiration (ET) Cover will be deployed at the Crescent Junction Disposal Site to be compliant with 40 CFR 192. This replacement cover shall be deployed in lieu of the prior approved UMTRA Cover.
- B. These Specifications apply only to the Crescent Junction Disposal Site UMTRA Project Final Cover System conversion to an ET Cover, including the removal of a portion of the previously approved UMTRA Cover and replacement with the new ET Cover.
- C. All work shall be performed in accordance with North Wind Portage safety and project requirements.
- D. The scope of work is indicated by the requirements of each Specification.
- E. The work includes, but is not limited to:
 - Removal and reclaiming of existing UMTRA cover system materials as indicated in the drawings;
 - Construction of an ET cover system;
 - Placement of impoundment perimeter riprap erosion control materials; and
 - Seeding of the ET final cover system.
- F. The Contractor shall use the design documents, to include but not be limited to these Specifications and the Construction Drawings, to construct the final cover system.

1.02 DEFINITIONS

- A. The Owner shall mean Department of Energy (DOE).
- B. The Contractor shall mean North Wind Portage, Inc. the project Remedial Action Contractor (RAC).
- C. The Engineer shall mean Dwyer Engineering LLC. The Engineer of Record may designate someone to act on his behalf, under his supervision.
- D. The Subcontractor shall mean any individual or company contracted by the Contractor to provide services or perform work associated with the project.
- E. Where “as shown,” “as detailed,” “as noted,” “as indicated,” or words of like meaning are used in the Contractor documents, it shall be understood that reference is being made to the drawings unless otherwise noted.

PART 2 MATERIALS

Not Applicable

PART 3 EXECUTION

3.01 SPECIFICATIONS

The priority of Contract Documents is Specifications take precedence over the Drawings which take precedence over the Project Scoping Plans.

3.02 DRAWINGS

A. An index of Project drawings is shown on the Drawings.

B. Dimensions shown on the Drawings take precedence over scaled dimensions. Large-scale details have precedence over smaller scale.

END OF SECTION

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PROJECT: CRESCENT JUNCTION DISPOSAL SITE FINAL COVER SYSTEM LOCATION: CRESCENT JUNCTION, UTAH	DOCUMENT NO.: SPECIFICATION-01-09-00
	SECTION NO.: 01 09 00
	ABBREVIATIONS
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

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SECTION 01 09 00

ABBREVIATIONS

PART 1 GENERAL

1.01 ABBREVIATIONS

- A. Abbreviations used in these Contract Documents shall refer to and designate the following, as applicable:

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BMP	Best Management Practice
CBR	California Bearing Ratio
CCS	Compaction Control System
CFR	Code of Federal Regulations
CQAP	Construction Quality Assurance Plan
CJ	Crescent Junction
DCN	design change notice
DOE	United States Department of Energy
D50	median rock size
ET	Evapotranspiration
FS	Federal Specifications
GPS	global positioning system
GTL	geotechnical testing laboratory
H	horizontal
HASP	Health and Safety Plan
Inc.	Incorporated
LLC	limited liability corporation
MARV	minimum average roll value
max.	maximum
MDD	maximum dry density
MSL	mean sea level
min.	minimum
NQA	Nuclear Quality Assurance
NFS	non frost susceptible
NA	not applicable
No.	number
NUREG	Nuclear Regulatory Report
OSHA	Occupational Safety and Health Act
PLS	pure live seed
QA	Quality Assurance
QC	Quality Control
RAC	Remedial Action Contractor

RAIP	Remedial Action Inspection Plan
RRM	residual radioactive material
SPCCP	Moab UMTRA Project Spill Prevention, Control, and Countermeasures Plan
SWPPP	Moab UMTRA Project Crescent Junction Stormwater Pollution Prevention Plan
TBD	to be determined
UBC	untreated base course
UMTRA	Uranium Mill Tailings Remedial Action
UDOT	Utah Department of Transportation
USDA	United States Department of Agriculture
V	vertical

UNITS OF MEASURE

AC	acre
cm/sec	centimeters per second
cu ft	cubic foot (feet)
CY	cubic yard(s)
ft	foot (feet)
in.	inch(es)
kg	kilogram
kN	kilonewton
lbs.	pounds)
lbf	pound-force
m	meter
m ³	cubic meters
mm	millimeter
mph	miles per hour
pcf	pounds per cubic foot
psi	pounds per square inch
yr	year
μm	micrometer

PART 2 PRODUCTS – Not Used.

PART 3 EXECUTION – Not Used.

END OF SECTION

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PROJECT: CRESCENT JUNCTION DISPOSAL SITE FINAL COVER SYSTEM LOCATION: CRESCENT JUNCTION, UTAH	DOCUMENT NO.: SPECIFICATION-02-93-20
	SECTION NO.: 02 93 20
	SEEDING, MULCHING, AND RESTORATION
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---END OF SECTION---

SECTION 02 93 20
SEEDING, MULCHING, AND RESTORATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. The work to be performed under this section shall include furnishing and installing all seed, fertilizer, mulch, mulch binder, and soil amendments shown on the Drawings or as directed by the Engineer. This work shall also include maintaining seeded areas as required.
- B. The areas to be seeded under this Specification Section shall include all areas designated by the Engineer and as described on the Drawings. All areas outside of specified limits where the vegetative growth has been injuriously disturbed or destroyed by the Contractor shall be restored and seeded in accordance with these specifications by the Contractor.

1.02 RELATED SECTIONS

- A. Section 31 00 01 Cover-Related Earthwork
- B. Section 31 00 50 Method Specification for Material Mixing and Surface
Admixture Placement
- C. Section 32 11 22 Final Cover System Riprap and Admixture Rock

1.03 SUBMITTALS

- A. The Contractor shall submit the following items:
 - 1. Catalog data, including sources of supply for amendments, mulch, tackifier, fertilizer, and erosion control blankets.
 - 2. Certification substantiating that material complies with specified requirements.
 - 3. Certified seed bag tags and copies of seed invoices identified by project name.
 - 4. Installation instructions, including proposed seeding schedule. Coordinate with specified maintenance periods to provide maintenance from date of final acceptance. Once schedule is accepted, revise dates only with Engineer approval after documentation of delays.

1.04 QUALITY ASSURANCE

- A. Material Quality Control:
 - 1. Provide seed mixture in containers showing species percentages in seed mix; test information including, purity, germination and noxious and restricted weeds; net weight; date of packaging; and location of packaging.
 - 2. Furnish seed labeled in accordance with the requirements of federal and Utah statutes and regulations governing seed labeling. Such resulting requirements include but are not necessarily limited to: Federal Seed Act and Amendments, rules and regulations established by the USDA; the Utah Seed Law; and all resulting regulations or restrictions established by other authorized entities.

3. In addition, ensure seed mix and its application comply with the requirements of all other federal and Utah statutes and regulations governing seeds, plants, and weeds. These requirements include but are not necessarily limited to: the Noxious Weed Control Act and all rules, regulations, or control measures by a noxious weed control district embracing Grand County, Utah; and the Harmful Plant Act.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. Opened or wet seed shall be rejected and returned to the responsible party.

PART 2 MATERIALS

2.01 SEED

- A. Obtain native grass seed from sources whose origin would ensure site adaptability. Plant sources from Utah or surrounding states are preferred.
- B. Obtain shrub and wildflower seed from sources whose origin would ensure site adaptability. Plant sources from Utah or surrounding states are preferred.
- C. Furnish certification, showing origin of seed and pure live seed (PLS) content as determined by a certified authority. Provide bags of seed that are tagged and sealed in accordance with the State Department of Agriculture or other local certification authority within the state of origin. The tag or label shall indicate analysis of seed and date of analysis, which shall not be more than 9 months prior to delivery date. Seed may be premixed by the seed dealer and appropriate data indicated on the bag label for each variety.
- D. The following seed mix is desired at the Crescent Junction Disposal Site for the final cover system and all disturbed areas to be revegetated.

NATIVE PERENNIAL MIX

<i>Common Name</i>	<i>Total Pounds Live Seed per Acre*</i>
Grasses	
Alkali Sacaton	4.0
Galleta Grass (if not available, use Indian Ricegrass)	8.0
Blue Grama	8.0
Other	
Four-wing saltbush	5.0
Scarlet Globemallow	1.0
Rocky Mountain Beeplant	8.0
Total PLS lbs. per Acre	34.0

**PLS is based on broadcast seeding. For drill seeding, half the PLS per Acre is adequate.*

2.02 STRAW MULCH

- A. Straw shall be stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold, or other objectionable material. At least 65% of the herbage by weight of each bale of straw shall be 10 in. long or longer. Rotted, brittle, or molded straw is not acceptable. Straw from introduced grasses is acceptable if cut prior to seed formation.

2.03 HYDRAULIC MULCH/TACKIFIER

- A. Provide mulch material consisting of 100 percent virgin wood fibers manufactured expressly from whole wood chips, such as Eco-Fibre or equal. Process chips in such a manner as to contain no growth or germination inhibiting factors. Do not produce fiber from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants unless approved by the Engineer. Provide materials free from contaminants such as lead paint, varnish or other metal contaminants. Hydraulic mulch shall contain non-toxic dye to assist in visually determining even distribution. Mulch material shall meet the following specifications:

<u>Parameter</u>	<u>Value</u>
pH at 3% consistency	4.5 +/- 0.5
Ash content	0.8% +/- 0.2%
Moisture holding capacity	1250 (grams water/100 grams oven dry fiber)
Moisture content	12% +/- 3% (Wet weight basis)

- B. Combine mulch with an organic plantago-based tackifier, such as M-binder or equal, that has no growth or germination inhibiting factors and is nontoxic. Apply the uniform mixture to the seeded area.
- C. Bagged mulch/tackifier mix that is homogenous within the unit package may also be used. Tackifier shall adhere to the fibers during manufacturing to prevent separation during shipment and to avoid chemical agglomeration during mixing in the hydraulic mulching equipment.

2.04 AMENDMENTS / SOIL ADDITIONS

- A. Soil amendments shall be determined based on cover soils used and potential nutrient deficiencies with those soils. This is to be determined prior to commencement of any seeding activities. All soil amendments shall be submitted and approved by the Engineer prior to use.

PART 3 EXECUTION

3.01 DUST CONTROL

- A. The Contractor shall comply with the Crescent Junction Fugitive Dust Control Plan (DOE-EM/GJ1235).

3.02 PREPARATION

- A. Preparation of the surface to be seeded.
 - 1. If the surface has been compacted due to traffic or other, loosen the upper surface to a maximum depth of 6 in. to prepare it for seeding. Large clods and stones, or other foreign material should not be present on the landfill surface that could interfere with seeding equipment.
 - 2. Do not till on ground that is already loose to a depth of 2 in. or more.
 - 3. Do not work when moisture content of soil is unfavorable or ground is otherwise in a non-tillable condition.
- B. Soil Amendments/Additions
 - 1. If soil amendments are used, uniformly apply to prepared seedbed in accordance with manufacturer recommended rates. Submit manufacturer recommendations and planned placement methods to Engineer for approval prior to commencement of seeding activities.
- C. Prepare seedbed again if, prior to seeding, the Engineer determines that rain or some other factor has affected prepared surfaces and that it may prevent seeding to proper depth.
- D. On excessively steep slopes (e.g., steeper than 2:1), hydraulic/broadcast seeding may be appropriate or as determined by the Engineer.

3.03 APPLICATION OF SEED

- A. General:
 - 1. Avoid seeding between November 1 and April 15. Provide for temporary soil stabilization measures between these dates. Do not seed during windy weather, or when topsoil is saturated or frozen.
 - 2. Equip seed boxes used for drill and broadcast seeding with an agitator.
 - 3. To prevent stratification of seed mix, do not run seed box agitators while seeding is not being performed.
 - 4. If seed mix is transported to site in a seed box or other equipment that subjects mix to shaking or similar movement that has the potential to cause stratification, remix seed prior to application.
 - 5. Seeding equipment shall be calibrated as appropriate to distribute seed at the specified rates.
 - 6. Unless otherwise shown on Drawings, seed areas disturbed by or denuded by construction operations or erosion.
 - 7. Ensure that no gaps will exist between passes of seeding equipment.
- B. Drill Seeding (drill seeding shall be utilized unless otherwise approved by the Engineer). Uniformly apply prescribed mix over area to be seeded as follows:
 - 1. Accomplish seeding operations, where practical, by drilling in a direction across slope and along the contour.
 - 2. Plant seeds approximately 1/4 in. deep. Do not exceed 4 in. distance between drilled furrows. If furrow openers on drill exceed 4 in., drill area twice to obtain a 4-in. distance between furrows.
 - 3. Seed with grass wheels, rate control attachments, seed boxes with agitators, and separate boxes for small seed.
 - 4. Once seed is applied, apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
 - 5. Prohibit vehicles from traveling over the seeded areas.

- C. Broadcast Seeding (small areas or very steep slopes may be broadcast seeded as approved by the Engineer):
 - 1. Where it is not practical to accomplish seeding by drilling, mechanically broadcast seed by use of a hydraulic mulch slurry blower, rotary spreader, or a seeder box with a gear feed mechanism. If seeding is done with a slurry blower, use highest pressure and smallest nozzle opening that will accommodate the seed.
 - 2. If hydraulically applying mulch as part of the broadcast seeding process, use a 2-step process. Once seed is applied, apply full complement of mulch. This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.
 - 3. Prohibit vehicles from traveling over the seeded areas.

3.04 STRAW MULCH: for slopes flatter than 3:1, Non-irrigated Projects

- A. Apply straw mulch at a minimum rate of 1.5 tons per acre of air-dry material. Spread straw mulch uniformly over area either by hand or with a mechanical mulch spreader to achieve 80 percent ground cover. When spread by hand, tear bales of straw apart and fluff before spreading. Depth of applied straw mulch shall not exceed 3 in. Do not mulch when wind velocity exceeds 10 mph.
- B. Straw mulch shall only be used where use of crimping equipment is practical. Place mulch in manner noted above and anchor the straw into the soil to a minimum depth of 2 in. and not to exceed 3 in. Use a crimper or heavy disc such as a mulch tiller, with flat serrated discs at least 1/4 in. thick, having dull edges, and spaced no more than 9 in. apart. Provide discs of sufficient diameter to prevent frame of equipment from dragging the mulch. Where practical, perform crimping in perpendicular directions. Do not use sheep's foot rollers, heavy equipment tracks, and standard disc cultivators for crimping.
- C. If straw mulched areas cannot be anchored by crimping, use hydraulic mulch wood fibers with tackifier. Mix slurry in a tank with an agitation system and spray under pressure uniformly over the soil surface. Keep all materials in uniform suspension throughout the mixing and suspension cycle when using hydraulic mulching equipment. Mix 100 lbs. of wood fiber with a minimum 150 lbs. to 200 lbs. of tackifier to anchor straw mulch. Apply mixture at a rate of 250 – 300 lbs./acre.
- D. Use both horizontal and vertical movements in the applicator to achieve an even application of the slurry material.

3.05 HYDRAULIC MULCHING/TACKIFIER: for slopes flatter than 2:1

- A. Mix slurry in a tank with an agitation system and spray, under pressure, uniformly over soil surface. Apply mulch evenly across landscape at a rate of 2000 lbs./acre.
- B. Use both horizontal and vertical movements in applicator to achieve an even application of slurry material. Keep all materials in uniform suspension throughout mixing and suspension cycle when using hydraulic mulching equipment.
- C. When using plantago-based tackifier (or equal) as mulch, apply tackifier at a rate of 150 lbs./acre.
- D. Prohibit foot/vehicle traffic from hydraulically mulched areas.

3.06 WATERING

- A. Temporary watering is not to be performed unless approved by the Design Engineer and Crescent Junction Operations/Site Manager.

3.07 MAINTENANCE

- A. Begin maintenance immediately after planting. Keep re-vegetated areas free of noxious weeds.
- B. Maintain seeded areas for not less than 60 days after final acceptance of work and longer as required to achieve final stabilization as described in Section 3.09 ACCEPTANCE.
- C. Reseed significant areas where vegetation has not been adequately established as determined by the Engineering Post-Closure Inspections to be performed.

3.08 CLEANUP AND PROTECTION

- A. Protect seeded areas, work, and materials from damage due to vehicles, pedestrians, and operations by other subcontractors. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged work as directed.
- B. Upon completion of all seeding operations, clean the portion of the project site used for storing materials and equipment of all debris. Remove all superfluous materials and equipment from the project site. Sweep walks and pavement clean upon completion of work in this section.

3.09 ACCEPTANCE

- A. Seeded areas will be reviewed for acceptance by the Engineer and/or representative of the Department of Energy when final stabilization has been achieved. Final stabilization is defined as “All soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover established that closely matches the surrounding undisturbed native vegetation. The owner will assume responsibility for adherence to the Storm Water Pollution Prevention Plan (SWPPP) and the need for further stabilization efforts (if any).

-- END OF SECTION --

MOAB UMTRA PROJECT MOAB, UTAH PROJECT NO: 35DJ2600	DOCUMENT NO.: 35DJ2600-056-SPEC-31-00-00
	SECTION NO.: 31-00-00
	EARTHWORK

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0	12/17/07	WDB	FMP	W. Barton	ALL	ISSUED FOR CONSTRUCTION
1	1/30/08	WDB	FMP	W. Barton	ALL	Page 16: Added Section 3.11.1.2 Pages 18-19, revised soil testing frequencies
2	2/27/08	WDB	FMP	W. Barton	ALL	Revised per DOE & Golder Comments Page 6 Section 1.2.7: revised to reference Section 32 11 23, AGGREGATE AND RIPRAP Page 7, Section 1.5: revised to include topsoil. Page 10, Section 3.1.5: revised to include additional requirements for safe trench excavation. Page 12, Section 3.4: revised to add sediment/erosion control to stockpile areas. Page 13, Section 3.6.2: revised to delete word muddy. Page 14, Section 3.9.1.3: revised to include sand (SW). Page 19, Section 3.14.2: revised frequency of check tests.
3	4/14/08	WDB	FMP	W. Barton	ALL	Page 8, Section 1.7: Added section about NQA-1 and Quality Levels. Page 16, Section 3.11.1: Revised from 10" loose lift thickness to 12" loose lift thickness. Page 16, Section 3.11.1.1, Item 2): Revised wording to clarify, fill placed in lifts not to exceed 1'2 loose. Page 16, Section 3.11.1.2, Item 2): Revised wording to clarify, fill placed in lifts not to exceed 12" loose.

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4	06/01/08	WDB	FMP	W. Barton	ALL	Revised per NRC Comments Page 5, Section 1.2 Revised Definitions. Page 17, Section 3.11; Revised Embankments Section, corrected misspelled words, and deleted sentence describing compaction of cohesionless material. Pages 17 - 20, Sections 3.11-3.14: Revised testing requirements to describe testing by others and the Contractor's role in compaction of material. Page 14, Section 3.7.1: Added moisture range of "optimum moisture content plus or minus 5%" Page 21, Section 3.14.4: Added moisture range of "optimum moisture content plus or minus 5%"

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
5	1/23/19	FMP	WDB	W. Barton	ALL	Section 1.2.2: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 1.3: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 1.5.3: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 1.5.4: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.1.5.5: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.1.6: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.1.7: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.3.2: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.6.1: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.11.1.2: Revised Computer Aided Earthmoving System to Computer Based Compaction System, Revised CAES to Computer Based Compaction System Section 3.11.3: Deleted "contracted by Energy Solutions" Section 3.12.1: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.14.4: revised Energy Solutions to RAC Section 3.14.4: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 3.15: Revised Construction Manager to Crescent Junction Operations/Site Manager

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6	09/14/2020	Butch Parton	Butch Parton	Butch Parton	ALL	Per DCN 027 Specification 31-00-00, Revised specification requirements to remove references stating "moisture content shall be modified to bring fill to optimum plus or minus 5%" and replace with the following statement, "Moisture content shall be maintained within a range needed to achieve specified compaction requirements".
7	03/13/2024	SFD			ALL	Removed reference to Specification Section 01 33 00 SUBMITTAL PROCEDURES. Removed reference to the company Energy Solutions. Adjusted format. Changed Section 3.11.1.1 to: "Place the material in successive horizontal layers of material not more than 12 inches in depth after compaction." Changed Section 3.11.1.2 Bullet 2 to "Dump and spread fill in lifts of nearly uniform thickness, not to exceed 12-inches compacted. Fill shall be compacted with equipment to satisfactorily meet the compaction requirement." Changed Section 3.11.1.2 Bullet 3 from CAES to Computer Based Compaction System (CBC). Changed Section 3.11.1.2 Bullet 4 from CAES to Computer Based Compaction System (CBC).

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SECTION 31 00 00**EARTHWORK****PART 1 GENERAL**

This Earthwork Specification covers much of the earthwork in support of the Moab UMTRA Project, including work at the Moab site, at Crescent Junction, and for the Green River to Crescent Junction Water Line. Earthwork not covered by this specification (covered under separate specifications) includes the Haul Road work at Moab, Placement and Compaction of Tailings and Interim Cover, and Placement and Compaction of Final Cap Layers.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

**AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION
OFFICIALS (AASHTO)**

AASHTO T 99	(2001; R 2004) Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 180	(2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop
AASHTO T 224	(2001; R 2004) Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM A 139	(2004) Electric-Fusion (arc)-Welded Steel Pipe (NPS 4 and Over)
ASTM C 136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM A 698	(2000a) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu ft)
ASTM D 1140	(2000) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557	(2002e1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/cu ft)
ASTM D 1883	(2005) CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2487	(2006) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 422	(1963; R 2002e1) Particle-Size Analysis of Soils
ASTM D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 6938	(2007b) In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (Oven Moisture)
ASTM D 4643	(2000) Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating
ASTM D 4944	(2004) Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester
ASTM D 4643	(2000) Determination of Water (Moisture) Content of Soil by Direct Heating

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2004) Structural Welding Code - Steel
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1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, CL, ML, and CL-ML. Satisfactory materials for grading comprise stones less than 4 inches, except for fill material for pavements and railroads which comprise stones less than 3 inches in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Crescent Junction Operations/Site Manager

when encountering any contaminated materials.

1.2.3 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D 698 or ASTM D 1557 abbreviated as a percent of laboratory maximum density. Since ASTM D 698 and ASTM D 1557 apply only to soils that have 30 percent or less by weight of their particles retained on the 3/4-inch sieve, degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4-inch sieve shall be as a percentage of the maximum density in accordance with AASHTO T 99 or AASHTO T 180 and corrected with AASHTO T 224.

1.2.4 Rock

Solid homogeneous material with firmly cemented, laminated, or foliated masses or conglomerate deposits, none of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also, large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume.

1.2.5 Unstable Material

Unstable materials are materials that are too soft or unstable to properly support the utility pipe, conduit, or structure.

1.2.6 Select Granular Material

Select granular materials are materials classified as GW, GP, SW, or SP, or by ASTM D 2487 where indicated. Not more than 30 percent by weight may be finer than the No. 200 sieve when tested in accordance with ASTM D 1140.

1.2.7 California Bearing Ratio

California Bearing Ratio (CBR) tests are tests to evaluate the strength of pavement subgrade. If required, perform CBR tests on select granular material in accordance with ASTM D 1883.

1.2.8 Pipe Bedding Material

Pipe bedding material shall consist of select granular material in accordance with Section 32 11 23, AGGREGATE AND RIPRAP.

1.2.9 Expansive Soils

Expansive soils are defined as soils that have a soil Activity number greater than 1.25, where Activity (Ac) = Plasticity Index/percent finer than 0.02 mm.

1.2.10 Non Frost-Susceptible (NFS) Material

Non Frost-Susceptible material is a uniformly graded gravel or washed sand with no more than 3 percent smaller than 0.02 mm.

1.3 SUBMITTALS

Approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. All submittals shall be provided to the Crescent

Junction Operations/Site Manager to include:

SUBMITTAL PROCEDURES:

SD-01 Preconstruction

Shoring; G;

Blasting; G;

Submit 15 days prior to starting work.

SD-03 Product Data

Utilization of Excavated Materials; Rock Excavation

Opening of any Excavation or Borrow Pit

Procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering unrippable rock in the project. Advance notice on the opening of excavation or borrow areas.

SD-06 Test Reports

Borrow/Fill Material Testing

Compaction Testing

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates Testing

Qualifications of the testing laboratory.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are available for elements of this project. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

Excavation will be designated as topsoil, common excavation, Mancos Shale, or rock excavation.

1.5.1 Topsoil

Topsoil is defined as the top one ft of natural soil at Crescent Junction.

1.5.2 Common Excavation

Common excavation includes all materials not classified as topsoil, Mancos shale or rock excavation.

1.5.3 Rock Excavation

Include rock excavation with blasting, excavating, grading, disposing of material classified as rock, and the satisfactory removal and disposal of boulders 1/2 cubic yard or more in

volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling and blasting; and hard materials (see Definitions). Include the removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic yard in volume that may be encountered in the work in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor encounters material that may be classified as rock excavation, uncover such material and notify the Crescent Junction Operations/Site Manager. The Contractor shall not proceed with the excavation of this material until the Crescent Junction Operations/Site Manager has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Crescent Junction Operations/Site Manager, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Crescent Junction Operations/Site Manager for the areas of work in which such deposits occur.

1.5.4 Blasting

Blasting shall be limited to that required for a quarrying operation to provide rock for the Waste Cell construction at Crescent Junction. At other project locations, blasting to break rock for excavating shall be performed only if no other method of rock removal will work, and only with prior written approval of a blasting plan. The Contractor shall submit a Blasting Plan in conformance with Federal, State, and local safety regulations, prepared and sealed by a registered professional engineer that includes calculations for overpressure and debris hazard. Provide blasting mats and use the non-electric blasting caps. Obtain written approval prior to performing any blasting and notify the Crescent Junction Operations/Site Manager 24 hours prior to blasting. Include provisions for storing, handling and transporting explosives as well as for the blasting operations in the plan. The Contractor is responsible for damage caused by blasting operations.

1.6 DEWATERING

Perform dewatering of work areas in accordance with the project plans and specification section 31 32 11, SURFACE-WATER MANAGEMENT AND EROSION CONTROL.

1.7 NQA-1 QUALITY LEVEL

All Earthwork activities for the Disposal Cell at Crescent Junction, including: the cell excavation, construction of the perimeter embankments, Waste Cell Spoil Material Embankment, and perimeter ditches are designated as Quality Level 2. All other work (not on the Disposal Cell) is non-Quality related (Quality Level 3).

PART 2 PRODUCTS

2.1 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in

bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Orange	Telephone and Other Communications
Blue	Water Systems
Green	Sewer Systems

2.2 MATERIAL FOR RIP-RAP

Provide filter fabric between soil and riprap in accordance with 31 05 19 GEOTEXTILE and rock conforming to RIPRAP in accordance with 32 11 23 AGGREGATE AND RIPRAP.

2.3 PIPE BEDDING MATERIAL

Provide bedding material consisting of sand, gravel, or crushed rock, open graded with a maximum particle size of 3/8 inch. Compose material of tough, durable particles. Bedding material shall be free of fines passing the No. 200 standard sieve.

2.4 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, open graded crushed rock, crushed gravel or uncrushed gravel placed beneath a slab with or without a vapor barrier below. Conform to ASTM C 33 for fine aggregate grading with a maximum of 3 by weight passing ASTM D 1140, No. 200 sieve.

2.5 PIPE CASING

2.5.1 Casing Pipe

Pipe for casing utility lines shall be ASTM A 139, Grade B or approved substitute. Match casing size to the outside diameter and wall thickness as indicated on the drawings. Protective coating is not required on casing pipe.

PART 3 EXECUTION

3.1 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated on the drawings. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Dispose of unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times.

Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor.

3.1.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the drawings. Do not excavate ditches and gutters below grades shown.

Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or riprap to grades shown. Dispose of excavated material as shown or as directed, except in no case allow material to be deposited a maximum 4 feet from edge of a ditch.

Maintain excavations free from detrimental quantities of brush, sticks, trash, and other debris until final acceptance of the work.

3.1.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed. Where pile foundations are to be used, stop the excavation of each pit at an elevation 1 foot above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, remove loose and displaced material and complete excavation, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

3.1.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. It is the responsibility of the Contractor to assess the soil and groundwater conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.1.4 Dewatering

While the excavation is open, dewater the construction area to limit accumulation of water in the work area and to prevent damage to finished work. Operate dewatering system continuously until construction work below existing water levels is complete.

3.1.5 Trench Excavation Requirements

Excavate trenches as recommended by the manufacturer of the pipe to be installed. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4.5 feet high, cut back to a stable slope (as defined by OSHA 29 CFR 1926), or provide with equivalent means of protection for employees who may be exposed to moving ground or cave-in. Excavate trench walls which are cut back to at least the angle of

repose of the soil as determined by a professional geotechnical engineer. "Safe trench excavation is at all times the responsibility of the Contractor."

3.1.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 1-inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.1.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 6 inches below the required grade and replace with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.1.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION.

3.1.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures sufficient to leave at least 12-inch clear between the outer structure surfaces and the face of the excavation. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.1.5.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Crescent Junction Operations/Site Manager, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.1.6 Underground Utilities

For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines until approval for backfill is granted by the Crescent Junction Operations/Site Manager. Report damage to utility lines or subsurface construction immediately to the Crescent Junction Operations/Site Manager.

3.1.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Crescent Junction Operations/Site Manager prior to concrete placement.

3.2 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from the borrow areas within

the limits of the project site, selected by the Contractor or from approved private sources. The Contractor is responsible for obtaining and delivering borrow material to the project site.

3.3 SHORING

3.3.1 General Requirements

Submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheet piling as excavations are backfilled, in a manner to prevent caving.

3.3.2 Geotechnical Engineer

The Contractor is required to hire a Professional Geotechnical Engineer to design shoring, and provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Crescent Junction Operations/Site Manager of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Crescent Junction Operations/Site Manager is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.4 STOCKPILE AREAS

Keep stockpiles in a neat and well drained condition, giving due consideration to drainage and erosion control at all times. Separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material.

3.5 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.6 GROUND SURFACE PREPARATION

3.6.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Crescent Junction Operations/Site Manager, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 2 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified

density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.6.2 Frozen Material

Do not place material on surfaces that are frozen, or contain frost.

3.7 UTILIZATION OF EXCAVATED MATERIALS

Dispose of unsatisfactory excavated materials in designated waste disposal or spoil areas. Use satisfactory material from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, and for similar purposes. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed.

3.7.1 Use of Excavated Material as Fill

Excavated material to be used as fill shall be stockpiled or hauled directly to the fill site. Prior to installation as fill, the material shall be tested to determine the maximum dry density (ASTM D 698) or (ASTM D 1557) and optimum moisture content (ASTM D 2216) of the material. Moisture content shall be maintained within a range needed to achieve specified compaction requirements.

Moisture shall be added to the material in a manner that results in a consistent moisture content throughout the fill. Quick tests of moisture content (ASTM D 4643, ASTM D 4944, or ASTM D 4959) shall be performed as required to maintain moisture control during fill placement.

3.8 BURIED TAPE AND DETECTION WIRE

3.8.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.9 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 95 percent laboratory maximum density (ASTM D 698) for cohesive materials or 98 percent laboratory maximum density for cohesionless materials (ASTM D 698), to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed as specified in paragraph GROUND SURFACE PREPARATION. Compact backfill materials in conformance with the applicable portions of paragraph GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9.1 Trench Backfill

Backfill trenches to the grade shown. Do not backfill trenches until all specified tests are performed.

3.9.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular

material or bedding material.

3.9.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6-inch loose thickness.

3.9.1.3 Bedding and Initial Backfill

Provide bedding of the type and thickness shown. Place initial bedding material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the bedding backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Compact backfill to top of pipe to 95 percent of ASTM D 698 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide bedding materials as follows:

- a. Clean, coarsely graded natural gravel, crushed stone or a combination thereof, having a classification of SW, GW or GP in accordance with ASTM D 2487 for bedding. Do not exceed maximum particle size of 3/8 inch.

3.9.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, and railroads with satisfactory material. Place backfill material and compact as follows:

- a. Roadways and Railroads: Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

3.9.2 Backfill for Appurtenances

After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure, place backfill in such a manner that the structure will not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.10 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.10.1 Buried Water Lines

Excavate trenches to a depth that provides a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.10.2 Electrical Distribution System

Provide a minimum cover of 24 inches from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.10.3 Pipeline Casing

Provide new smooth wall steel pipeline casing under existing railroad by the boring and jacking method of installation. Provide each new pipeline casing, where indicated and to the lengths and dimensions shown, complete and suitable for use with the new piped utility as

indicated. Install pipeline casing by dry boring and jacking method as follows:

3.10.3.1 Bore Holes

Mechanically bore holes and case through the soil with a cutting head on a continuous auger mounted inside the casing pipe. Weld lengths of pipe together in accordance with AWS D1.1. Do not use water or other fluids in connection with the boring operation.

3.10.3.2 Cleaning

Clean inside of the pipeline casing of dirt, weld splatters, and other foreign matter which would interfere with insertion of the piped utilities by attaching a pipe cleaning plug to the boring rig and passing it through the pipe.

3.10.3.3 End Seals

After installation of piped utilities in pipeline casing, provide watertight end seals at each end of pipeline casing between pipeline casing and piping utilities. Provide watertight segmented elastomeric end seals.

3.10.4 Rip-Rap Construction

Place rip-rap on filter fabric in the areas indicated. Install riprap to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.10.4.1 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate “pockets” of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.11 EMBANKMENTS

3.11.1 Earth Embankments

Construct earth embankments in accordance with the following subsections. Section 3.11.1.1 shall apply to all earth embankments at Moab and Crescent Junction except the Waste Cell Perimeter Embankments and the Waste Cell Spoil Material Embankment. Section 3.11.1.2 shall apply to the Waste Cell Perimeter Embankments and Section 3.11.1.3 shall apply to the Waste Cell Spoil Material Embankment.

3.11.1.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of material not more than 12 inches in depth after compaction. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact material to at least 95 percent laboratory maximum density in accordance with ASTM D 698. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved

equipment.

3.11.1.2 Waste Cell Perimeter Embankment at Crescent Junction

The Waste Cell Perimeter Embankment forms the outside of the waste cell, and will have 2:1 interior slopes, 5:1 exterior slopes, and a 30-ft-wide level top. Material from the cell excavation will be used to construct the Waste Cell Perimeter Embankment. The fill shall be tested (by others) to determine its maximum dry density in accordance with ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort. Moisture content shall be maintained within a range needed to achieve specified compaction requirements.

Construct the Waste Cell Perimeter Embankment as follows:

- 1) Prepare the ground beneath the proposed perimeter embankment by stripping vegetation and loose soil from the site, scarifying and compacting the top 6 inches of soil.
- 2) Dump and spread fill in lifts of nearly uniform thickness, not to exceed 12-inches loose. Fill shall be compacted with equipment to satisfactorily meet compaction requirements.
- 3) At the Contractor's option, the compactor may be equipped with a Computer Based Compaction System (CBC), and soil placement and compaction shall be controlled by the CBC.
- 4) If the CBC is used, the Contractor shall assist on-site soil testing personnel by using the CBC to determine and document compaction. If the CBC is not used, soil density tests will be performed by testing personnel in accordance with Section 3.14, below.

3.11.1.3 Waste Cell Spoil Material Embankment at Crescent Junction

The Waste Cell Spoil Material Embankment is a fill embankment to be constructed north of the waste cell. The embankment will divert storm water from the Book Cliffs around the waste cell, and shall be constructed of surplus excavated material (spoil material) from the waste cell excavation. Prior to placement, spoil material shall be tested to determine its maximum dry density in accordance with ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort. Moisture content shall be maintained within a range needed to achieve specified compaction requirements.

Construct the Waste Cell Spoil Material Embankment as follows:

- 1) Prepare the ground beneath the proposed perimeter embankment by stripping vegetation and loose soil from the site.
- 2) Dump and spread fill in lifts of nearly uniform thickness, not to exceed 12-inches loose. Compact material with rollers, equipment tracks, or successive passes of scrapers. Fill shall be compacted to a density of 90% of the laboratory determined maximum density in accordance with ASTM D 698.
- 3) Soil density tests will be performed by testing personnel in accordance with Section 3.14, below.

3.12 SUBGRADE PREPARATION

3.12.1 Proof Rolling

Prior to the placement of fill or stone base material perform proof rolling to identify soft soil areas. Proof roll the existing subgrade with rubber-tired construction equipment, such as a loaded dump truck or loaded scraper, with a minimum weight of 45,000 lbs. Notify the Crescent Junction Operations/Site Manager a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Crescent Junction Operations/Site Manager. Undercut rutting or pumping of material as directed by the Crescent Junction Operations/Site Manager to a depth of 12 inches and replace with select material.

3.12.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inches below finished grade for the subgrade.

Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line and grade, in accordance with project plans.

3.12.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 95 percent of laboratory maximum density (ASTM D 1557).

3.12.3.1 Subgrade for Railroads

Compact subgrade for railroads to at least 95 percent laboratory maximum density for cohesive materials or 98 percent laboratory maximum density for cohesionless materials (ASTM D 1557).

3.12.3.2 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percent laboratory maximum density (ASTM D 1557) for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 6 inches of subgrade.

3.13 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except for the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.13.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation.

The Contractor is responsible for protecting and maintaining the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.13.2 Capillary Water Barrier

Place a capillary water barrier under concrete floors and slabs directly on the subgrade and compact with a minimum of two passes of a vibratory compactor.

3.13.3 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.14 TESTING

In-place density testing of fill material will be performed by testing personnel. The following sections and the Remedial Action Inspection Plan (RAIP) describe the testing that will be performed by others, so that the Contractor will be familiar with the type and frequency of tests being performed. When test results indicate that compaction is not as specified, the Contractor will be required to rework the material, replace and recompact to meet specification requirements. The following type and number of tests are the minimum for each type operation.

3.14.1 In-Place Densities

In-place density testing will be performed using nuclear gage ASTM D6938 and/or Sand Cone ASTM D 1556 methods. Moisture content of soil will be determined using oven ASTM D 2216 or microwave ASTM D 4643 methods. For small work areas (less than ½ acre), in-place density tests will be performed at the following frequency:

- a. One test per 5,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per 500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

For large fill areas (greater than 1 acre), in-place density tests will be performed at the following frequency:

- a. For material compacted by other than hand-operated machines: One test per 50,000 square feet or 1,850 cubic yards (CY) of material placed, or fraction thereof, a minimum of one test for each lift of fill or backfill, and a minimum of two tests per day.
- b. For material compacted by hand-operated machines: One test per 500 square feet, or

fraction thereof, of each lift of fill or backfill areas.

3.14.1.1 In-Place Density Testing of Waste Cell Perimeter Embankment

- a. For material compacted by other than hand-operated machines: One test per 50,000 square feet or 1,850 cubic yards of material placed, or fraction thereof, a minimum of one test for each lift of fill or backfill, and a minimum of two tests per day.
- b. For material compacted by hand-operated machines: One test per 500 square feet, or fraction thereof, of each lift of fill or backfill areas.

3.14.1.2 In-Place Density Testing of Waste Cell Spoil Material Embankment

- a. For material compacted by other than hand-operated machines: One test per 100,000 square feet or 3,700 cubic yards of material placed.
- b. For material compacted by hand-operated machines: One test per 500 square feet, or fraction thereof, of each lift of fill or backfill areas.

3.14.2 Check Tests on In-Place Densities

If ASTM D 6938 is used, check in-place densities by ASTM D 1556 as follows:

- a. One check test for each 20 tests per ASTM D 6938, of fill or backfill compacted by other than hand-operated machines.
- b. One check test for each 10 tests per ASTM D 6938, of fill or backfill compacted by hand-operated machines.

3.14.3 Optimum Moisture and Laboratory Maximum Density

Laboratory Density and Moisture Content tests (ASTM D 698, ASTM D 1557, and ASTM D 2216) will be performed (by others) for each type of fill material to determine the optimum moisture and laboratory maximum density values. For small fill areas of 50,000 cubic yards of fill or less, one representative test per 5,000 cubic yards of fill and backfill will be performed, or when any change in material occurs that may affect the optimum moisture content or laboratory maximum density. For fill areas requiring more than 50,000 cubic yards of fill, one representative test per 20,000 cubic yards of fill and backfill will be performed, or when any change in material occurs that may affect the optimum moisture content or laboratory maximum density.

3.14.4 Moisture Control

In the stockpile, excavations, or borrow areas, moisture tests will be performed (by others) to determine in situ moisture content. Moisture content shall be maintained within a range needed to achieve specified compaction requirements. The Contractor shall control the moisture content of material being placed as fill, and may perform additional tests of moisture content or make use of tests performed by others to control moisture. Testing of moisture content may be performed by any of the following tests:

- 1) ASTM D 2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (Oven Moisture)
- 2) ASTM D 4643 - Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating

- 3) ASTM D 4944 - Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester
- 4) ASTM D 4959 - Determination of Water (Moisture) Content of Soil by Direct Heating
- 5) During unstable weather, perform tests as dictated by local conditions and approved by the Crescent Junction Operations/Site Manager.

3.15 DISPOSITION OF SURPLUS MATERIAL

Surplus material or other soil material not required or suitable for filling or backfilling, and brush and refuse, shall be removed from Government property or disposed of on site as directed by the Crescent Junction Operations/Site Manager.

-- End of Section --

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PROJECT: CRESCENT JUNCTION DISPOSAL SITE FINAL COVER SYSTEM LOCATION: CRESCENT JUNCTION, UTAH	DOCUMENT NO.: SPECIFICATION-31-00-01
	SECTION NO.: 31 00 01
	COVER-RELATED EARTHWORK
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
0	03/13/2024	SFD			ALL	ISSUED FOR CONSTRUCTION

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SECTION 31 00 01

COVER-RELATED EARTHWORK

This specification section covers only the earthwork in support of the Crescent Junction Disposal Cell Final Cover System conversion to an Evapotranspiration (ET) Cover, including the partial removal of the previously placed Uranium Mill Tailings Remedial Action (UMTRA) Cover.

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes

1. All labor, materials, equipment, and incidentals necessary to perform excavation, backfill, fill, grading, and compaction required for completion of the work shown on the Drawings and specified herein. The work shall include, but not be limited to:
 - a. Dust control.
 - b. Excavation of materials from designated areas.
 - c. Backfill of designated excavated areas.
 - d. Partial removal and reclaiming of materials from previously placed UMTRA cover system.
 - e. Construction of the ET Cover system.
 - f. Placement of erosion and surface water management controls on and adjacent to the ET Cover system.
 - g. Subgrade preparation for the cover system and erosion control features (riprap) surrounding the cover system.
 - h. Finish grading of the site.

1.02 RELATED SECTIONS

- A. Section 02 93 20 Seeding, Mulching, and Restoration
- B. Section 31 00 20 Placement and Compaction of RRM
- C. Section 31 00 00 Earthwork
- D. Section 31 00 50 Method Specification for Material Mixing and Surface Admixture Placement
- E. Section 32 11 22 Riprap and Admixture Rock

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 1. ASTM D75 – Standard Practice for Sampling Aggregates
 2. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils
 3. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))

4. ASTM D1140 – Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
5. ASTM D2922 – (2005) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
6. ASTM D3017 – (2005) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
7. ASTM D3740 – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rocks as Used in Engineering Design and Construction
8. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.04 DEFINITIONS

A. Definitions pertinent to the earthwork requirements of this project include:

1. Excavation: Any man-made cut, cavity, trench, or depression in the Earth's surface formed by earth removal required to reach the lines and grades indicated on the Drawings or specified herein. It shall include removal of soil, silt, clay, sand, gravel, talus, soft or disintegrated rock, boulders, or detached pieces of solid rock.
2. Waste materials excavation: Any waste material excavation or contact with residual radioactive material (RRM) at the site shall be in accordance with the most recent version of the Health and Safety Plan (DOE-EM/GJ1038), Radiation Protection Program (DOE-EM/GJ610), Radiation Protection Program Manual (DOE-EM/GJRAC1885), and other applicable site plans.
3. Borrow soils excavation: Excavation of borrow materials including soil, silt, clay, sand, gravel, talus, soft or disintegrated rock, boulders, and removal of detached pieces of solid rock carried out to reach lines and grades indicated on the Drawings or specified herein. This excavation shall include excavations for cover and finish grading.
4. Over excavation: Excavation carried out beyond the lines and grades indicated on the Drawings or in the Specifications.
5. Percent maximum density: A percentage of the maximum density obtained by the test procedure presented in ASTM D698, as applicable.
6. Subgrade: When referencing the cover system, the subgrade refers to the top of the RRM, tailings, and/or waste soils that were placed, graded, and/or compacted to be covered by the final cover system.
7. Subgrade preparation: Includes fine grading and compaction of excavations for the installation of the cover systems, including drainage ditches, backfills, and cover upon which bedding materials, riprap, or other features are to be constructed.
8. Cover soil: Shall consist of soil removed from the designated borrow source(s) to be used as cover soil.

9. Mancos Shale cover soil: Cover soil excavated from the general area of the disposal area footprint composed completely of Mancos Shale clay.
10. Overburden cover soil: Cover soil excavated from the general area of the disposal area footprint composed of overburden or alluvium soil located above the Mancos Shale layer.
11. Rock/soil admixture: Also referred to as a “Desert Pavement,” is the top layer of the final cover system composed of a defined percent by volume of rock uniformly mixed with a defined percent by volume of cover soil from the designated cover borrows source(s).
12. Unsuitable material: Material not meeting the requirements set forth herein for fill materials or as otherwise determined by the Engineer to be inappropriate and/or unacceptable for use. Unsuitable material shall be disposed of by the Contractor.
13. Common fill: Shall include satisfactory materials from site excavation or from approved borrow for general site grading, subgrade preparation, and other activities, as needed and as directed by the Engineer.
14. Gravel: Rock larger than #4 sieve (4.75 mm).

1.05 SUBMITTALS

- A. All submittals shall be submitted to and approved by the Engineer prior to commencement of related work.
- B. Submit to the Engineer for review the proposed methods of construction, including mixing, dewatering, excavation, filling, compaction, and backfilling for the various portions of the work. The Contractor shall remain responsible for the adequacy and safety of the methods.
- C. Submit to the Engineer mixing method to be utilized to uniformly mix the rock and cover soil for the top rock/soil admixture layer of the cover system per Specification Section 31 00 50 Method Specification for Material Mixing and Surface Admixture Placement.
- D. Submit to the Engineer proposed mixing method to be utilized to uniformly mix dissimilar soil textures for any layer within the cover system.
- E. Submit to the Engineer the type and amount of soil amendments proposed for cover soils. Refer to Specification Section 02 93 20 SEEDING, MULCHING, AND RESTORATION.
- F. Submit to the Engineer proposed mixing method to be utilized to uniformly mix the soil amendments into the material composing the top rock/soil admixture layer of the cover system per Specification Section 31 00 50 Method Specification for Material Mixing and Surface Admixture Placement.

PART 2 PRODUCTS

2.0 COVER MATERIALS

- A. General:
 1. Cover soil materials shall be obtained from the borrow source(s) designated and approved by the Engineer.

2. All soil properties shall be submitted to the Engineer for approval. This includes as a minimum: grain size distribution (ASTM D422 and ASTM D1140) and moisture density relationship (ASTM D698). Other properties may be required by the Engineer.
3. Cover soil to be used within the surface admixture layer shall be tested for agronomic properties to determine whether nutrient and/or organic material amendment is required and to what extent.
4. Rock for inclusion in the surface admixture layer shall be obtained from an approved borrow source with size and durability properties approved by the Engineer. Refer to Specification Section 32 11 22 FINAL COVER SYSTEM RIPRAP AND ADMIXTURE ROCK.
5. The Contractor shall make his own determination of any processing that may be required, and shall perform testing as required to meet the Specifications for the various construction materials.
6. The Engineer shall be granted access to each proposed source to collect samples for testing. The Engineer may perform additional tests to determine if the materials meet the requirements specified herein.
7. Approval will be based on evidence of compliance with the requirements specified herein.

2.1 RRM MATERIAL

RRM material will consist of uranium mill tailings from the Moab Pile, off-pile contaminated soils, and demolition debris and other waste materials stored in the Pile in Moab, Utah. The RRM material will be excavated, mixed and blended, dried to near optimum moisture content for compaction, loaded in containers, and shipped to Crescent Junction for disposal. Off-pile contaminated soil material will be excavated and hauled to the tailings pile and eventually mixed with the tailings. Demolition debris and other waste materials will be excavated and shipped similar to the RRM material. In the waste cell, non-soil materials will be placed in the contaminated RRM fill in a manner that will minimize voids or differential settlement in the waste mass. RRM placement shall comply with Section 31 00 20 PLACEMENT AND COMPACTION OF RRM.

2.2 INTERIM COVER SOIL LAYER

Interim cover soil will be approved borrow soil from the excavation of the Crescent Junction disposal cell. The approved soil for the interim cover soil layer can be overburden and/or Mancos Shale. It will be material that has been produced on-site by modifying the existing overburden soil and/or weathered Mancos Shale excavated on-site. Overburden and/or weathered Mancos Shale shall be excavated, pulverized, wetted, and mixed to produce a uniform fine-grained soil. Soil shall be free of roots, debris, organic or frozen material, and shall have a maximum clod size of 4 inches in greatest dimension at the time of compaction, based on a visual inspection.

2.3 RADON BARRIER

The Radon Barrier is the layer constructed directly on top of the interim cover layer in the waste cell. The Radon Barrier soil shall be produced by modifying the weathered Mancos Shale excavated on-site. Weathered Mancos Shale shall be excavated, separated from other

excavated materials, pulverized, wetted, and mixed to produce a uniform fine-grained fill soil. It shall be free of roots, debris, organic or frozen material, and shall have a maximum particle size of 4-inches at the time of compaction.

Radon Barrier soil used in the cover system shall comply with the criteria listed in Table 1. Testing of Radon Barrier soil shall be performed to verify conformance with the criteria in Table 1 and as described in Sections 3.07 to 3.09.

Placement of Mancos Shale soil will be visually inspected to make sure there are no locations where rock-type particles accumulate in a concentrated location. Particles found in a concentrated location will be removed or reworked per quality control direction.

Table 1. Required Physical Properties of Mancos Shale Cover Soil

Test Property	Test Value	Method
Max. particle size	4-inches	ASTM D 422
Min. percent passing No. 4 sieve	80	ASTM D 422
Min. percent passing No. 200 sieve	50	ASTM D 1140
Min. liquid limit	30	ASTM D 4318
Max. liquid limit	50	ASTM D 4318
Min. plasticity index	10	ASTM D 4318
Max. plasticity index	40	ASTM D 4318

2.4 FROST PROTECTION SOIL LAYER

The frost protection soil layer is the layer constructed directly on top of the radon barrier to provide protection of the underlying radon barrier from potential soil property changes due to freeze/thaw cycles. Frost protection cover soil will be approved borrow soil from the excavation of the Crescent Junction disposal cell. The approved soil for the frost protection soil layer can be overburden and/or Mancos Shale. It will be material that has been produced on-site by modifying the existing overburden soil and/or weathered Mancos Shale excavated on-site. Overburden and/or weathered Mancos Shale shall be excavated, pulverized, wetted, and mixed to produce a uniform fine-grained soil. Soil shall be free of roots, debris, organic or frozen material, and shall have a maximum clod size of 4 inches in greatest dimension at the time of compaction, based on a visual inspection.

2.5 SURFACE ADMIXTURE LAYER

The surface admixture layer is the surface layer composed of a mixture of rock and overburden/alluvium soil at the ratio of 60% rock to 40% soil by volume. The rock for the final cover layers shall be rock material that has long-term chemical and physical durability meeting requirements set forth in Specification Section 32 11 22 FINAL COVER SYSTEM RIPRAP AND ADMIXTURE ROCK. The cover soil shall be overburden or alluvium soil excavated from the site's approved borrow source. The rock and soil shall be mixed with a method submitted per Specification Section 31 00 50 METHOD SPECIFICATION FOR MATERIAL MIXING AND SURFACE ADMIXTURE PLACEMENT.

2.5.1 SOIL FOR ADMIXTURE LAYER

The cover soil to be used in the surface admixture layer shall be overburden or alluvium soil located above the Mancos Shale approved borrow soil from the excavation of the Crescent Junction waste cell or from the existing stockpiles of this material. It will be material that has been produced on-site by modifying the existing overburden soil

excavated on-site. Other sources of cover soil must be approved by the engineer prior to use. Overburden soil shall be excavated, pulverized, wetted, and mixed to produce a uniform fine-grained soil. Soil shall be free of roots, debris, organic or frozen material, and shall have a maximum clod size of 4 inches in greatest dimension at the time of compaction, based on a visual inspection. Cover soil to be used within this surface admixture layer shall be tested prior to placement for agronomic properties to determine whether nutrient and/or organic material amendment is required and to what extent.

2.5.2 ROCK FOR ADMIXTURE LAYER

The rock mixed into the admixture layer shall be sized as designated on the drawings and as specified in Specification Section 32 11 22 RIPRAP AND ADMIXTURE ROCK. The rock for the final cover surface admixture layer shall achieve an acceptable durability score for its intended use, as well as other acceptance criteria as described in Specification Section 32 11 22 RIPRAP AND ADMIXTURE ROCK.

2.6 IMPORTED MATERIAL ACCEPTANCE

A. All imported materials specified in this section are subject to the following requirements:

1. All tests necessary for the Contractor to locate an acceptable source of imported material shall be made by the Contractor. Certification that the material conforms to the Specification requirements along with copies of the test results from a qualified testing laboratory shall be submitted to the Engineer for approval at least 20 days before the material is required for use. Samples shall be representative and clearly marked to show the source of the material and the intended use on the project. Sampling of the material source shall be done by the Contractor in accordance with ASTM D75. Notify the Engineer at least 5 days prior to sampling. The Engineer may, at the Engineer's option, observe the sampling procedures. Tentative acceptance of the material source shall be based on an inspection of the source by the Engineer and/or the certified test results submitted by the Contractor to the Engineer, at the Engineer's discretion. No imported materials shall be delivered to the site until accepted in writing by the Engineer.
2. Classification tests shall be made by the Contractor on samples taken at the place of production prior to shipment. Test results shall be forwarded to the Engineer within 48 hours after receiving results.
3. If tests conducted by the Contractor or the Engineer indicate that the material does not meet Specification requirements, material placement will be terminated until corrective measures are taken.
4. Material that does not conform to the Specification requirements shall be removed and replaced by the Contractor.

2.7 REUSE OF ROCK: Should any rock currently placed be repurposed, the Engineer is to be consulted prior to the commencement of rock removal/movement.

2.8 EQUIPMENT: All equipment to be used for the construction of the ET Cover system and any related monitoring equipment must be submitted to and approved by the Engineer.

PART 3 EXECUTION

3.01 GENERAL

- A. All soils, waste material, and fill materials shall be placed and compacted to the lines and grades shown on the Drawings. The cover layer thicknesses and slopes, as designated in these specifications and plans, shall be measured on final grade for each layer. Survey requirements shall be consistent with the Remedial Action Inspection Plan (DOE-EM/GJ1547-E).
- B. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill materials.
- C. Do not place fill if material is frozen, or if surface upon which fill is to be placed is frozen.
- D. Tolerances: Tolerances will be verified by survey in accordance with the Remedial Action Inspection Plan (DOE-EM/GJ1547-E).
- E. The Contractor shall follow the Spill Prevention, Control, and Countermeasure Plan (DOE-EM/GJ1477) to preclude the accidental discharge of fuel, oil, etc., in order to prevent adverse effects on water quality.
- F. If any portion of the clean fill soil used as subgrade soil does not meet the specified requirements, the Contractor shall remove such material and replace it with fill materials meeting the specification. Material to be removed will be determined by the Engineer.

3.02 DUST CONTROL

- A. The Contractor shall comply with the Crescent Junction Fugitive Dust Control Plan (DOE-EM/GJ1235).

3.03 PROTECTION

- A. Protect existing surface and subsurface features on-site and adjacent to the site as necessary, in accordance with the approved Moab UMTRA Stormwater Pollution Prevention Plan (SWPPP) (DOE-EM/GJ1238), Health and Safety Plan (DOE-EM/GJ1038), Radiation Protection Program (DOE-EM/GJ610), Radiation Protection Program Manual (DOE-EM/GJRAC1885), and other applicable site plans.

3.04 EXCAVATION

- A. Cover materials shall be soil material from the waste cell excavation and rock from approved source(s). Materials shall be excavated, segregated into either overburden/alluvium fill or weathered Mancos Shale, and stockpiled for use as cover materials. Stockpiles shall be at locations shown in the project plans or as directed by the Remedial Action contractor (RAC) Crescent Junction (CJ) Operations/Site Manager.
- B. The Contractor shall execute all miscellaneous earth excavation related to specified tasks required under this contract.
- C. During construction, perform excavation in a manner and sequence that will provide proper drainage at all times.
- D. At all times during construction, provide sloping, run-on/runoff diversion structures, and other best management practices (BMPs) to minimize water entering excavations. Prior to fill placement, ensure excavations are dry so as to obtain a satisfactory subgrade foundation condition.

- E. The Contractor shall perform required excavation to the lines and grades indicated on the Drawings. Where practicable and as approved by the Engineer, suitable materials removed from excavation shall be used as fill in various areas of the site. Excavated material may be stockpiled for later use.
- F. Preparation:
 - 1. Required lines, levels, contours, and datum shall be identified prior to the start of excavation.
 - 2. Unsatisfactory or Excess Materials: Unsatisfactory and excess excavated uncontaminated material generated during the Work and not approved for use in the Work shall be disposed of as directed by the RAC CJ Operations/Site Manager.

3.05 REMOVAL OF EXISTING COVER MATERIAL

- A. Refer to Drawing E-02-C-200 EXISTING COVER REMOVAL. The cover materials placed above the radon barrier for the prior approved UMTRA cover profile shall be removed as indicated on the Drawings and stockpiled for future use.
 - 1. The 6-inch-thick top rock layer shall be removed and reclaimed for future use.
 - 2. The 3-ft-thick frost protection layer soil shall be removed and reclaimed for future use.
 - 3. The 6-inch-thick Infiltration and Biobarrier rock layer shall be removed and reclaimed for future use.
- B. During removal of existing cover materials, care shall be taken to not disturb the previously placed radon barrier. The remaining radon barrier composed of Mancos Shale shall meet the requirements set forth in this specification.

3.06 SUBGRADE AND RRM MATERIAL PLACEMENT

- A. Subgrade Soil Layer (top of waste finish grade): The final grading of this subgrade soil layer shall be as designated in the Drawings with a grading tolerance of +0.17ft with no minimum tolerance.
 - 1. For all material to be placed – subgrade soil related to the final cover system shall be placed as specified in Specification Section 31 00 20 PLACEMENT AND COMPACTION OF RRM for placement of RRM and Specification Section 31 00 00 EARTHWORK for placement of other subgrade material.
 - 2. For material previously placed where partial removal of existing cover materials is performed – quality assurance shall be performed on the upper foot for moisture and density criteria for the remaining cover soil to verify they comply with this specification. Should they not comply, the materials shall be reworked as required to meet requirements set forth in this specification.
- B. RRM Material: RRM Material shall be placed as specified in Specification Section 31 00 20 PLACEMENT AND COMPACTION OF RRM. Quality assurance shall be performed for moisture and density criteria for the subgrade soils. The final grading of this subgrade soil shall be as designated in the Drawings and within the tolerances identified in this specification (Table 2).
- C. Fill materials shall be placed in continuous and approximately uniformly thick layers for their full length and width unless otherwise specified. Refer to Specification Section 31 00

20 PLACEMENT AND COMPACTION OF RRM for placement of RRM and Specification Section 31 00 00 EARTHWORK for placement of other subgrade material.

- D. The method of dumping and spreading the materials shall ensure uniform distribution of the material.
- E. Construction: Shape subgrade to line, grade, and cross section in accordance with the plans and compact as specified. Shape the entire subgrade to line, grade, and cross section.
- F. If subgrade preparation is adversely affected prior to construction completion, the Contractor shall rework the subgrade soil or replace clean fill soil to meet specified requirements. The repaired subgrade shall be approved by the Engineer before any work is placed thereon.
- G. Provide moisture control necessary to successfully complete compaction and construction requirements.
- H. Any areas of subgrade damaged by traffic, erosion, settlement, or other cause, shall be repaired and the grades shown on the drawings shall be reestablished. Any exposed subgrade that exhibits desiccation cracking shall be regraded and compacted prior to placement of any cover material.
- I. Field compaction and moisture testing shall be performed in accordance with ASTM D698 at a rate consistent with the Remedial Action Inspection Plan (DOE-EM/GJ1547-E).

3.07 BACKFILLING – COMMON FILL

- A. Each layer of shaping fill materials leading to the final prepared subgrade shall be compacted to a minimum of 95 percent of maximum dry density as determined by ASTM D698. RRM shall be placed per Specification Section 31 00 20 PLACEMENT AND COMPACTION OF RRM.
- B. Field compaction and moisture testing shall be performed in accordance with ASTM D698 at rate consistent with the Remedial Action Inspection Plan (DOE-EM/GJ1547-E).
- C. All lift surfaces must maintain a uniform slope.
- D. Fill placed at densities outside of the specified allowable density range shall be reworked to meet the density and moisture requirements or removed and replaced by acceptable fill compacted to meet these requirements.
- E. Satisfactory materials may be used for the construction of an adequate subgrade. Material conforming to the requirements of common fill shall be placed in lifts having a maximum thickness of 1 ft measured after compaction.
- F. Clods or hard lumps of earth exceeding 4 inches in greatest dimension shall be broken up or removed before compaction of the material.
- G. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings.
- H. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings, and no soft spots or under compacted areas shall be allowed in the work.
- I. No compaction shall be performed when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

- J. Backfilling shall not be performed when the soil is frozen.

3.08 COVER PLACEMENT

- A. Interim Cover Soil: The Interim Cover Soil layer is the base of the final cover system. The Interim Cover Soil shall be placed in a 1-ft-thick compacted lift as described in Sections 2.2, 3.08, and 3.09. The Interim Cover Soil shall be compacted to a minimum of 90% of the maximum dry density as determined by ASTM D698. Quality assurance shall be performed on the upper foot for moisture and density criteria for the subgrade soils. The final grading of this Interim Cover soils shall be as designated in the Drawings and within the tolerances identified in this specification.
- B. Radon Barrier Layer Soil: Directly on top of the interim cover shall be a 4-ft -thick layer of Mancos Shale as described in Sections 2.3, 3.08, and 3.09. Radon Barrier Layer Soil shall be placed in lifts of approximately 1-ft compacted. The Radon Barrier Layer Soil shall be compacted to a minimum of 90% of the maximum dry density as determined by ASTM D698. Quality assurance shall be performed on each layer for moisture and density criteria. The final grading of this Radon Barrier Layer soil shall be as designated in the Drawings and a minimum total thickness of 4-ft, as confirmed by a post-construction survey as compared to the design grades.
- C. Frost Protection Soil Layer: The frost protection soil layer is to be a 28.5-in-thick cover soil as described in Sections 2.4, 3.08, and 3.09. The frost protection layer shall be placed in two approximately equal depth lifts and compacted to a minimum of 90% of the maximum dry density as determined by ASTM D698. Quality assurance shall be performed on the upper foot for moisture and density criteria for the subgrade soils. The final grading of this Interim Cover soils shall be as designated in the Drawings and within the tolerances identified in this specification.
- D. Surface Admixture Cover Soil: The surface layer is to be a 10-in-thick mixture of rock and cover soil as described in Sections 2.5, 3.08, and 3.09. The rock and soil shall be placed and mixed per Specification Section 31 00 50 METHOD SPECIFICATION FOR MATERIAL MIXING AND SURFACE ADMIXTURE PLACEMENT. Quality assurance shall be performed on the layer for uniformity of rock / soil mixture, moisture, and density criteria for the mixed soils. The final grading of this admixture soil shall be as designated in the Drawings and within the tolerances identified in this specification.
- a. The rock shall be mixed with accepted cover soil to produce an erosion-resistant admixture top layer of the cover system. All rock testing and grain size distribution shall be submitted to the Engineer for approval.
 - b. The rock shall be D_{50} of 2.0 inches.
 - c. The rock-to-soil ratio shall be 60% rock to 40% soil by volume. The rock and soil are to be uniformly mixed. The mixing method and location as well as equipment to be used are to be approved by the Engineer prior to commencing. Uniformity of rock to soil throughout the material to be placed and compacted on the final cover is critical. Quality assurance activities shall verify uniformity of mixing prior to placement on the final cover.
 - d. The rock/soil admixture shall be placed and compacted to the grades and depth shown on the Drawings. Positive drainage shall be maintained at all times.
 - e. The compacted soil density is to be uniform throughout the layer.

- f. At the discretion of the Engineer, the rock/soil admixture may be scarified or disced to a depth not to exceed 6 inches prior to seeding of the final cover after the final grades and depth have been accepted.

3.09 SUMMARY OF COVER AND SUBGRADE/RRM CONSTRUCTION

Table 2. Cover Material Summary¹

Soil Property	Surface Rock/Soil Admixture	Frost Protection Layer	Radon Barrier Layer	Interim Cover
Depth	10 inches	28.5 inches	4 ft	12 inches
Depth, Tolerance	Specification Section 31 00 50 METHOD SPECIFICATION FOR MATERIAL MIXING AND SURFACE ADMIXTURE PLACEMENT	Combined thickness of Frost Protection Layer and Surface Rock/Soil Admixture + 0.1 ft (+1 inch)	+0.17 ft, - 0 ft (+ 2 inches, - 0 inch)	+0.17 ft, - 0 ft (+ 2 inches, - 0 inch)
Allowable soil texture	Overburden/alluvium soil from designated borrow source. Uniformly mixed with rock: 60% rock to 40% soil by volume.	Alluvium soil and/or Mancos Shale soil from designated borrow source.	Mancos Shale soil meeting requirements outlined in Table 1.	Alluvium soil and/or Mancos Shale soil from designated borrow source.
Rock size	D ₅₀ of 2.0-in. diameter	NA	NA	NA
Max. object size	Soil – Nominally 4-in. dia. Refer to Specification Section 32 11 22	4-in. dia.	4-in. dia.	4-in. dia.
Soil compaction Minimum	Specification Section 31 00 50 METHOD SPECIFICATION FOR MATERIAL MIXING AND SURFACE ADMIXTURE PLACEMENT	90% of maximum dry density (ASTM D698)	90% of maximum dry density (ASTM D698)	90% of maximum dry density (ASTM D698)
Soil compaction Maximum	Specification Section 31 00 50 METHOD SPECIFICATION FOR MATERIAL MIXING AND SURFACE ADMIXTURE PLACEMENT	NA	NA	NA
Soil moisture content	Specification Section 31 00 50 METHOD SPECIFICATION FOR MATERIAL	Moisture status to allow adherence to density requirements	Moisture status to allow adherence to density requirements	Moisture status to allow adherence to density requirements

	MIXING AND SURFACE ADMIXTURE PLACEMENT			
Minimum	No minimum other than minimizing dust during placement	No minimum other than minimizing dust during placement	No minimum other than minimizing dust during placement	No minimum other than minimizing dust during placement
Maximum	Optimum moisture content (ASTM D698)	Minimize moisture content while meeting density requirements	Minimize moisture content while meeting density requirements	Minimize moisture content while meeting density requirements

3.10 GRADING

- A. Installation of cover material shall be performed at all places that are indicated on the Drawings, to the lines, grades, and elevations shown or otherwise as directed by the Engineer. During the process of grading, the subgrade shall be maintained in such condition that it shall be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the prosecution or condition of the work.
- B. The Engineer reserves the right to make minor adjustments or revisions in lines or grades as necessary during the progress of the work.
- C. All cut and fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the Drawings or as directed by the Engineer.

3.11 SLOPE SURFACE PREPARATION

- A. All slopes shall be constructed to the lines, grades, and elevations shown on the Drawings or as directed by the Engineer.

3.12 DISPOSAL OF SURPLUS MATERIAL

- A. No excavated materials shall be removed from the site or disposed of by the Contractor except as directed by the RAC CJ Operations/Site Manager.

3.13 SAFETY

- A. The Contractor shall ensure full compliance with applicable requirements of OSHA, the Health and Safety Plan (DOE-EM/GJ1038), Radiation Protection Program (DOE-EM/GJ610), Radiation Protection Program Manual (DOE-EM/GJRAC1885), and other applicable Plans.
- B. Special attention is directed to Title 29 Labor, Part 1518, "Safety and Health Regulations for Construction," and detailed requirements of Subpart P, "Excavations, Trenching and Shoring."
- C. Comply with local and specific requirements of the State of Utah.

3.14 TEMPORARY STOCKPILING

- A. Contractor may temporarily stockpile materials at a staging location approved by the RAC CJ Operations/Site Manager or Engineer in the vicinity of the cover system or construction areas. Confine stockpiles to approved locations only. Do not obstruct roads or streets.
- B. Material shall be placed in temporary stockpiles as follows:
 - 1. Maximum slopes shall be 2H:1V.

3.15 STOCKPILE ACCESS AND EXCAVATION

- A. Take necessary precautions to maintain existing erosion and dust control measures and prevent offsite sediment and dust releases.
- B. When work is completed in the stockpile area, grade area to drain surface water runoff to appropriate collection and discharge points.

3.16 CLEANUP AND DISPOSAL

- A. Garbage, refuse, used oil, and any waste will be handled in accordance with the Site Waste Management Plan.

PART 4 QUALITY CONTROL/QUALITY ASSURANCE

4.01 QUALITY CONTROL

A. General

1. The geotechnical testing firm and laboratory shall, at a minimum, be in compliance with ASTM D3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rocks as Used in Engineering Design and Construction; or AASHTO Accreditation Procedure Manual (AASHTO R 18); or as approved by the Engineer.
2. The Contractor shall test materials as set forth in the applicable referenced sections and as required herein.

B. Material Testing Requirements

1. Only approved borrow sources shall be used for cover soil. Should other borrow sources need to be used or evaluated, the Contractor shall arrange for an inspection by the Engineer of each proposed borrow source prior to the commencement of earthwork operations. During said inspection, the Contractor shall provide any equipment necessary to excavate test pits throughout the limits of the proposed source so as to provide the Engineer with a thorough inspection of the type(s) and uniformity of material(s) throughout the proposed source. Upon the Engineer's visual inspection and preliminary acceptance of a proposed borrow source, the Contractor shall collect representative samples of the borrow soils for subsequent geotechnical testing in accordance with the Remedial Action Inspection Plan (DOE-EM/GJ1547-E). Tests identified in the Remedial Action Inspection Plan (DOE-EM/GJ1547-E) can be altered or changed at the discretion of and as directed by the Engineer.
2. The Contractor is required to submit representative samples of each proposed borrow material to the geotechnical testing laboratory (GTL) at the minimum frequencies specified in the Remedial Action Inspection Plan (DOE-EM/GJ1547-E). The physical property tests shall be completed for each sample and the material approved prior to use of the material at the site. The Contractor shall complete all testing on materials prior to delivery to the site at the frequency specified in the Remedial Action Inspection Plan (DOE-EM/GJ1547-E). Cover materials (soil and rock) must be pre-approved prior to delivery to the site. Additional quality control testing will be performed on samples of delivered material. If, during the course of construction, an alternative borrow source is used, the material must be pre-approved by the Engineer in accordance with the requirements of this Specification prior to delivery to the site.
3. Physical specimens of all proposed foreign borrow materials shall also be submitted to the Engineer, if requested. The Engineer shall have the authority to reject any and all soils that are believed to be inappropriate for earthwork construction.

C. Field Quality Control Testing Requirements

1. The Contractor shall provide all horizontal and vertical controls necessary for all earthworks as well as associated grid layout and staking using benchmarks and monuments, if any, shown on the Drawings and required by these Specifications.
2. Placing soil material and performing earthwork will be subject to periodic QA inspection by the Engineer. The GTL shall provide quality control (QC) inspection as necessary including field moisture and density tests during the compaction of each lift of soil in accordance with the Remedial Action Inspection Plan (DOE-EM/GJ1547-E).

The Contractor shall also provide labor and equipment to prepare smooth surface spot locations as designated by the GTL or the Engineer on which to perform field tests.

3. Following the placement and compaction of each lift of soil, said lift shall be tested in accordance with the Remedial Action Inspection Plan (DOE-EM/GJ1547-E) to determine the in-place compacted dry density and moisture content of the in-place soils, and to determine conformance of these data with the project specifications, before subsequent lifts are placed.
4. Test results outside of the specified requirements shall be considered failing unless otherwise approved by the Engineer. Deficient areas shall be reworked in accordance with approved techniques as stated herein.
5. The Engineer may direct the Contractor to provide inspection trenches or have test pits be cut into the designated borrow area(s) prior to this soil's removal or into the cover system after installation to determine that the Specifications have been met. Such trenches or pits will be of limited depth and size, and shall be backfilled with the material excavated therefrom, or other fill material meeting the requirements for the zones cut into. Backfill shall be compacted to a density equal to that of the contiguous fill.

END OF SECTION

MOAB UMTRA PROJECT MOAB, UTAH PROJECT NO: 35DJ2600	DOCUMENT NO.: 35DJ2600-056-SPEC-31-00-20
	SECTION NO.: 31-00-20
	PLACEMENT AND COMPACTION OF RRM
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
0	12/17/07	WDB	FMP	W. Barton	ALL	ISSUED FOR CONSTRUCTION
1	01/30/08	WDB	FMP	W. Barton	ALL	Page 5, Section 1.3.2: Added Dozers Page 6, Section 3.2.1: Revised Lift Thickness Page 7, Section 3.4.1: Revised Test Frequencies
2	02/27/08	WDB	FMP	W. Barton	ALL	Page 6, Section 2.2: Removed requirement to screen material.
3	04/14/08	WDB	FMP	W. Barton	ALL	Page 5, Section 1.4: Add section 1.4 NQA-1 Quality Level Page 6, Table 1, Revised gradation to limit fines. Page 6, Section 3.2.1: Revised from 10" loose lift thickness to 12" loose lift thickness.
4	06/02/08	WDB	FMP	W. Barton	ALL	General, revised "Tailings" to "RRM" Page 6, Section 2.2: Revised section on material requirements for Interim Cover. Page 6, Section 3.1.1: Revised section to clarify test requirements for Interim Cover. Page 7, Section 3.2.2: Revised moisture requirement to add "optimum plus or minus 5%". Page 7, Section 3.2.5: Added demolition debris sizing. Page 8, Section 3.4.2: Revised moisture requirement to add: for RRM - "optimum plus or minus 3%", and for Interim Cover - "optimum plus or minus 5%".
5	1/23/19	FMP	WDB	W. Barton	ALL	Section 1.2: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 1.3.2: Revised compaction equipment requirements Section 2.1: Revised moisture requirements Section 3.1.1: Revised Energy Solutions to Crescent Junction Operations/Site Manager, revised proctor from 5 points to 4 points, added ASTM reference

**Jacobs**

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MOAB UMTRA PROJECT
MOAB, UTAH
PROJECT NO: 35DJ2600

DOCUMENT NO.:
35DJ2600-056-SPEC-31-00-20

SECTION NO.: 31-00-20

**PLACEMENT AND COMPACTION OF
RRM**

This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
						Section 3.2.1: Revised Computer Aided Earthmoving System and CAES to Computer Based Compaction System, revised lift thickness Section 3.2.2: Revised moisture content requirement Section 3.2.4: Deleted requirement for final lift Section 3.2.5: Revised debris minimization requirements Section 3.4.1: Revised CAES to Computer Based Compaction System Section 3.4.2: Deleted section Section 3.4.3: Revised section number to 3.4.3, revised CAES to Computer Based Compaction System Section 3.5.1: added "for dust suppression" Section 3.5.2: added option to add a protective top layer over Interim Cover for erosion and root protection. Section 3.5.3: Removed "as directed" from last sentence
6	10/17/19	FMP	WDB	W. Barton	ALL	Revised to incorporate Design Change Notice 026. Section 1.3.1: Revised minimum lift thickness, Section 3.2.1: Revised minimum lift thickness, Section 3.4.1, 2: Added requirement to alternate compaction testing between the top half and the bottom half of each lift.

MOAB UMTRA PROJECT MOAB, UTAH PROJECT NO: 35DJ2600	DOCUMENT NO.: 35DJ2600-056-SPEC-31-00-20
	SECTION NO.: 31-00-20
	PLACEMENT AND COMPACTION OF RRM
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
7	03/13/2024	SFD			ALL	Section 1.2: Removed reference to Specification Section 01 33 00 SUBMITTAL PROCEDURES. Deleted "Protection" and "Equipment." Deleted sections 1.3.1, 1.3.2, and 1.3.3. Section 2.2: Deleted section. Section 3.1.1 2): Deleted section. Then, converted Section 3.1.1 3) to 2) Removed reference to Interim Cover. Section 3.2.1: Removed reference to Interim Cover. Throughout specification: Replaced 'computer-based compaction system' with 'computer-based Compaction Control System (CCS)'. Section 3.2.2: Removed reference to Interim Cover. Section 3.2.3 Removed reference to Interim Cover. 2): Deleted section. Section 3.2.3 1): Added "minimum of" in front of 90 percent. Section 3.4.1: Removed reference to Interim Cover. Added "Compaction can be verified by a computer-based and GPS guided Compaction Control System (CCS). This system shall be correlated to in-place density using verification tests upon initial use or when a material change in the RRM soil properties is observed. This correlation establishes the number of passes needed by the CCS to achieve the specified in-place density. Alternatively, on newer models, the system may correlate Compaction Measurement Values (CMV) to in-place density tests as well as utilizing the pass count methodology. When compaction of a lift of RRM is achieved, the CCS will produce a map of the location and thickness of the completed lift. The map utilizes color coding to illustrate the coverage of CMV or pass count that the compactor completed over a lift. These maps and associated records for each lift of soil / RRM placed will constitute documentation of completed lifts and be compiled as construction records. Section 3.5.2: First sentence – deleted "or

						Interim Cover." Deleted the remainder of the section after the first sentence. Section 3.5.3: First sentence – deleted "and Interim Cover soil." Section 3.5.4: Second sentence – deleted "or Interim Cover layers." Removed Interim Cover Placement from this specification section and included it with Section 31 00 01.
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DIVISION 31 – EARTHWORK

SECTION 31 00 20

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-- End of Section Table of Contents --

SECTION 31 00 20
PLACEMENT AND COMPACTION OF RRM

PART 1 GENERAL

This specification covers placement, compaction and testing requirements for RRM material layers at Crescent Junction.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------|--|
| ASTM D 422 | (1963; R 2002el) Particle-Size Analysis of Soils |
| ASTM D 698 | (2000ael) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu ft) |
| ASTM D 1140 | (2000) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve |
| ASTM D 1556 | 2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 2216 | (2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass |
| ASTM D 2488 | (2006) Description and Identification of Soils (Visual- Manual Procedure) |
| ASTM D 2922 | (2005) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 3017 | (2005) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 3740 | (2004a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction |
| ASTM D 4318 | (2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils |
| ASTM D 4643 | (2000) Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating |
| ASTM D 4944 | (2004) Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester |
| ASTM D 4959 | (2016) Standard Test Method for Determination of Water Content of Soil By Direct Heating |

ASTM D 6938 (2007b) In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. All submittals shall be provided to the Crescent Junction Operations / Site Manager to include:

SD-03 Product Data

Materials Handling Plan describing the following: processing and placement of the soil; type, model number, weight and critical dimensions of equipment to be used for soil processing, compaction, scarification, and smooth rolling; method of protecting fill materials from changes in moisture content and freezing after placement.

Testing Laboratory

Name and qualifications of the proposed testing laboratory.

SD-06 Test Reports

RRM/Fill Material Testing Compaction Testing

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests.

1.3 EQUIPMENT

RRM shall be installed with equipment capable of scarifying and preparing the ground surface to receive fill, spreading fill material in uniform lifts, and compacting it to the density required by this specification.

1.4 NQA-1 QUALITY LEVEL

All construction and testing activities included in this specification are designated as Quality Level 2.

PART 2 PRODUCTS

2.1 RRM MATERIAL

RRM material will consist of uranium mill tailings from the Moab Pile, off-pile

contaminated soils, and demolition debris and other waste materials stored in the Pile at Moab. Most of the material will be uranium mill tailings, consisting of contaminated sands, slimes, intermediate material, and cover soil. The RRM material will be excavated, mixed and blended, dried to moisture necessary to meet required compaction specifications, loaded in containers, and shipped to Crescent Junction for disposal. Off-pile contaminated soil material will be excavated and hauled to the tailings pile and eventually mixed with the tailings. Debris and other waste materials will be excavated, placed in containers, and shipped like the RRM material. In the waste cell, non-soil materials will be placed in the contaminated RRM fill in a manner that will minimize voids in the waste mass.

PART 3 EXECUTION

3.1 RRM AND FILL SOIL ASSESSMENT TESTS

Assessment tests shall be performed on RRM to assure compliance with specified requirements and to develop compaction requirements for placement. A minimum of three tests for maximum dry density (ASTM D 698) and moisture content (ASTM D 2216) shall be performed for each type of RRM soil observed. During placement of RRM, quick moisture content tests (ASTM D 4643, ASTM D 4944, or ASTM D 4959) shall be performed as required to maintain moisture control.

3.1.1 Compaction Testing

In-place density testing of RRM will be performed by the Remedial Action Contractor. The following sections describe the type and frequency of tests being performed. When test results indicate that compaction is not as specified, the material will be reworked, replaced and/or recompact to meet specification requirements.

The following type and number of tests are the minimum for each type operation:

- 1) RRM Testing: A representative sample from each principal type or combination of blended RRM materials shall be tested to establish compaction curves using ASTM D 698. A minimum of 4 points shall be used to develop each compaction curve as per ASTM D 698.
- 2) In-place density testing of RRM shall be performed in accordance with Section 3.4 of this specification.

3.2 INSTALLATION

3.2.1 RRM Placement

RRM shall be placed to the lines and grades shown on the drawings. A GPS-guided computer-based Compaction Control System (CCS) can be used to direct fill

placement such that RRM is placed in lifts of nearly uniform thickness which will not exceed an average uncompacted thickness of 24 inches for RRM. In areas where hand operated tampers must be used, the loose lift thickness should not exceed 4 inches.

3.2.2 Moisture Control

RRM shall be placed and compacted within the moisture content range needed to achieve 90% of the laboratory determined maximum dry density of each type of material. The range in moisture content shall be maintained uniform throughout each lift as necessary to achieve 90% compaction and dust control. The moisture content shall be maintained uniform throughout each lift.

3.2.3 Compaction

RRM shall be compacted to meet the following density requirements:

- 1) RRM – minimum of 90 percent of the laboratory determined maximum dry density as determined by ASTM D 698.

3.2.4 Scarification

Scarification shall be performed on all areas of the upper surface of each lift prior to placement of the next lift. Scarification shall be accomplished with approved equipment. The final lift of soil shall not be scarified.

3.2.5 Placement of Demolition Debris

Demolition debris will be placed in the waste cell along with RRM material.

Debris shall not contain free liquids. Debris shall be sized to minimize voids. Pipes and ducts that are 6 inches or greater in diameter shall be crushed or, if crushing is impractical, shall be cut in half longitudinally or filled. Rubber tires shall be cut and placed in order to minimize void space. Debris shall be spread and/or oriented in a manner that results in a minimum of voids.

Debris may be placed as a sacrificial lift at the bottom of the disposal cell in a 2-foot lift. Debris in sacrificial lifts shall contain no free liquids, and oriented in a manner that minimizes voids and contained within the 2-foot lift profile. Sacrificial debris lifts are not subject to moisture and compaction criteria.

3.3 CONSTRUCTION TOLERANCES

The top surface of the RRM shall be no greater than 2 inches above the lines and grades shown on the drawings. No minus tolerance will be permitted.

3.4 CONSTRUCTION TESTS

3.4.1 RRM Tests

Compaction can be verified by the CCS. This system shall be correlated to in-place density using verification tests upon initial use or when a material change in the RRM soil properties is observed. This correlation establishes the number of passes needed by the CCS to achieve the specified in-place density. Alternatively, on newer models, the system may correlate Compaction Measurement Values (CMV) to in-place density tests as well as utilizing the pass count methodology. When compaction of a lift of RRM is achieved, the CCS will produce a map of the location and thickness of the completed lift. The map utilizes color coding to illustrate the coverage of CMV or pass count that the compactor completed over a lift. These maps and associated records for each layer of soil placed will constitute documentation of completed lifts and be compiled as construction records.

Perform compaction Verification Tests, in-place density and moisture content tests on compacted fill material, in accordance with the following requirements:

- 1) Verification tests of in-place density shall be performed during the initial compaction correlation of the CCS and on any soil layers in which the computer-based compaction system indicates that problems occurred obtaining compaction.
- 2) When verification in-place density and moisture content tests are performed on a soil layer, a minimum of two tests shall be performed per 5,000 cubic yards of fill material placed, when the CCS is not used. Compaction testing should alternate between checking compaction in the top half of each lift and the bottom half of each lift.
- 3) Compaction and moisture content tests shall be performed in accordance with the following methods:
 - ASTM D 1556 – Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - ASTM D 2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (Oven Moisture)
 - ASTM D 6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Note: Companion sand cone tests and oven moisture tests must be performed along with nuclear tests until a sufficient number have been performed to demonstrate a clear correlation.

3.4.2 Test Results

Where the CCS indicates acceptable compaction, the computer output for that lift

(lift thickness, location, and pass count or CMV) shall be considered proof of satisfactory lift placement. If the CCS indicates that adequate compaction is not achieved, the lift shall be reworked until an acceptable result is achieved. Verification test results of ASTM D6938, In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth), shall be used to confirm the acceptability of the computer-based compaction system results.

3.5 PROTECTION

3.5.1 Moisture Content

After lift placement, moisture content shall be maintained for dust suppression until the next lift is placed.

3.5.2 Erosion

Erosion that occurs in the RRM shall be repaired and grades re-established.

3.5.3 Freezing and Desiccation

Freezing and desiccation of the RRM shall be prevented. If freezing or desiccation occurs, the affected soil shall be reconditioned.

3.5.4 Retests

Areas that have been repaired shall be retested as directed. Repairs to the RRM shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

-- End of Section --

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PROJECT: CRESCENT JUNCTION DISPOSAL SITE FINAL COVER SYSTEM LOCATION: CRESCENT JUNCTION, UTAH	DOCUMENT NO.: 35DJ2600-056-SPEC-31-00-50
	SECTION NO.: 31 00 50
	METHOD SPECIFICATION FOR MATERIAL MIXING AND SURAFCE ADMIXTURE PLACEMENT
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
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METHOD SPECIFICATION FOR MATERIAL MIXING AND SURFACE ADMIXTURE
PLACEMENT

To be determined

---END OF SECTION---



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MOAB UMTRA PROJECT
MOAB, UTAH
PROJECT NO: 35DJ2600

DOCUMENT NO.:
35DJ2600-056-SPEC-31-32-11

SECTION NO.: 31-32-11

**SURFACE WATER MANAGEMENT AND
EROSION CONTROL**

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REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
0	12/17/07	WDB	FMP	W. Barton	ALL	ISSUED FOR CONSTRUCTION
1	1/30/08	WDB	FMP	W. Barton	ALL	Page 4, Sections 2.3 and 3.1: Added a tackifier or crusting agent for erosion control.
2	1/23/19	FMP	WDB	W. Barton	ALL	Section 1.2: Revised Construction Manager to Crescent Junction Operations/Site Manager, Section 2.3: Revised Construction Manager to Crescent Junction Operations/Site Manager, Section 3.2: Revised Construction Manager to Crescent Junction Operations/Site Manager, Section 3.4: Revised Construction Manager to Crescent Junction Operations/Site Manager
3	03/13/24	SFD			2, 3, 4	Section 1.2: Removed reference to Section 01 33 00, Submittal Procedures. Section 2.3: Removed reference to Section 33 40 01, Storm Drainage. Section 3.4: changed 'weekly' to 'monthly'

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SECTION 31 32 11

SURFACE-WATER MANAGEMENT AND EROSION CONTROL

PART 1 GENERAL

1.1 SCOPE

This section includes materials and placement of silt fence, erosion mat, check dams, construction entrances, diversions, ditches, channels, berms, and stabilization; and maintenance of sedimentation basins and surface-water management and erosion control measures.

1.2 SUBMITTALS

Approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. All submittals shall be provided to the Crescent Junction Operations / Site Manager to include:

SD-03 Product Data

Manufacturer’s data on silt fence;

Manufacturer’s data on erosion control matting

SD-08 Manufacturer’s Instructions

Manufacturer’s installation and maintenance instructions

PART 2 PRODUCTS

2.1 SILT FENCE

Furnish silt fence with either woven or nonwoven geotextile. Silt fence shall be:

- a. Woven geotextile consisting of slit films of polypropylene treated with ultraviolet light stabilizers, or nonwoven geotextile consisting of long chain polymeric filaments or polyester yarns, inert to chemicals commonly found in soils and to hydrocarbons, and resistant to mildew, rot, insects, and rodent attack.
- b. Reinforcement Backing: Shall be minimum 14-gauge steel wire and maximum mesh spacing of 6 inches or synthetic netting of equal strength. Use of reinforcement backing can be eliminated if post spacing is a maximum of 6 feet and the geotextile tensile strength is at least 200 pounds.
- c. Posts: Shall be either wood or steel with minimum length of 4 feet. Wood posts shall be at least 2 inches by 2 inches of oak or similar hardwood. Steel posts shall be round or shaped as a “U”, “T”, or “C”. Steel posts shall have a minimum weight of 1.33 pounds per linear foot and shall have projections for fastening reinforcement to silt fence.
- d. Wire Staples: Shall be at least 9-gauge thickness with a minimum length of 1 inch.

- e. A preassembled silt fence meeting the material requirements may be used instead of a field constructed silt fence.

2.2 EROSION MAT

Furnish erosion mat that shall be a woven blanket-like fabric made of biodegradable yarn with the following material properties:

- a. Material Content: Coir Yarn: 100 percent; containing 45 percent Lignin, 55 percent Cellulose (approximately)
- b. Weight: Minimum 22.7 ounces per square yard;
- c. Open Area: 38 percent (approximately); and
- d. Average Mesh Opening: 0.4-in. × 0.5-in.

Furnish erosion mat that will resist degradation for a minimum 6-month period after installation.

Furnish erosion mat having a permissible velocity of 7 feet per second.

2.3 OTHER MATERIALS

- a. Culverts shall be in accordance with design plans and details.
- b. Construction entrances shall be in accordance with design plans and details.
- c. Tackifiers or crusting agents shall be used to reduce soil erosion as directed by the Crescent Junction Operations / Site Manager.
- d. Materials for other surface-water management and erosion controls shall be in accordance with design plans and details.

2.4 EQUIPMENT

Furnish equipment to perform work specified in this section.

PART 3 EXECUTION

3.1 INSTALLATION

- a. Install silt fence in accordance with Manufacturer's Instructions.
- b. Install check dams in ditches and channels in accordance with project plans and details.
- c. Tackifiers or crusting agents shall be applied in accordance with manufacturer's application instructions.
- d. Construct channels, ditches, and other earthwork as shown on the construction drawings and in accordance with the Contractor's Surface-Water Management and Erosion Control Work Plan. Earthwork for channels, ditches, and berms shall be in accordance with Section 31 00 00, EARTHWORK.

3.2 ADDITIONAL REQUIREMENTS

Prevent the runoff of polluting substances such as silt, clay, fuels, oils, and contaminated soils from migrating into water supplies and surface waters.

Remove accumulated silt and debris from behind the face of the silt fence when the silt deposits reach approximately one half the height of the fence. Replace silt fence geotextile damaged during maintenance operations. Removed silt and debris shall be placed in locations approved by the Crescent Junction Operations / Site Manager.

3.3 MAINTENANCE

Clean, maintain, repair, and replace surface-water management and erosion controls for the duration of the contract in accordance with the Contractor's Surface-Water Management and Erosion Control Work Plan.

3.4 INSPECTIONS

Inspect surface-water management and erosion control measures and sedimentation basins to evaluate their effectiveness and need for maintenance. Any required repairs to the surface-water management and erosion control measures and sedimentation basins shall be initiated upon discovery, but no later than 24 hours after discovery. Inspections shall occur, at a minimum, at the following frequencies:

- a. Monthly.
- b. Daily after each rain event exceeding 0.5 inch.
- c. Daily during prolonged rainfall events.

Records of inspections shall be kept on file on site by Contractor and shall be submitted monthly to the Crescent Junction Operations / Site Manager. The records of inspection shall include the following:

- a. Summary of the scope of the inspection.
- b. Name of inspector.
- c. Inspection date.
- d. Inspection location.
- e. Purpose of the inspection (regular monthly, following a storm, etc.).
- f. Observations relative to performance of the surface-water management and erosion control measures.
- g. Any necessary corrective actions.
- h. Corrective actions completed and their performance since the previous inspection.

-- End of Section --

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PROJECT: CRESCENT JUNCTION DISPOSAL SITE FINAL COVER SYSTEM	DOCUMENT NO.: SPECIFICATION-32-11-22
	SECTION NO.: 32 11 22
	FINAL COVER SYSTEM RIPRAP AND ADMIXTURE ROCK
LOCATION: CRESCENT JUNCTION, UTAH	
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

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SECTION 32 11 22

FINAL COVER SYSTEM RIPRAP AND ADMIXTURE ROCK

PART 1 GENERAL

This RIPRAP AND ADMIXTURE ROCK Specification covers only the earthwork in support of the Moab UMTRA Project Final Cover System conversion to an Evapotranspiration (ET) Cover, including the removal of the previously approved final cover and placement of the new ET Cover. Specification Section 32 11 23 contained in the Final Remediation Action Plan (DOE-EM/GJ1547) shall be used for aggregate and riprap used at the Crescent Junction site that is not part of the Disposal Cell Final ET Cover System.

1.1 RELATED SECTIONS

- | | |
|---------------------|---|
| A. Section 02 93 20 | Seeding, Mulching, and Restoration |
| B. Section 31 00 01 | Cover Related Earthwork |
| C. Section 31 00 20 | Placement and Compaction of RRM |
| D. Section 31 32 11 | Surface Water Management and Erosion Control |
| E. Section 31 00 50 | Method Specification for Material Mixing and Surface
Admixture Placement |
| F. Section 32 11 23 | Aggregate and Riprap |

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

- | | |
|--------------|--|
| AASHTO T 11 | (2005) Standard Method of Test for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing |
| AASHTO T 19 | (2004) Standard Method of Test for Bulk Density ("Unit Weight") and Voids in Aggregate |
| AASHTO T 27 | (2006) Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates |
| AASHTO T 99 | (2001; R 2004) Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop |
| AASHTO T 180 | (2004) Standard Method of Test for Moisture- Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop |
| AASHTO T 193 | (2003) Standard Method of Test for The California Bearing Ratio |
| AASHTO T 224 | (2001; R 2004) Correction for Coarse Particles in the Soil Compaction Test |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------|--|
| ASTM C 1260 | (2005a) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method) |
| ASTM C 127 | (2004) Standard Test Method for Density, Relative Density (Specific |

ASTM C 128	Gravity), and Absorption of Coarse Aggregate (2004a) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C 131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 29/ C 29M	(1997; R 2003) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C 88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 698	(2000a) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu ft)
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002e) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³)
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2006) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 6938	(2007b) In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 75	(2003) Standard Practice for Sampling Aggregates
ASTM E 11	(2004) Wire Cloth and Sieves for Testing Purposes
ASTM D5873	(2014) Standard Test Method for Determination of Rock Hardness by Rebound Hammer Method

1.3 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.3.1 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in AASHTO T 99 or AASHTO T 180 abbreviated as a percent of laboratory maximum dry density. The degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4-inch sieve shall be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 99 or AASHTO T 180 Method D and corrected with AASHTO T 224.

1.4 SUBMITTALS

Approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. All submittals shall be provided to the Engineer:

- Sampling and Testing, G;
- Field Density Tests, G;
- Certified copies of test results for approval not less than 10 days before material is required for the work.
- Calibration curves and related test results prior to using the device or equipment being calibrated.

- Copies of field test results within 24 hours after the tests are performed.

1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Remedial Action Contractor (RAC) Crescent Junction Operations/Site Manager or Engineer may specify the time and location of the tests. Copies of test results shall be furnished to the RAC Crescent Junction Operations/Site Manager and Engineer within 24 hours of completion of the tests.

1.5.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the RAC Crescent Junction Operations/Site Manager or Engineer.

1.5.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.5.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with AASHTO T 27 and AASHTO T 11. Sieves shall conform to ASTM E 11.

1.5.2.2 Moisture-Density Determination

The laboratory maximum dry density and optimum moisture content shall be determined in accordance with AASHTO T 99 or AASHTO T 180, Method D and corrected with AASHTO T 224.

1.5.2.3 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 6938. For the method presented in ASTM D 6938 the calibration curves shall be checked and adjusted if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 6938 result in a wet unit weight of soil and when using this method, ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 6938, on each different type of material being tested at the beginning of a job.

1.5.2.4 Wear Test

Wear tests shall be made on aggregate material in conformance with ASTM C 131.

1.5.2.5 Soundness

Soundness tests shall be made on aggregate in accordance with ASTM C 88.

1.5.3 Testing Frequency

1.5.3.1 Tests on Proposed Rock Material

To demonstrate that the proposed material meets all specified requirements, one of each of the following tests shall be performed on the proposed rock material prior to commencing construction. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis.
- b. Durability per Table 1.

1.5.4 Approval of Rock Material

The source of the material shall be selected prior to the time the material will be required in the work. Approval of material will be based on test results.

1.6 WEATHER EFFECTS

Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.7 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work shall be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.8 NQA-1 QUALITY LEVEL

All rock armoring activities for the Disposal Cell at Crescent Junction, including: the Cover System, Apron Riprap, Slope Riprap, and Channel Armor are designated as Quality Level 2. All other work (not on the Disposal Cell) is non-Quality related.

PART 2 PRODUCTS

2.1. Riprap

Riprap for slope and channel protection shall be provided at locations indicated on the drawings. Riprap shall be sized in accordance with plans and as listed in Tables 2 and 3.

2.1.1 Stone for Admixture Cover Layer and Riprap

Stone for the final cover surface rock/soil admixture layer and rock armoring, shall be rock material that has long-term chemical and physical durability. Rock for final cover layers shall achieve an acceptable score for its intended use, in accordance with the following rock scoring and acceptance criteria (Table 1):

Table 1. NRC Table of Scoring Criteria for Rock Quality

Laboratory Test	Weighing Factor			10	9	8	7	6	5	4	3	2	1	0
	L*	S*	I*	Good			Fair			Poor				
Specific Gravity	12	6	9	2.75	2.70	2.65	2.60	2.55	2.50	2.45	2.40	2.35	2.30	2.25
Absorption, %	13	5	2	.1	0.30	0.50	0.67	0.83	1.0	1.5	2.0	2.5	3.0	3.5
Sodium Sulfate, %	4	3	11	1.0	3.0	5.0	6.7	8.3	10.0	12.5	15.0	20.0	25.0	30.0
LA Abrasion, %	1	8	1	1.0	3.0	5.0	6.7	8.3	10.0	12.5	15.0	20.0	25.0	30.0
Schmidt Hammer	11	13	3	70	65	60	54	47	40	32	24	16	8	0

* L = Limestone, S = Sandstone, I = Igneous

Notes:

- 1) Scores were derived from Tables 6.2, 6.5, and 6.7 of NUREG /CR-2642, Long-Term Survivability of Riprap for Armoring Uranium Mill Tailings and Covers: A Literature Review, 1982.
- 2) Weighing Factors are derived from Table 7 of "Petrographic Investigations of Rock Durability and Comparisons of Various Test Procedures," by G.W. Dupuy, Engineering Geology, July 1965. Weighing factors are based on inverse of ranking of test methods for each rock type. Other tests may be used; weighing factors for these tests may be derived using Table 7, by counting upward from the bottom of the table.
- 3) Test methods should be standardized, if a standard test is available and should be those used in NUREG/CR2642, so that proper correlations can be made.

2.1.1.1 Rock Acceptance Criteria

An acceptable rock score depends on the intended use of the rock. The rock's score must meet the following criteria:

- For occasionally saturated areas, which include the top and sides of the final cover, the rock must score at least 50% or the rock is rejected. If the rock scores between 50% and 80% the rock may be used, but a larger D₅₀ must be provided (oversizing). If the rock score is 80% or greater, no oversizing is required.
- For frequently saturated areas, which include all channels and buried slope toes, the rock must score 65% or the rock is rejected. If the rock scores between 65% and 80%, the rock may be used, but must oversized. If the rock score is 80% or greater, no oversizing is required.

Oversize rock as follows (**Important Note: Any oversizing of rock must be approved by the Engineer**):

- Subtract the rock score from 80% to determine the amount of oversizing required. For example, a rock with a rating of 70% will require oversizing of 10 percent (80% – 70% = 10%).
- The D₅₀ of the stone shall be increased by the oversizing percent. For example, a stone with a 10% oversizing factor and a D₅₀ of 12 inches will increase to a D₅₀ of 13.2 inches. The final thickness of the stone layer shall increase proportionately to the increased D₅₀ rock size. For example, a layer thickness equals twice the D₅₀, such as when the plans call for 24 inches of stone with a D₅₀ of 12 inches, if the stone D₅₀ increases to 13.2, the thickness of the layer of stone with a D₅₀ of 13.2 should be increased to 26.4 inches.
- Additional samples shall be obtained and tested when approximately one-third and two-thirds of the total volume of material has been produced, and a final sample shall be obtained and tested near completion of production. If the total volume of material placed for riprap and bedding material is greater than 30,000 cubic yards, a gradation test shall be performed for each additional 10,000 cubic yards, or fraction thereof produced.

2.1.2 Stone Layers for the Waste Cell Final Cover

Stone shall be provided and installed for the following Final Cover Layers (Table 2):

Table 2. Rock Application Areas

Application	Type of Material	Material Size
Cover Rock/Soil Admixture*	Riprap 1,000 yr.*	D ₅₀ 2.0 in. *
Cover East/West Side Slope	Riprap 1,000 yr.	D ₅₀ 2.0 in.
East/West Apron Armor	Riprap 1,000 yr.	D ₅₀ 6.0 in.
Cover North Side Slope	Riprap 1,000 yr.	D ₅₀ 3.0 in.
North Apron Armor	Riprap 1,000 yr.	D ₅₀ 8.0 in.
Cover South Side Slope	Riprap 1,000 yr.	D ₅₀ 3.0 in.
South Apron Armor	Riprap 1,000 yr.	D ₅₀ 12.0 in.

* Rock in cover top admixture layer

2.1.2.1 Cover Surface Admixture Layer

The rock in the cover surface admixture layer shall meet the 1,000-year lifespan rock scoring criteria. The gradation shall be as listed in Table 3. Gradations will be performed at the source. The rock supplier will certify the rock that is delivered to the site with no additional testing post-delivery required.

Table 3. Gradation of Final Cover Admixture Rock & Perimeter Riprap

Sieve Designation	Cover Rock/Soil Admixture*, East and West Side Slope	East and West Apron	North and South Side Slope	North Apron	South Apron
D ₅₀ (in)	2	6	3	8	12
Min Thickness (in)	4	18	6	24	36
Bedding Thickness (in)	4		4		
Gradation Requirements					
21 inches					100
12 inches				90-100	10-65
10 inches				45-90	0-40
8 inches		90-100		35-50	
7 inches		45-90			
6 inches		35-55		0-30	0-20
5 inches			100		
4 inches	100	10-40			

Sieve Designation	Cover Rock/Soil Admixture*, East and West Side Slope	East and West Apron	North and South Side Slope	North Apron	South Apron
3 inches			5-100		
2 inches	5-100				
1.5 inch	0-42	5-30	0-25		0-5
3/4 inch	0-18		0-18		
1/2 inch		0-30			
No 4	0-5	0-5	0-5	0-5	

* Rock in cover top admixture layer

Note: The Contractor is not required to provide washed riprap, and the gradations shown in this table allow a small percentage of fines. The Contractor shall, however, minimize the amount of fine material to prevent segregation of fines from riprap and the concentration of fine materials in any location. See Section 3 EXECUTION for more direction on placement of riprap to limit concentration of undersized material.

2.1.2.2 Final Cover Edge Riprap

The Cover Edge consists of the perimeter edge of Waste Cell slope and a 10-ft transition zone along the top of the slope. Cover Edge stone sizes, thicknesses, and gradations shall correspond to the adjacent slope as listed in Table 3 (i.e. transition zone above the east and west slope shall have D₅₀ rock 2-inch and 4-inches thick, min. with 4-inches of bedding material beneath the rock while the north and south slope shall have D₅₀ rock 3-inch and 6-inches thick, min. with 4-inches of bedding material beneath the rock). Riprap shall be placed on the Final Cover Edges in accordance with the locations shown on the Final Cover Plans. The riprap must meet the 1,000-year lifespan rock scoring criteria (Table 1). Riprap shall have bedding material placed below as indicated on the drawings and Table 3 above - following gradation requirements specified in Section 2.2.

2.1.2.3 Apron Armor Riprap

Apron armor riprap for the Waste Cell shall have stone sizes, thicknesses, and gradations as listed in Table 3. Riprap armoring shall be placed in accordance with locations shown in the drawings and table 3 with gradations as listed. The riprap must meet the 1,000-year lifespan rock scoring criteria (Table 1).

2.2 Bedding Material

Bedding material shall be obtained from borrow areas approved by the Engineer. The Contractor shall process the materials, as required, to meet the gradation requirements specified below.

2.2.1 Gradation

Bedding material shall be reasonably well-graded within the following limits (Table 4):

Table 4. Bedding Gradation

U. S. Standard Sieve Size (Nominal) (Square Openings)	Percent Passing (by weight)
3 inches	100
1-½ inch	50–100
¾ inch	37–82
No. 4	20–50
No. 20	0–14
No. 100	0–5

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the RAC Crescent Junction Operations/Site Manager or Engineer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 Placement and Compaction of Riprap

For the Crescent Junction Disposal Cell, the Contractor must supply and install riprap such that the riprap material does not segregate. The objective is a uniform distribution of the specified riprap gradation. If excessive fine material is present in the riprap, it may settle to the bottom of a truck during transport and segregate from the riprap when dumped. The Contractor shall minimize the fines in the riprap and spread the stone in a manner that prevents concentration of fine materials. Visual inspection of the riprap placement will be performed by the inspection personnel and any pockets of fines observed will be required to be replaced with material containing a uniform distribution of the specified material gradation. The Contractor shall minimize segregation of materials when bedding material is placed in conjunction with the installation of riprap and when no bedding material is required. The following shall be adhered to when installing riprap and/or bedding material unless submitted to and approved by the Design Engineer.

- A. Erosion protection materials shall be handled, loaded, transported, stockpiled, and placed in a manner that avoids nonconformance with specifications due to segregation and degradation, including materials moved to and from stockpiles.
- B. Subgrade preparation shall be as specified in Specifications.
- C. The bedding material shall be spread and compacted in one layer.
- D. Placing of material by methods that will tend to segregate particle sizes within the layer will not be permitted.

- E. Riprap material, up to a maximum nominal size of 12 inches, may be placed by dumping and may be spread by bull-dozers or other suitable equipment.
- F. Dumped riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the bedding material. The larger stones shall be well distributed throughout the mass. The finished riprap shall be free from pockets of small stones and clusters of larger stones.
- G. Placing stone by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted.
- H. Rearranging of individual stones by mechanical equipment or by hand may be required to the extent necessary to obtain a well-keyed and reasonably well-graded distribution of stone sizes.
- I. Larger pieces of riprap may require individual placement by equipment. Hand arrangement will be required only to the extent necessary to secure acceptable results.
- J. Stones shall be selected and positioned so as to produce an essentially solid, densely placed face of rock with all stones firmly wedged in place. Any stones that are not firmly wedged shall be adjusted and additional selected stones inserted or existing stones replaced, so as to achieve a solid interlock.
- K. For riprap placed by clam-shell or similar equipment, hand arrangement will be required only to the extent necessary to secure the results specified herein. Stones shall be selected individually and positioned manually under experienced supervision so as to produce an essentially solid layer with all stones firmly wedged in place. Any stones that are not firmly wedged, shall be adjusted by crow-bars or similar tools and additional selected stones inserted, or existing stones replaced, so as to achieve solid interlock.
- L. Each layer of riprap shall be track-walked by two passes of a Caterpillar D6 bulldozer or equal unless otherwise approved by the Engineer. Riprap shall be spread in a manner that will achieve full coverage and a uniformly distributed well-keyed, densely placed layer.
- M. Construction equipment other than spreading and compaction equipment shall not be allowed to move over the placed riprap material and bedding material layers except at equipment crossovers as designated by the Engineer. Fill materials shall be placed temporarily at equipment crossovers to prevent degradation of placed riprap materials.
- N. Each crossover shall be cleaned of all contaminating materials and approved by the Engineer before additional materials are placed in these areas. Other construction equipment may move over placed riprap and bedding layers. The Engineer may restrict such traffic to minimize damage to completed layers. Areas of riprap and bedding layers damaged by construction equipment shall be restored to meet the requirements of these Specifications.

3.3.1 Tolerances

- A. The material layers shall be placed generally to the limits and thicknesses shown on the Drawings within the following tolerances:
 - 1. The top of the prepared subgrade and/or bedding subgrade shall be within +0.1 foot of the design elevations.
 - 2. Top of bedding material shall be within +0.1 foot of the design elevations.
 - 3. The in-place thickness of riprap material shall be between 90 percent and 125 percent of the thickness shown.
 - 4. Local irregularities not exceeding the thickness limits above will be permitted provided that such irregularities do not form noticeable mounds, ridges, swales or

depressions that could cause concentrations of surface runoff or form ponds or gullies.

5. The material placed meets the gradation requirements specified.

- B. Riprap layer thickness will be directly measured on a specified grid to determine that minimum thickness requirements are met. A specified area is determined on top of the riprap layer. The rock within the grid is removed to the top of the bedding layer (when appropriate). A measurement device (i.e., tape measure) may be used to determine the distance from the top of the bedding to the top of the riprap layer.
- C. Materials segregated or not placed according to the above requirements shall be regraded or adjusted, or removed and replaced using appropriate equipment, to conform with the tolerances and limits given above. Materials not meeting the requirements of this Section shall be removed and placed with specified materials. Rejected materials shall be disposed of at designated disposal sites. Materials not meeting the grading requirements shall be reprocessed or discarded. The Contractor may require modification of the processing and grading operations to ensure that the specified grading requirements are met.

3.4 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed by the RAC Crescent Junction Operations/Site Manager.

-- End of Section --

MOAB UMTRA PROJECT MOAB, UTAH PROJECT NO: 35DJ2600	DOCUMENT NO.: 35DJ2600-056-SPEC-32-11-23
	SECTION NO.: 32-11-23
	AGGREGATE AND RIPRAP
This title sheet is the first page of the specification and a record of each issue or revision. The pages revised and the description of the revision should be noted under remarks.	

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
0	12/17/07	WDB	FMP	W. Barton	ALL	ISSUED FOR CONSTRUCTION
1	1/30/08	WDB	FMP	W. Barton	ALL	Page 11, Table 3, Revised Gradations to allow small amount of fines.
2	2/27/08	WDB	FMP	W. Barton	ALL	Page 8, Section 1.5, Revised weather limitations. Page 11, Section 2.1.6.2, revised riprap thicknesses.
3	4/15/08	WDB	FMP	W. Barton	ALL	Page 8, Section 1.7: Added section about NQA-1 and Quality Levels.
4	06/03/08	WDB	FMP	W. Barton	ALL	Revised Section 1.4.2.2, deleted requirements to check Liquid Limit and Plasticity Index. Revised Section 1.4.3.1, deleted requirements to check Liquid Limit and Plasticity Index.
5	07/03/08	WDB	FMP	W. Barton	ALL	Revised Section 2.1.4, Riprap: Added sentence clarifying: TABLE 1 for non-disposal cell aggregate TABLE 3 for disposal cell aggregate/riprap Revised Section 2.1.6.1 Biobarrier: Added sentence describing the filter requirements of biobarrier material. Revised TABLE 3: Adjusted gradations to increase sizes of materials as follows: Cover Top - D50 = 2 in Cover N, E & W edge - D50 = 4 in Cover South Edge/Slope - D50 = 6 in CJ East and West Apron - D50 = 6 in CJ North Apron - D50 = 8 in CJ South Apron - D50 = 12 in Added note to TABLE 3: Contractor to

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
						limit the amount of fines associated with riprap to minimize segregation of riprap during installation. Revised Section 3.6 Installation of Riprap: Added paragraph requiring Contractor to minimize fines and install riprap such that it does not segregate.
6	09/09/10	WDB	FMP	W. Barton	ALL	Revise Table 3, Cover Biobarrier gradation: change range for 1 ½ inch sieve from 40-50 to 40-60.
7	05/20/11	WDB	FMP	W. Barton	ALL	Revise Spec Section 2.1.6, Stone Layers for the Waste Cell Final Cover, to change riprap D50 sizes, and gradations . Table 3 was extensively revised.
8	08/18/11	WDB	FMP	W. Barton	ALL	Revise Table 3, Gradation of fines in accordance with C+D 065 and CID 067.
9	1/23/19	FMP	WDB	W. Barton	ALL	Section 1.3: Revised Construction Manager to Crescent Junction Operations/Site Manager Section 1.4: Revised Contracting Officer to Crescent Junction Operations/Site Manager Section 1.4.1: Revised Contracting Officer to Crescent Junction Operations/Site Manager Section 3.3: Revised Contracting Officer to Crescent Junction Operations/Site Manager
10	03/13/24	SFD				Part 1 GENERAL: added "This specification covers aggregate and riprap on the project not directly associated with the disposal cell. The riprap and rock associated with the disposal cell is covered by Specification Section 33 11 22 FINAL COVER SYSTEM RIPRAP AND ADMIXTURE." Section 1.3: Deleted reference to Specification Section 01 33 00 Submittal Procedures Section 1.7: Changed "Cover Biobarrier, Top" to "Admixture Rock" Section 2.1: Deleted rows with Cover Biobarrier, Cover Top, Cover Apron Riprap, Cover Slope Riprap Section 2.1.4: last sentence changed "Table 3, below" to "Specification Section 32 11 22." Section 2.1.5: deleted this section. Section 2.1.5.1: changed Section 2.1.5.1 to 2.1.4.1 Section 2.1.6: deleted this section. Section 2.1.6.1: deleted this section.

REV.	DATE	BY	CKD	APPROVED	PAGES	REMARKS
						Section 2.1.6.2: deleted this section. Section 2.1.6.3: deleted this section.

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SECTION 32 11 23

AGGREGATE AND RIPRAP

PART 1 GENERAL

This specification covers aggregate and riprap on the project not directly associated with the disposal cell. The riprap and rock associated with the disposal cell is covered by Specification Section 33 11 22 FINAL COVER SYSTEM RIPRAP AND ADMIXTURE.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 11	(2005) Standard Method of Test for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
AASHTO T 19	(2004) Standard Method of Test for Bulk Density ("Unit Weight") and Voids in Aggregate
AASHTO T 27	(2006) Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
AASHTO T 99	(2001; R 2004) Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 180	(2004) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop
AASHTO T 193	(2003) Standard Method of Test for The California Bearing Ratio
AASHTO T 224	(2001; R 2004) Correction for Coarse Particles in the Soil Compaction Test

ASTM INTERNATIONAL (ASTM)

ASTM C 1260	(2005a) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 127	(2004) Standard Test Method for Density , Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C 128	(2004a) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C 131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 1260	(2005a) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 29/C 29M	(1997; R 2003) Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
ASTM C 88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 698	(2000ael) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu ft)
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002el) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 Kn-m/m ³)
ASTM D 2167	(1994; R 2001) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2006) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 6938	(2007b) In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 75	(2003) Standard Practice for Sampling Aggregates
ASTM E 11	(2004) Wire Cloth and Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Untreated Base Course

Untreated Base Course (UBC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in AASHTO T 99 or AASHTO T 180 abbreviated as a percent of laboratory maximum dry density. The degree of compaction for material having more than 30 percent by weight of their particles retained on the ¾ inch sieve shall be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 99 or AASHTO T 180 Method D and corrected with AASHTO T 224.

1.3 SUBMITTALS

Approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. All submittals shall be provided to the Crescent Junction Operations/Site Manager to include:

SD-06 Test Reports

Sampling and Testing, G;

Field Density Tests , G;

Certified copies of test results for approval not less than 10 days before material is required for the work.

Calibration curves and related test results prior to using the device or equipment being calibrated.

Copies of field test results within 24 hours after the tests are performed.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency . The Crescent Junction Operations/Site Manager may specify the time and location of the tests. Copies of test results shall be furnished to the Crescent Junction Operations/Site Manager within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Crescent Junction Operations/Site Manager.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with AASHTO T 27 and AASHTO T 11. Sieves shall conform to ASTM E 11.

1.4.2.2 Moisture-Density Determinations

The laboratory maximum dry density and optimum moisture content shall be determined in accordance with AASHTO T 99 or AASHTO T 180, Method D and corrected with AASHTO T 224.

1.4.2.3 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 6938. For the method presented in ASTM D 6938 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 6938 result in a wet unit weight of soil and when using this method. ASTM D 938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 6938. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 6938, on each different type of material being tested at the beginning of a job.

1.4.2.4 Wear Test

Wear tests shall be made on aggregate material in conformance with ASTM C 131.

1.4.2.5 Soundness

Soundness tests shall be made on aggregate in accordance with ASTM C 88.

1.4.3 Testing Frequency

1.4.3.1 Tests on Proposed Material

To demonstrate that the proposed material meets all specified requirements, one of each of the following tests shall be performed on the proposed material prior to commencing construction, and subsequently for every 5,000 cubic yards of material. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis.
- b. Moisture-density relationship.
- c. Wear.
- d. Soundness .

1.4.4 Approval of Material

The source of the material shall be selected prior to the time the material will be required in the work. Approval of material will be based on test results.

1.5 WEATHER EFFECTS

Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work shall be subject to approval

before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.7 NQA-1 QUALITY LEVEL

All rock armoring activities for the Disposal Cell at Crescent Junction, including: The Cover Admixture Rock, Apron Riprap, Slope Riprap, and Channel Armor are designated as Quality Level 2. All other work (not on the Disposal Cell) is non-Quality related (Quality Level 3).

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel, angular sand, or other approved material. Untreated Base Course shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. Gravel shall be free of silt and clay as defined by ASTM D 2487, organic matter, and other objectionable materials or coatings. Aggregates will be used for the following applications, and the material properties for each of these applications will be provided in the following section:

Application	Name of Material	Gradation
Road Base	Untreated Base Course	UDOT UBC
Pipe Bedding	Coarse sand/gravel	ASTM D 448 #9
Drainage Stone	Open graded gravel	ASTM D 448 #57
Riprap slope armor	Riprap	D50 per plans
Riprap channel armor	Riprap	D50 per plans
CJ Channel Armor	Riprap, 1,000 yr	DSO 2 in

2.1.1 Road Base

Aggregate for road base beneath asphalt pavement and for unpaved gravel roads and pads shall be UDOT Untreated Base Course. The UBC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel for road base shall be provided in the gradation listed in Table 1. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified

requirements and shall be stockpiled separately.

2.1.2 Pipe Bedding

Pipe bedding shall be coarse sand, or fine gravel, free from deleterious materials and rocks larger than 3/8 inch. Sandy soil or excavated shaly soil may be used for pipe bedding if it is excavated or processed such that the material size is similar to the gradation listed in Table 1.

2.1.3 Drainage Stone

Drainage stone is an open graded stone material intended as a capillary break beneath concrete slabs. Drainage stone will also be used for French Drains and seepage collection drains for retaining structures and mechanically stabilized earth structures. Drainage stone shall be provided in the gradation listed in Table 1.

2.1.4 Riprap

Riprap for slope and channel protection shall be provided at locations indicated on the drawings. Riprap shall be sized in accordance with plans and as listed in Table 1. Materials listed in Table 1 are not intended for use on the Disposal Cell at Crescent Junction. Disposal Cell materials are included in Specification Section 32 11 22.

Table 1. Gradation of Aggregates

Percentage by Weight Passing Square Mesh Sieve

Sieve Designation	Road Base	Pipe Bedding	Drainage Stone	Riprap Slope Armor	Riprap Channel Armor
12 inch	--	--	--	--	100
10 inch	--	--	--	100	80-100
8 inch	--	--	--	80-100	20-80
6 inch	--	--	--	20-60	0-20
4 inch	--	--	--	0-20	0
2 inch	--	--	--	0	--
1-1/2 inch	100	--	100	--	--
1 inch	90-100	--	95-100	--	--
3/4 inch	70-85	--	--	--	--
1/2 inch	65-80	--	25-60	--	--
3/8 inch	55-75	100	--	--	--
No. 4	40-65	85-100	10-20	--	--
No. 8	--	20-40	5-10	--	--
No. 16	25-40	10-20	0	--	--
No. 50	--	5-10	--	--	--
No. 200	7-11	0-5	--	--	--

2.1.4.1 Rock Acceptance Criteria

An acceptable rock score depends on the intended use of the rock. The rock's score must meet the following criteria:

- For occasionally saturated areas, which include the top and sides of the final cover, the rock must score at least 50 percent or the rock is rejected. If the rock scores between 50 percent and 80 percent the rock may be used, but a larger D₅₀ must be provided (oversizing). If the rock score is 80 percent or greater, no oversizing is required.
- For frequently saturated areas, which include all channels and buried slope toes, the rock must score 65 percent or the rock is rejected. If the rock scores between 65 and 80 percent, the rock may be used, but must be oversized. If the rock score is 80 percent or greater, no oversizing is required.

Oversize rock as follows:

- Subtract the rock score from 80 percent to determine the amount of oversizing required. For example, a rock with a rating of 70 percent will require oversizing of 10 percent (80 – 70 percent = 10 percent).
- The D₅₀ of the stone shall be increased by the oversizing percent. For example, a stone with a 10 percent oversizing factor and a D₅₀ of 12 inches will increase to a D₅₀ of 13.2 inches.
- The final thickness of the stone layer shall increase proportionately to the increased D₅₀ rock size. For example, a layer thickness equals twice the D₅₀, such as when the plans call for 24 inches of stone with a D₅₀ of 12 inches; if the stone D₅₀ increases to 13.2, the thickness of the layer of stone with a D₅₀ of 13.2 should be increased to 26.4 inches.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control.

3.2 OPERATION OF AGGREGATE SOURCES

Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated to produce the quantity and quality of materials meeting these specifications requirements in the specified time limit.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Crescent Junction Operations/Site Manager to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the base course(s), the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the base course(s), the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 31 00 00 EARTHWORK. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

3.5 INSTALLATION OF UNTREATED BASE COURSE

3.5.1 Placing

The material shall be placed on the prepared subgrade or subbase in layers of uniform thickness. When a compacted aggregate layer 6-inches or less in thickness is required, the material shall be placed in a single layer. When a compacted aggregate layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall be thicker than 6 inches or thinner than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades shown in the plans.

3.5.2 Grade Control

The finished and completed base course shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required base course thickness so that the finished base course and the subsequent surface course will meet the designated grades.

3.5.3 Compaction of Untreated Base Course

Each layer of the Untreated Base Course (UBC) shall be compacted as specified with approved compaction equipment. In all places not accessible to the rollers, the mixture shall be compacted with hand- operated power tampers. Compaction of UBC shall continue until each layer has a degree of compaction that is at least 95 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.4 Thickness

Compacted thickness of the base course shall be as indicated. No individual layer shall be thicker than 6-inches nor be thinner than 3-inches in compacted thickness.

3.5.5 Finishing

The surface of the top layer of base course shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of base course is $\frac{1}{2}$ inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in and compacted to bring to grade.

3.5.6 Smoothness of Base Stone for Pavement

The surface of the top layer shall show no deviations in excess of $\frac{1}{2}$ -inch when tested with a 12-foot straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50-foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.6 INSTALLATION OF RIPRAP

Riprap shall be placed at locations, thicknesses, and sizes indicated on the drawings. At all locations except the Waste Cell at Crescent Junction, riprap shall be placed over a geotextile in accordance with Section 31 05 19 GEOTEXTILE. For the Waste Cell cover slopes, bedding aggregate shall be placed and the riprap installed over the bedding aggregate.

For the Crescent Junction Disposal Cell, the Contractor must supply and install riprap such that the riprap material does not segregate. The objective is a uniform distribution of the specified riprap gradation. If excessive fine material is present in the riprap, it may settle to the bottom of a truck during transport and segregate from the riprap when dumped. The Contractor shall minimize the fines in the riprap, and spread the stone in a manner that prevents concentration of fine materials. Visual inspection of the riprap placement will be performed by the inspection personnel and any pockets of fines observed will be required to be replaced with material containing a uniform distribution of the specified material gradation. The Contractor shall minimize segregation of materials when bedding material is placed in conjunction with the installation of riprap and when no bedding material is required.

3.7 TRAFFIC

Completed portions of the base course for pavement may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.8 MAINTENANCE

The base course shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any base course that is not paved over

prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.9 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed.

-- End of Section --