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Attachment G.

Lyons Quarry 100% Design – Technical Specifications

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DIVISION 02

EXISTING CONDITIONS

SECTION 02 21 13
SITE SURVEY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Underground utility locate.
2. Measurement and mapping of all local site features, easements, utility locates and legal monuments.
3. Photography of local property features and legal monuments.
4. Mapping of all property easements.
5. Placement of local control for site development.
6. Placement of soil boring locations for geotechnical investigation.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. Section 31 23 16 – Excavation
4. Section 31 23 23 – Fill
5. Section 31 37 00 - Riprap

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. National Society of Professional Surveyors:
   a. Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys, 2/16.
2. Building code:
   a. International Code Council (ICC):
      1) International Building Code and associated standards, 2015 Edition including all amendments, referred to herein as Building Code.
3. General:
   a. Furnish all necessary equipment, materials, and labor to effectively measure the site in accordance with these specifications. Additional local surveying requirements for local platting, mapping, etc., shall be researched and followed by the surveyor.
   b. The Contractor shall be responsible for all damage to public and private property resulting from the operations of its employees.
   c. The Contractor shall be responsible for gaining permission to access any site(s) required for surveying. Any site-specific training to access the property shall be the responsibility of the Contractor.

1.3 DEFINITIONS

A. “Contractor” shall mean person, firm, or corporation with whom Owner may enter into contract for execution of work specified relating to the Survey of the site.

1.4 SUBMITTALS

A. Topographical Survey:
1. See Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Submit to the Owner complete CAD files within one week after field visit.
3. CAD file shall be AutoCAD Civil 3D files with 3D points and TIN (Triangulated Irregular Network) surfaces of topography included. All site features shall be drawn and included within CAD file. Contractor shall receive Owner approval to use different CAD software.
4. TIN surface(s) shall be exported as individual .XML format files. XML files shall be delivered with CAD files.

5. Point files of all field survey data, including control shall be delivered in .csv format. Any point code description data sets shall be included with point files.
6. Submit PDF of the completed topography survey to the Owner.

B. Site Photos:
1. Field survey photos shall be included with the topographical survey.

C. Site Staking:
1. Provide site control staking as required for site development. Work with the Owner to determine amount of staking to be completed.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 INITIAL SURVEY

A. An initial survey shall be performed to document existing grade prior to excavation, fill (where fill is planned), and riprap placement as shown on the drawings.

B. Results of the initial survey shall be submitted to Engineer at least seven days prior to commencement of any excavation activities. The initial survey shall be conducted within a single one week period.

3.2 AS-BUILT FINAL SURVEY

A. The following shall be included in the final topography survey:
1. Survey datum and units: the vertical and horizontals datum shall meet state and local guidelines. The datum and units shall be provided with the survey, including coordinate system, foot units (international, U.S. survey), ground conversion factors (as applicable), etc.
a. All surveys shall be spatially tied in and geo-referenced. A datum specific only to the development area shall not be used.
b. The contractor shall provide all digital source data (i.e., for Trimble equipment, the .job file) and the RTK survey report.
2. Site topography including but not limited to:
a. Existing ground topography shall be recorded with a maximum grid spacing of 100 FT. Topography shall be presented in 5 FT intervals unless otherwise noted.
b. Grade breaks, including but not limited to: bench crests and toe limits, berms (tops and toes), depressions, ditches, swales, drainages, hills, rock piles, steep hill faces, road centerlines, waterlines, wetlands, trees, shrubs, storm water ponds and flow lines.
c. All roads surrounding public and private roads shall be surveyed, including centerline, edge of asphalt, intersections, shoulder, culverts, and borrow ditches. Private access roads shall be provided, including two tracks (both tracks to allow for rebuilding if needed).
d. Adjacent property topography information shall be provided up to 100 FT past the proposed development area, unless otherwise noted by the Owner. Additional topography past the initial development area shall include any utilities (road, storm water, electric) that may need updating due to proposed development.

B. Easements: All utility, property, landscape, road, road right-of-way, floodplain, and public and private easement information shall be included and displayed with the survey file for plat and/or site development. Road centerlines shall be provided for structure setback requirements.
1. Research of site easements shall be the Contractor's responsibility prior to site surveying.
a. Title reports shall be requested as needed by the Contractor.

C. Monuments: All monuments shall be clearly surveyed and labeled within survey file. All section corners and existing property pins shall be located. Section corners (minimum of three) shall be located or established for development of new property parcels. Research of monuments shall be the responsibility of the Contractor prior to site visit.

D. Control shall be clearly established on the site. Contractor will be responsible for establishing a minimum of three control points that can be located within the site development area. Control shall be clearly established in an area that will preserve the horizontal and vertical information. Marked rebar (12 IN minimum depth) shall be used for control points.

E. Underground utilities shall be located and surveyed in via ["Call before you dig 811"] locate services. All private and public underground utilities shall be located. Utilities survey information shall include the name of the corresponding utility company with the field marking.

F. Power and electrical utilities shall be located and surveyed. All power poles, anchors, electrical structures, etc., shall be surveyed. Overhead electric lines crossing the survey site shall have the next adjacent pole(s) in all directions surveyed in. Utility owner information shall be provided with survey.

G. Any additional surface utilities, including but not limited to: manholes, light structures, storm drains, fiber optics, railroads, inlets, utility boxes, hydrants, and valves shall be provided. Research of site utilities shall be completed prior to field survey visit.

H. All visible site structures, including but not limited to: buildings, fences, gates, junk piles, signs, mailboxes, concrete structures (top and bottom of concrete), walk paths, and cattle guards shall be surveyed.

I. Culverts shall be located and surveyed; inlets and outlet elevation shall be provided along with culvert size and type.

J. A 3D TIN surface shall be developed with the approved CAD software. Contractor shall review and prepare a 3D TIN surface to be used for grading and volume calculations.

K. Survey notes and legend information shall be included in survey deliverables.

L. Site photos shall include site features, including but not limited major structure, utilities or any additional items that may require removal to allow for site development. Adjacent roads, structures, property boundaries, etc., shall be photographed. All storm drains, culverts, and storm structures shall be clearly photographed.

3.3 WORKMANSHIP AND METHODS

A. Provide equipment capable of recording horizontal and vertical measurements within 1/100 FT degree of accuracy.

B. Contractor is responsible for meeting local surveying best practices and plat recording requirements.

C. Contractor is responsible for providing additional survey equipment if needed when GPS equipment may not be suitable.

D. Aerial surveys are not to be used unless requested and approved by the Owner.

END OF SECTION

SECTION 02 81 13
DISPOSAL OF EXCAVATED MATERIALS

PART 1 - GENERAL

1.2 WORK INCLUDES

A. Transportation and disposal of excavated earth materials.

B. Transportation and disposal of demolished infrastructure.

1.3 RELATED SECTIONS

A. Section 32 90 00: Restoration and Seeding.

B. Section 31 23 16: Excavation

C. Section 31 23 23: Fill

1.4 DEFINITIONS

A. Earth materials – rock, soil, sludge or sediment that does not meet the specification for Backfill.

B. Existing debris – any solid material that is not rock, soil, sludge or sediment (e.g. electrical conduit, concrete, rebar, timbers, tires, etc.).

1.5 SUBMITTALS

A. Provide identity of the proposed landfill to receive debris materials 14 days prior to transportation to the landfill.

B. Manifests or other documentation of waste disposal including photo documentation of the material before and after loading on to the truck.

PART 1 - PRODUCTS

NOT USED

PART 2 - EXECUTION

1.6 GENERAL

A. Disposal of non-contaminated earthen materials will be to an existing on-site repository.

B. Disposal of debris encountered during excavation will be sent to a controlled landfill.

1.7 TRANSPORTATION AND DISPOSAL REQUIREMENTS

A. Earth materials placed in the on-site repository will require restoration and seeding in accordance with Section 32 90 00 – Restoration and Seeding.

B. It is assumed that all earth materials requiring transportation or on-site disposal will not be considered to contain hazardous contaminated substances or hazardous waste. If hazardous materials are encountered during reclamation, the CONTRACTOR will stop work immediately and notify OWNER. The OWNER will then notify the appropriate response agencies.

C. Debris encountered during excavation will be transported and disposed of in a controlled landfill.

END OF SECTION

DIVISION 31

EARTHWORK

SECTION 31 10 00
SITE CLEARING

PART 1- GENERAL

1.1 WORK INCLUDES

A. Site clearing in the work areas for excavation or fill.

B. Temporary erosion- and sedimentation-control measures.

C. Protecting existing vegetation to remain.

D. Removing existing vegetation, clearing and grubbing, stripping and stockpiling topsoil.

1.2 RELATED SECTIONS

A. Section 31 25 00: Erosion Protection and Sedimentation Control

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site.
   1. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in- place surface soil and is the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

A. Pre-Construction Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant protection measures are in place.

B. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.

6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

C. Do not direct vehicle or equipment exhaust towards protection zones.

D. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

E. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

1.7 SCHEDULING AND SEQUENCING

A. Begin site clearing and grubbing only after erosion and sediment control provisions are in place.

B. Haul roads, access roads, and additional staging areas needed by CONTRACTOR not shown on the Drawings may be cleared upon approval of OWNER and after CONTRACTOR submits and implements a revised Erosion and Sediment Control Plan to the OWNER for approval.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a l-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.
1. Restore damaged improvements to their original condition, as acceptable to OWNER.

3.2 PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by OWNER.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Do not saw cut trees >12” and <48” diameter. Use excavator or equivalent machine to loosen root mass and push over existing trees designated for removal. Remove all branches from trunk. Keep root ball intact with tree trunk and stockpile in designated area.
3. Use only hand methods for grubbing within protection zones.
4. Mulch tree branches to be used for restoration.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

3.4 TOPSOIL STRIPPING

A. Strip topsoil to a depth of 6 inches, or as approved by OWNER, in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Remove non-soil materials from topsoil, including gravel and other objects more than 3 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 10 feet

2. Do not stockpile topsoil within protection zones.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Excavation of reclamation slopes.

1.2 RELATED SECTIONS

A. Section 31 10 00: Site Clearing

B. Section 31 25 00: Erosion Protection and Sedimentation Control.

1.3 REFERENCES

A. The following is a list of Standards which apply to this Section:
   1. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR, Part 1926, Subpart P, Excavation Standards
   2. IME (Institute of Makers of Explosives) Safety Library Publications (SLPs).

1.4 DEFINITIONS

A. Common Excavation: Excavation in all earth materials including soil, weathered rock, and fractured unweathered rock.

B. Rock Excavation: Excavation in any earth materials that can not be performed with modern earth work equipment, special attachments, pre-drilling, or other excavation technology or methods and requires controlled blasting excavation methods.

C. Controlled Blasting: Use of explosives in a carefully controlled manner to facilitate excavation of hard, cemented materials. Controlled blasting requires control of various elements of the blast, including hole size, position, alignment, depth, spacing, burden, charge size, and distribution and delay sequences to excavate rock materials to the desired lines while maintaining ground vibrations and air-overpressure within specified maximum limits. Preshearing, cushion blasting, and line drilling are all forms of controlled blasting.

D. Air-Overpressure: Temporary changes in ambient air pressure caused by blasting.
   1. Air-overpressure is expressed in units of psi or dB or dBL (linear decibel scale). Measurements for blasting are made with microphones having a flat frequency response for over-pressure in the 2 to 200 Hz range. A- weight or C-weight microphones shall not be used for these measurements.

E. Blaster-in-Charge or Blasting Supervisor: The single designated and licensed person with complete responsibility and total authority over all decisions involving safe handling, use and site storage of explosives. The Blaster-in-Charge and Blasting Supervisor may be the same person.

F. Charge-per-Delay: For vibration control, any charges firing within any 8-millisecond time period are considered to have a cumulative effect on vibration and air-overpressure effects. Therefore, the maximum charge-per-delay (W) is the sum of the weight of all charges firing within any 8-millisecond time period. For example, if two 10-lb. Charges fire at 100 ms and one 15-lb charge fires at 105 ms, the maximum charge per delay would be 35lbs.

G. Delay: A distinct pause of pre-determined time between detonations of single charges or groups of charges

H. Occupied Building: Structure on or off construction limits that is occupied by humans or livestock.

I. Peak Particle Velocity (PPV): The maximum of the three ground vibration velocities measured in the vertical, longitudinal and transverse directions. Velocity units are expressed in inches-per-second (ips).

J. Primary Initiation: The method whereby the blaster initiates the blast(s) from a remote and safe location. Primary initiation systems use pneumatic tubing or shock-tubes to convey firing energy from blasters to blast locations.

K. Production Holes: Blast holes in the main body of the rock mass being removed by drilling and blasting.

L. Prohibited Persons: Persons prohibited from handling or possessing explosive materials as defined by the seven categories described in Section 555.11 of 27 CFR (ATF Rules).

M. Residential Building: Includes single and multiple family dwellings, hotels, motels and any other structure containing sleeping quarters.

N. Scaled Distance: A factor describing relative vibration energy based on distance and charge-per-delay. For ground vibration control and prediction purposes, Scaled Distance (Ds) is obtained by dividing the distance of concern (D) by the square root of the charge-per-delay (W), $Ds = D/(W)^{0.5}$. Minimum scaled distance limits are used to establish charge weights and the units of scaled distance (Ds) are ft-lb-0.5.

O. Stemming: Crushed stone, tamped clay or other inert earth material placed in the unloaded collar area of blastholes for the purpose of confining explosive charges and limiting rock movement and air-overpressure (airblast).

P. Sub-drilling: The portion of the blasthole that is drilled below or beyond the desired excavation depth or limit. Subdrilling is generally required to prevent the occurrence of high or tight areas of unfractured rock between blastholes.

Q. Top Soil: Sufficient in nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant life. This soil contains organic material unsuitable as fill or backfill.

R. Unsuitable Foundation Soils: Soils that display yielding, excessive rutting, excessive water content, or have desiccated; soft clays, loose sands, and open or narrowly graded gravels.

1.5 SUBMITTALS

A. Shop Drawings:
   1. Excavation Plan: Include the following information as a minimum:
      a. Methods and sequencing of excavation in the various excavation areas.
      b. Numbers, types and sizes of equipment proposed to perform excavations.
      c. Anticipated difficulties and proposed resolutions.
      d. Conceptual plans and sections showing sloping or shoring of temporary slopes as necessary for construction.
      e. Proposed locations of stockpiled excavated material.

B. Pre-Blast Survey:
   1. At least 14 days prior to the commencement of any work involving explosives, conduct a pre-blast condition survey to thoroughly document the condition of all permanent man-made structures which have the potential to be impacted by blasting operations.
   2. The pre-blast survey shall include a photographic or videotape record of all exposed facilities, including structures, utilities, wells, buried cables, and other man made features within 1500 feet of the blast area.
   3. Submit three (3) copies of all pre-blast survey reports, including photographs or video recordings, to OWNER.
   4. Within 14 days following completion of all blasting activities, complete post-blast surveys and submit three (3) copies of post-blast survey reports, including photographs or video recordings, to OWNER.

C. Blasting Safety Plan:
   1. No drilling or blasting work shall be performed until the CONTRACTOR's Safety Plan and Blasting Control Plan for such operations has been submitted and approved by the OWNER.
   2. At a minimum of 14 days prior to the commencement of any work involving explosives, submit a complete Safety Plan For The Use Of Explosives. A Blasting Safety Plan simply stating: "all regulations will be followed" will not be acceptable. Blasting Safety Plan shall include:
      a. A complete list of all authorities having jurisdiction over operations involving the transportation, storage, handling and use of explosives.
      b. Copies of all required blasting permits regarding explosive use, possession, transportation (if applicable) and storage.
      c. Copies of Colorado Type I Licenses, with construction blasting or special operations endorsements for the type of work involved, for all blasters overseeing blasting operations.
      d. A complete description of the clearing and guarding procedures that will be employed to ensure personnel, staff, visitors, and all other persons are at safe locations during blasting. This information shall include details regarding visible warning signs or flags, audible warning signals, method of determining blast areas (all areas affected by any potentially harmful blast effects), access blocking methods, guard placement and guard release procedures, primary initiation method, and the system by which the blaster-in-charge will communicate with site guards, and the method to notify other CONTRACTORs, visitors, or project personnel on-site of a scheduled blast.
      e. A detailed description of how explosives will be:
         1) Stored on site, and
         2) transported and used at the various project work areas.
         3) Plans shall explain how day-storage magazines and explosive transport vehicles will satisfy all applicable ATF, OSHA, federal, Colorado and local regulations.
         4) This plan shall also indicate how explosives will be inventoried, secured and guarded to prevent theft or unauthorized use and shall have Table of Distance calculations for storage areas.
      f. Include Material Safety Data Sheets (MSDS) and technical data sheets for all products and specific details about hazard communication programs for employees.
      g. Equipment that will be used to monitor the approach of lightning storms and in the event of such, evacuation and site security plans.
      h. Detailed contingency plans for handling of misfires caused by cutoffs or other causes.

D. Blast Reports:
   1. Submit a Blast Report to the OWNER within 24 hours of each blast event. Maintain copies of Blast Reports onsite in a three-ring binder and available for immediate review by OWNER. The Blast Reports shall include:
      a. Location, date and time of blast.
      b. Name, signature, and license number of blaster-in-charge.
      c. Identification, direction and distance in feet, from the nearest blast hole to the nearest potentially affected structure, such as any dwelling, school, church, or community or institutional building either:
         1) Not located in permit area; or
         2) Not owned nor leased by the person who conducts the mining operations.
      d. Weather conditions, including temperature, wind direction, and approximate velocity.
      e. Type of material blasted.
      f. Sketches of the blast pattern including number of holes, burden, spacing, and delay pattern. Sketches shall also show decking, if holes are decked to achieve different delay times within a hole.
      g. Diameter and depth of holes.
      h. Types of explosives used.

i. Total weight of explosives used per hole and maximum weight of explosives per 8-millisecond period.
j. Initiation system.
k. Type and length of stemming.
l. Mats or other protections used.
m. Type of delay detonator and delay periods used.
n. Number of persons in the blasting crew; and
o. Seismographic and air-overpressure records, including:
    1) Type of instrument, sensitivity, and the calibration signal of the gain setting or certification of annual calibration.
    2) Exact location of instrument and the date, time and distance from the blast.
    3) Name of the person and firm taking the reading.
    4) Name of the person and firm analyzing the seismographic and air-overpressure record.
    5) The vibration and air-overpressure levels recorded.
p. Summary report of all complaints including complaints regarding blasting-related damage.

E. Permits:
1. Submit copies of all required blasting or explosives related permits.

1.6 QUALITY ASSURANCE

A. Qualifications
1. A blasting supervisor licensed by the State of Colorado, Division of Oil and Public Safety, and acceptable to the OWNER shall be on the site, and in immediate charge of the blasting operations. The license of the supervising blaster(s) shall contain endorsements for construction blasting or a special operations endorsement applicable to the type of blasting on this project.
2. Blasting supervisor shall have no less than three years of experience in controlled blasting on projects of similar character. A written description of the education and experience of this supervisor shall be submitted. The description shall be specific and include references who are able to verify the details. The blasting supervisor may act as Blaster-in-Charge.
3. A list of at least three previous projects of similar character performed by the Blaster in Charge, successfully completed. List shall include contact names and phone numbers of the owner's responsible project manager or engineer.
4. All persons engaged in handling explosives shall have had an Employee Possessor background check submitted to BATFE. Prohibited persons not having been granted a relief from disability shall not handle explosives.

B. Regulatory Requirements
1. Comply with the applicable rules, regulations and standards established by Federal, State and Local Regulatory Agencies, including rules and regulations for storage, transportation, and use of explosives.
2. Whenever blasting operations are in progress, explosives shall be stored, handled and used as provided in: the Federal Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, as amended; Safe Explosives Act, Title XI, Subtitle C of Public Law 107-296, Interim Final Rule; and Organized Crime Control Act of 1970, Title XI, Public Law 91-452, Approved October 15, 1970, as amended.
3. Ensure that all explosive deliveries to work sites are done in compliance with recent rules and regulations issued by the Department of Transportation (DOT) and the Transportation Security Administration (TSA) on commercial transportation of explosives pursuant to the mandates of the USA PATRIOT ACT of 2001. Under TSA rules, commercial drivers with hazardous materials endorsement shall undergo a personal background records check, training and testing.
4. Comply with all the applicable provisions of OSHA of 1970, 29 U.S.C., Section 651 et seq., including safety and health regulations for construction.

5. U.S. Code of Federal Regulations (CFR)
    a. CFR 27, U.S. Department of Justice, Alcohol, Tobacco, Firearms and Explosives Division (ATF). 27 CFR Part 555, Implementation of the Safe Explosives Act, Title XI, Subtitle C of Public Law 107-296; Interim Final Rule.
    b. Organized Crime Control Act of 1970, Title XI, Public Law 91-452, Approved October 15, 1970, as amended.
    c. CFR 49, Parts 100-177 (DOT RSPA); 301-399 (DOT FHA).
    d. Federal Occupational Safety and Health Act of 1970, as amended.
    e. Construction Safety Act of 1969, as amended.
6. State Agencies: Compliance with the following, as administered by the Colorado Department of Labor and Employment.
    a. Colorado Code of Regulations (7 CCR 1101-9)
    b. Colorado Revised Statutes (Title 9, Articles 6 & 7)

PART 2 - PRODUCTS

2.1 BLAST MONITORING

A. Blast Monitoring Seismographs:
    1. Requires 3-axis velocity transducer, air-overpressure transducer, and data acquisition and storage device.
    2. Flat frequency response between 2 and 250 Hz.
    3. Air over-pressure maximum level of 148 dB.

PART 3 - EXECUTION

3.1 GENERAL

A. Excavate to lines, grades, and dimensions shown on the Drawings, and as necessary to accomplish Work.

B. Excavate soil and rock to within a tolerance of ±0.1 and ±0.5 foot, respectively except where dimensions or grades are shown on the Drawings as maximum or minimum.

C. Do not over-excavate without the OWNER's written authorization.

D. Take precautions to preserve material below the limit of excavation and repair damage to material below the limit of excavation to the satisfaction of OWNER.

E. Stockpile topsoil removed during excavation that is to be applied after backfill operations.

F. Selectively process and stockpile materials as necessary to yield suitable types and sufficient quantities of the various fill materials required for construction of the Work.

G. Maintain excavations in the dry until fill is placed.

H. Provide adequate survey control to avoid unauthorized overexcavation.

3.2 BLASTING

A. Blast only between the hours of 9 a.m. and 3 p.m. during any workday (Monday-Friday), unless special circumstances warrant another time or day and special approval is granted in writing by the OWNER.

B. Controlled blasting shall be employed. Take all necessary precautions to preserve the material below and beyond the established limits of excavation.

C. Control blasting such that maximum peak particle velocities at the nearest edge of any completed structure within one mile of the blast location shall not exceed 1.0 inch per second and air over-pressure shall not exceed 133 dB.

D. Monitor blast vibrations by conducting seismic monitoring.
   1. Locate seismographs south of St. Vrain Creek and at the north, east and west limits of the site.
   2. Seismic monitoring equipment shall be 4-channel units capable of measureing air-overpressure and vertical, longitudinal, and transverse directions of ground vibration velocities.
   3. Peak partical velocity shall be the largest of the three measured ground vibration velocities.

E. Control fly rock to prevent damage to persons, structures, existing improvements, or vegetation.
   1. Use burden and stemming requirements as required to control flyrock.
   2. Use blasting mats in developed areas.

F. Fifteen minutes prior to each blast, sound an audible siren or horn capable of being heard within one-half mile of the blasting site.

G. Blasting operations may be suspended by the OWNER for any one or more of the following:
   1. Safety precautions are inadequate.
   2. Existing structural conditions are aggravated or adjacent improvements are damaged as a result of blasting.
   3. Blasting methods adversely impact the stability of intact rock outside the prescribed limits of excavation.
   4. Skilled operators and/or licensed foreman are not present.

H. Blasting operations shall not resume until modifications have been made to correct the conditions that resulted in the suspension.

I. Repair or replace any damage caused by blasting. Repair or replace any damage resulting from possession or use of explosives for the Work.

J. A blasting supervisor licensed by the State of Colorado, Division of Oil and Public Safety, and acceptable to the OWNER shall be on the site, and in immediate charge of the blasting operations.
   1. The license of the supervising blaster(s) shall contain endorsements for construction blasting or a special operations endorsement applicable to the type of blasting on this project.
   2. Such supervisor shall have no less then three years of continuous experience in controlled blasting on projects of similar character.
   3. The blasting supervisor and the blaster-in-charge may be the same person.

3.3 STOCKPILING EXCAVATED MATERIAL

A. When necessary, stockpile excavated material that is waiting for disposal or use as fill.

B. Confine stockpiles to within approved work areas.

C. Do not stockpile excavated material adjacent to trenches and other excavations unless excavation sideslopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

D. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce settlement.

END OF SECTION

SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Dewatering system.
2. Surface water control system.
3. Monitoring wells.
4. System operation and maintenance.
5. Water disposal.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. Section 31 23 16 - Excavation .
4. Section 31 23 23 - Fill
5. Section 31 23 33 – Trenching, Backfilling, and Compacting for Utilities
6. Section 31 25 00 - Erosion Protection and Sedimentation Control.
7.

1.2 QUALITY ASSURANCE

1.3 DEFINITIONS

A. Dewatering:
1. Lowering of groundwater table and intercepting horizontal water seepage to prevent groundwater from entering [excavations, trenches and shafts.]
2. Disposing of removed water.

B. Surface Water Control:
1. Removal of surface water within open excavations or ponding areas.

C. Foundations:
1. Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Dewatering plan design data and Drawings including the following:
a. Proposed type of dewatering system with complete description of equipment and instrumentation to be used.
b. Arrangement, locations, and depths of system components.
c. Pipe sizes and capacities.
d. Filter types and sizes.
e. Water disposal method and location.
f. Surface water control devices.
g. System operation, monitoring, and maintenance procedures.
h. Method of monitoring water quality.
i. Signed and sealed by professional engineer.
3. Product technical data including:
a. Dewatering pump data including the following:
1) Size, capacity, and means of operation [of engine and motor].

b. Pumping equipment for control of surface water within excavation.

1.5 PROJECT CONDITIONS

PART 2 - PRODUCTS

2.1 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:
   1. See Specification Section 31 25 00.
   2. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
   3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
      a. If necessary or requested by OWNER, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:
   1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
   2. Protect and maintain benchmarks, monuments or other established reference points and property corners.
      a. If disturbed or destroyed, replace at own expense to full satisfaction of OWNER and controlling agency.
   3. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
      a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
      b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
      c. All repairs to be made and paid for by CONTRACTOR.
   4. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by OWNER to prevent serious interruption of travel.

3.2 DEWATERING

A. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.

3.3 SURFACE WATER CONTROL SYSTEMS

A. Provide ditches, berms, and other devices to divert and collect surface pond water from reaching the Scour Berm 18” RCP drainage pipe. Use necessary erosion control BMPs as specified in Specification Section 31 25 00.

B. If necessary, divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels, storm drains and settling basins in accordance with requirements of the agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation and fill areas.

END OF SECTION

SECTION 31 23 23
FILL

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Fill placement and compaction for reclamation slopes.

B. Fill for backfill of sediment pond.

C. Miscellaneous fill or backfill not specifically covered in other sections.

1.2 RELATED SECTIONS

A. Section 31 10 00: Site Clearing

B. Section 31 23 16: Excavation

C. Section 31 25 00: Erosion Protection and Sedimentation Control

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Society for Testing and Materials (ASTM):
      a. ASTM C 117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
      b. ASTM C 136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates
      c. ASTM D 75, Standard Practice for Sampling Aggregates.
      d. ASTM D 422, Test Method for Particle-Size Analysis of Soils.
      e. ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m.3)).
      f. ASTM D 4318, Standard Test Method for Liquid Limit, Plastic Limit, Plasticity Index of Soils.
      g. ASTM D 6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

A. Backfill: Fill materials placed in trenches, excavations, and around structures, pipes and other facilities.

B. Borrow Material: Fill or backfill material from required excavations or from designated borrow areas on the site.

C. Certified/Certification: Review, approved, stamped, and signed by a Professional Engineer registered in the State of Colorado.

D. Completed Course: A course or layer that is ready for next layer or next phase of Work.

E. Coverage: One coverage is defined as the requirement for successive trips of a piece of compaction equipment, which by means of sufficient overlap, will ensure contact on the entire surface of the layer by the equipment.

F. Deleterious Materials: Organic matter, trash, rubbish, debris, oversize materials, and soluble materials.

G. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

H. Fill: All materials used to raise existing grade where not defined as backfill.

I. Fines: Material passing the No. 200 sieve as determined in accordance with ASTM D 422.

J. Imported Material: Material obtained from sources off site.

K. Lift: Loose (uncompacted) layer of material.

L. Optimum Water Content: Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

M. Oversize Materials: Soil particles, soil clods, sedimentary fragments, rocks, and other materials having a maximum dimension in excess of the specified limits.

N. Particle Size: The size of a particle before compaction measured parallel to its longest dimension.

O. Period of Inactivity or Extended Shutdown: Four days.

P. Relative Compaction:
1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D 698.
2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by OWNER.

Q. Well-Graded:
1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
2. Does not define numerical value that must be placed or coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.5 SUBMITTALS

A. Shop Drawings:
1. Fill Placement Plan to include:
   a. Planned sequence for construction.
   b. Fill placement rates and planned equipment spread for material processing, hauling, placement and compaction.
   c. Protection of completed fill during shutdowns, and preparation methods prior to resuming placement after shutdowns.
2. Catalog and manufacturer's data sheets for all equipment to be used to compact fill and backfill.
3. Sources of imported materials.

B. Samples:
1. For all imported materials; taken at source.

C. Quality Control Submittals:
1. Certified test results documenting conformance with all Specification requirements for:
   a. Imported materials.
   b. Borrow materials

1.6 QUALITY ASSURANCE

A. Certified quality control test results for all imported material. Submit prior to importing materials. CONTRACTOR is responsible for scheduling and performing tests as specified during production.

B. Perform water content, field density, gradation, and other tests during borrow materials development and fill placement as needed to develop and manage operations and produce consistent embankment fill and backfill meeting Specification requirements.

C. Notify OWNER when any of the following occur:

1. Embankment fill is about to be placed or fill operations are about to be resumed after a period of inactivity.
2. Structures are ready for backfilling, or backfilling operations are about to be resumed after a period of inactivity.
3. Soft or loose surface is encountered where fill or backfill is to be placed.
4. Materials appear to be deviating from the Specifications.
5. Initial sampling of imported material is to be conducted or importing of a material to the site is about to begin.
6. Borrow excavation is about to be shifted from one area to another, or a change in borrow materials is encountered.

1.7 SCHEDULING AND SEQUENCING

A. Complete applicable Work specified in Sections 31 10 00, Site Clearing, 31 23 16, Excavation, and Section 31 25 00: Erosion Protection and Sedimentation Control as required prior to placing fill or backfill.

B. Place fill only during daylight hours.

PART 2 - PRODUCTS

2.1 SOURCE QUALITY CONTROL

A. Source(s) of imported material must be approved by OWNER before material is imported to the site.

B. Samples:
1. Provide one 50-pound sample of each imported material, collected in accordance with ASTM D 75.
2. Clearly mark to show source of material and intended use.
3. Provide certified test results to document conformance with Specification requirements.

C. Tests:
1. As necessary to locate acceptable sources of imported material and to develop and manage borrow areas.
2. During production of imported and on-site fill materials, perform gradation test and Atterberg limits tests in accordance with ASTM C 117, ASTM C 136, and ASTM D 4318.
3. Provide gradation test results to OWNER within 48 hours of sampling; provide all other test results to OWNER upon test completion.

2.2 EARTH FILL

A. Well graded select or processed on-site bedrock or overburden materials consisting of hard igneous or sedimentary rock fragments, gravel, sand, and fines.

B. Allowable USCS classifications: SW, SP, SM, SC, SC-SM, GW, GP, GM, GC, and GC-GM.

C. Gradation: Graded uniformly and continuously from boulder size to silt size, maximum particle size equal to two-thirds of the lift thickness, maximum 45 percent fines in the minus 3-inch fraction.

D. Moisture Content – Within 3 percent of optimum based on ASTM D 698.

2.3 MOISTURE CONDITIONING EQUIPMENT

A. Provide water trucks and other supplemental equipment necessary to uniformly apply water in borrow areas, stockpiles, or to loose lifts of material for proper compaction.

B. Watering equipment shall be equipped with pressurized distributor bars or other means necessary to assure uniform application or water.

C. Provide blades, discs, and other supplemental equipment necessary to process borrow materials and pulverize residual bedrock into acceptable size particles, blend non-uniform fill and backfill materials, and for aerating and drying out wet materials.

2.4 COMPACTION EQUIPMENT

A. Provide dedicated compaction equipment of suitable type, capable of achieving the requirements of the Specifications, and which provide a satisfactory uniform, homogeneous fill.

B. Hauling or placement equipment shall not be considered compaction equipment.

C. Provide hand-operated equipment for use in confined areas not accessible to regular compaction equipment or where regular compaction equipment might damage structures or piping. Compaction equipment shall be subject to the approval of OWNER.

PART 3 - EXECUTION

3.1 GENERAL

A. Keep placement surfaces free of water, ice, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness in a manner that avoids segregation.

C. Compact each lift at the specified moisture content, using the specified equipment, and to specified densities, prior to placing succeeding lifts.

D. Slope lifts only as necessary to keep placement surfaces drained of water.

E. The maximum allowable particle size delivered in the fill and backfill at placement location and prior to any compaction shall be no larger than the maximum specified in Part 2.

F. Process by blading, disking, harrowing, or other methods as necessary to provide sufficient disaggregation and blending of fill and backfill. Processing of material to achieve the required particle size shall occur in the borrow areas.

G. Maintain moisture content of delivered materials within the range specified and compact materials in the lift to produce the specified fill characteristics.

H. Do not place fill or backfill if fill or backfill material is frozen, contains ice, or if surface upon which fill or backfill is to be placed is frozen. Remove frozen materials as needed to resume placement operations.

3.2 MOISTURE CONDITIONING AND PROCESSING

A. Moisture condition and process material prior to and during borrow excavation so that material is within the specified moisture content and particle size limits at the time it is delivered to the placement location.

B. Provide supplemental sprinkling on the fill to keep material within specified moisture content limits throughout the placement and compaction process, and to preserve moisture in completed courses until placement of overlying courses.

C. Blend material by disking, blading, or harrowing to maintain uniform moisture content throughout the lift.

D. Do not attempt to compact material that contains excessive moisture. Material that becomes too wet shall be removed or reworked. Aerate material by blading, disking, harrowing, or other methods to hasten the drying process.

E. Provide suitable types and numbers of watering and blending equipment to keep pace with fill and backfill placement activities, Provide additional equipment or restrict material placement rates if watering and blending equipment cannot keep pace with fill and backfill placement.

F. Maintain moisture conditions of the fill surface during nights, weekends, holidays, and other periods of temporary work stoppage.

3.3 COMPACTION

A. Compact all material by mechanical means. If tests indicate that compaction or moisture content is not as specified, or if compaction equipment being used is not as specified, terminate material placement and take corrective action prior to resuming material placement.

B. Operate compaction equipment in accordance with manufacturer's instructions and recommendations. Maintain equipment in such condition that it will deliver the manufacturer's rated compactive effort.

C. Operate Sheepsfoot and tamping foot rollers at a speed less than 5 miles per hour, and vibratory drum roller at a speed less than 3 miles per hour.

D. Operate sheepsfoot and tamping foot rollers to maintain the spaces between the individual feet clear of adherent materials that impair the effectiveness of the roller.

E. Where a minimum number of coverages is specified, provide a minimum 20 percent overlapping roller passes for each complete roller coverage per lift.

F. Provide suitable quantity of equipment to keep pace with fill and backfill placement activities. Restrict material placement rates if compaction equipment cannot keep pace with fill and backfill placement.

3.4 EARTH FILL

A. Construct fill to the lines and grades shown.

B. Where the surface under the fill is steeper than 4 horizontal to 1 vertical, excavate benches in the slope equal to the lift height to expose firm, moist, dense surfaces just prior to placing the next lift of fill.

C. Maintain the soil fill surfaces, including sloping the surfaces to drain, preventing or repairing gullies, and maintaining surfaces free of weeds or other vegetation, until final completion and acceptance of all Work.

D. Protect soil fill during periods of inactivity or extended shutdown. Grade surfaces to facilitate runoff and wheel roll or compact with a smooth drum roller to reduce infiltration and softening.

E. A temporary cover or loose lift of soil fill can be placed to protect the fill during periods of frost provided the loose lift is removed or properly moisture conditioned and compacted in accordance with these Specifications prior to placing additional fill.

F. After periods of inactivity or extended shutdowns, prepare the fill surface by moisture conditioning and re-compacting prior to resumption of fill and backfill activities:

G. Fill Placement:
   1. Maximum Lift Thickness:
      a. Thirty-six (36) inches for fill placed along reclaimed slopes.
      b. Nine (9) inches for embankment material, drainage swales, and in areas near pipes, utilities, and structures.
   2. Compaction: Not less than 90 percent relative compaction (ASTM D 698).
   3. Moisture Content: Within 3 percent of optimum (ASTM D 698).

3.5 FIELD QUALITY CONTROL

A. Field Testing and Inspections:

1. Initial laboratory compaction, gradation, and Atterberg limit tests are required prior to placement of any fill or backfill materials; additional tests are required during construction at the specified frequency and whenever material variation occurs such that existing information is not representative. Testing shall also be performed at locations as requested by the OWNER where minimum frequencies are unrepresentative for variable materials or inconsistent construction operations, and to retest previously failed materials after corrective actions have been implemented.
2. Laboratory Compaction Tests:
    a. Prior to placement of fill and backfill, a minimum of four laboratory compaction density tests in accordance with ASTM D 698 for each different soil and weathered bedrock material used.
    b. Rock corrections applied to density and moisture content determinations for oversize materials larger than 3/4-inch.
3. Gradation and Atterberg Limit Tests:
    a. Prior to placement of fill and backfill, four gradation tests and four Atterberg limit tests for each different soil material used; tests shall correspond with samples used for initial laboratory compaction and minimum/maximum density tests. Gradation test shall be performed in accordance with ASTM D 422, and Atterberg limits test shall be performed in accordance with ASTM D 4318.
4. In-Place Density and Moisture Content measurements:
    a. During fill and backfill placement, in-place density testing shall be performed in accordance with ATSM D 6938.
    b. One test shall be performed for each lift of fill placed.
5. Test Reporting:
    a. Written copies of all Field Tests shall be available on site at all times.
    b. Corrective Actions: Where testing of in-place materials fails to meet these Specifications, the questionable materials shall be removed or retested after corrective measures have been implemented. Retests will reference the prior failing test number.

END OF SECTION

SECTION 31 23 33
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation, trenching, backfilling and compacting for all drain piping.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 16 Excavation
   4. Section 33 05 16 - Precast Concrete Structures.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C33/C33M, Standard Specification for Concrete Aggregates.
      b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-LBF/FT^3 (600 kN-M/M^3)).
      c. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
      d. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
   4. Submit sieve analysis reports on all granular materials.

B. Informational Submittals:
   1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
   2. Trench shield (trench box) certification if employed:
      a. Specific to Project conditions.
      b. Re-certified if members become distressed.
      c. Certification by registered professional structural engineer, registered in the state where the Project is located.
      d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.

B. Protect and maintain benchmarks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.

C. Verify location of existing underground utilities

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:
   1. As approved by OWNER.
      a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
      b. Moisture content at time of placement: ±3 PCT of optimum moisture content as specified in accordance with ASTM D698.

B. Bedding Materials:
   1. As approved by the OWNER.
   2. Granular bedding materials:
      a. ASTM C33/C33M, gradation 67 (3/4 IN to No. 4 sieve) defined below:

Sieve Size	1 IN	3/4 IN	3/8 IN	No. 4	No. 20
Percent Passing by Weight	100	90-100	20-55	0-10	0

      1) Well-graded crushed stone.
      2) Well graded crushed gravel.
      3) Well graded gravel.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials as directed by Geotechnical Engineer.

3.2 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by OWNER.

B. Excavation for Appurtenances:
   1. 12 IN (minimum) clear distance between outer surface and embankment.
   2. See Specification Section 31 23 16 for applicable requirements.

C. Groundwater Dewatering:
   1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system according to Section 31 23 19 to prevent softening and disturbance of subgrade to allow pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
   2. Groundwater shall be drawn down and maintained at least 2 FT below the bottom of any trench or manhole excavation prior to excavation.
   3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
      a. Employ dewatering specialist for selecting and operating dewatering system.
   4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.

5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
6. Install groundwater monitoring wells as necessary.
7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Cost of groundwater dewatering shall be included in the lineal foot unit price of the pipe installation

D. Trench Excavation:
1. Excavate trenches by open cut method to a minimum depth of 6 IN below bottom exterior surface of the pipe.
2. Any trench or portion of trench, which is opened and remains idle for seven calendar days, or longer, as determined by the OWNER, may be directed to be immediately refilled, without completion of work, at no additional cost to OWNER.
   a. Said trench may not be reopened until OWNER is satisfied that work associated with trench will be prosecuted with dispatch.
3. Observe following trenching criteria:
   a. Trench size:
      1) Excavate width to accommodate free working space.
      2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN
more than 33 IN	24 IN

      3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe.
      4) Keep trenches free of surface water runoff.
         a) Include cost in Bid.
         b) No separate payment for surface water runoff pumping will be made.
4.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:
1. Backfill and compact to 90 PCT of maximum dry density per ASTM D698.
2. Backfill with granular bedding material as option.

B. Rock Excavation:
1. Excavate minimum of 12 IN below bottom exterior surface of the pipe.
2. Backfill to grade with suitable earth or granular material.
3. Form bell holes in trench bottom.

C. Subgrade Stabilization:
1. Stabilize the subgrade when directed by the OWNER.
2. Observe the following requirements when unstable trench bottom materials are encountered.
   a. Notify OWNER when unstable materials are encountered.
   b. Remove unstable trench bottom caused by CONTRACTOR failure to dewater, rainfall, or CONTRACTOR operations.
      1) Replace with subgrade stabilization with no additional compensation.

D. Pipe Bedding
1. Pipe bedding shall be furnished and placed in accordance with the requirements in these Specifications.
2. Pipe shall be placed on a firm layer of bedding material and shall be bedded uniformly throughout its length.

a. The bearing shall be achieved by shaping the bedding or by lightly “bouncing” the pipe to set it into the bedding.
b. Pipe bedding material shall be placed at a minimum thickness of 6 IN.

3.4 BACKFILLING METHODS

A. Carefully Compacted Backfill:
1. Furnish where specified for trench embedment conditions and for compacted backfill conditions at a minimum up to the springline of the pipe.
2. Comply with the following:
a. Place backfill in lifts not exceeding 8 IN (loose thickness).
b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
d. Compact each lift to specified requirements.

B. Common Trench Backfill:
1. Perform in accordance with the following:
a. Place backfill in lift thicknesses capable of being compacted to densities specified.
b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

C. Water flushing for consolidation is not permitted.

3.5 COMPACTION

A. General:
1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:
1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.
a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	75 PCT relative density by ASTM D4253 and ASTM D4254

b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	95 PCT of maximum dry density by ASTM D698
	Cohesionless soils	75 PCT relative density by ASTM D4253 and ASTM D4254

c. Toe drain bedding and backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	60 PCT relative density by ASTM D4253 and ASTM D4254

d. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	95 PCT of maximum dry density by ASTM D698
	Cohesionless soils	60 PCT of relative density by ASTM D4253 and ASTM D4254
Under turfed, sodded, plant seeded, nontraffic areas	Cohesive soils	85 PCT of maximum dry density by ATM D698
	Cohesionless soils	40 PCT of relative density by ASTM D4253 and ASTM D4254

3.6 FIELD QUALITY CONTROL

A. Testing:
   1. Perform in-place moisture-density tests as directed by the Owner.
   2. Perform tests through recognized testing laboratory approved by Owner.
   3. Costs of "Passing" tests paid by Owner.
   4. Perform additional tests as directed until compaction meets or exceeds requirements.
   5. Cost associated with "Failing" tests shall be paid by Contractor.
   6. Reference to Engineer in this Specification Section will imply Geotechnical Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
   7. Assure Owner has immediate access for testing of all soils related work.
   8. Ensure excavations are safe for testing personnel.

END OF SECTION

SECTION 31 25 00
EROSION PROTECTION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Design, install, maintain, and remove all necessary erosion protection and sediment controls.

1.2 DEFINITIONS

A. Best Management Practices (BMP's): Techniques, processes, activities, and structures used in combination to reduce pollutant discharges in stormwater. BMP's include source control practices (non-structural BMPs) and engineered structures designed to treat runoff based on site-specific conditions before, during, and after construction.

B. Sediment and Erosion Control devices as defined herein shall mean silt fences, hay bales, erosion control logs, sandbag cofferdams, sediment ponds, sediment traps, or other devices approved by OWNER.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Stormwater Management Plan (SWMP) consisting of SWMP Plan and Report developed in accordance with Urban Drainage and Flood Control District (UDFCD), Urban Storm Drainage Criteria Manual Volume 3 (UDFCD, 2016).
   2. Wind Erosion and Dust Control Plan. The SWMP must contain wind erosion and dust control BMPs to keep soil particles from entering the air, during working and non-working periods, as a result of land disturbing construction activities.

1.4 REFERENCES

A. Boulder County Storm Drainage Criteria Manual (Boulder County, 2016).

B. Urban Drainage and Flood Control District (UDFCD), Urban Storm Drainage Criteria Manual Volume 3 (UDFCD, 2016).

PART 2 - PRODUCTS

2.1 EROSION CONTROL BMPS

A. Erosion control BMPs include Earth Dikes and Drainage Swales and other similar temporary source controls used to limit erosion of soil. These are typically surface treatments that limit erosion by redirecting flows or reducing velocities of concentrated flow. Earth dikes and drainage swales control the flow path of runoff at a construction site by diverting runoff around areas prone to erosion, such as steep slopes. Earth dikes and drainage swales may also be constructed as temporary conveyance features. This will direct runoff to additional sediment control treatment BMPs, such as sediment traps or basins.

2.2 SEDIMENT CONTROL BMPS

A. Sediment control BMPs include silt fences, sediment control logs, and other similar temporary soil sediment control measures that limit transport of sediment off-site to downstream properties and receiving waters. These are generally treatment processes that either provide filtration through a permeable media or that slow runoff to allow settling of suspended particles.
   1. Silt fence is a woven geotextile fabric attached to wooden posts and trenched into the ground. It is designed as a sediment barrier to intercept sheet flow runoff from disturbed areas.

2. Sediment control logs are a linear roll made of natural materials used as a sediment barrier to intercept sheet flow runoff from disturbed areas. Sediment control logs also are used as check dams in small drainage ditches.
    a. Made from natural materials such as straw, coconut fiber, or compost and free from any noxious weed seeds or defects.
    b. Minimum 9 inches diameter.

2.3 SEDIMENT BASIN

A. Use existing sediment pond in conjunction with other BMP's for sediment control.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datums for the construction of erosion control facilities.

3.2 SEDIMENT AND EROSION CONTROLS

A. Install necessary sediment and erosion control measures prior to any ground disturbing activities, including site clearing, stripping and stockpiling topsoil, excavation, fill placement and grading.

B. The BMPs shown on the drawings are the minimum sediment and erosion controls required. Install additional or alternate BMPs as necessary to address conditions encountered during the work.

3.3 EROSION CONTROL MEASURES

A. Earth Dikes and Drainage Swales (ED/DS)
    1. Install ED/DS to divert runoff around areas of disturbance.
    2. Install ED/DS as temporary conveyance features to direct runoff to additional sediment control treatment BMPs, such as sediment traps or basins.
    3. Place and compact earth dike embankments to 90 percent of maximum density and within 2 percent of optimum moisture content according to ASTM D 698.
    4. Where construction traffic must cross a swale, install a temporary culvert with 12 inch minimum diameter.

B. Wind Erosion and Dust Control
    1. Use wind erosion and dust control BMPs to keep soil particles from entering the air as a result of land disturbing construction activities.
    2. BMPs include site watering, seeding and mulching, or other practices that provide prompt surface cover.

3.4 SEDIMENT CONTROL MEASURES

A. Silt Fence
    1. Install silt fence for sediment control around stockpiles located outside constructed sediment and erosion control measures.
        a. Imbed silt fence posts a minimum depth of 18 inches and at least 3 feet from the toe of the slope. There should be no sag
        b. Burry a minimum 10 inch tail of silt fence at a minimum depth of 6 inches in a 6'x4' anchor trench on the upslope side of the silt fence.
        c. Maintain silt fence during construction. Replace damaged sections and remove accumulated sediment before it reaches 6 inches in depth.

B. Sediment Control Log (SCL)
    1. Install SCLs for sediment control associated with sheet flow runoff from diversion ditches and as check dams in the ditches.
        a. Properly trench and stake SCLs to prevent undercutting, bypassing and displacement.
        b. Trench SCLs to a depth of one-third of the SCL diameter.

c. Stake SCLs with a minimum 4 foot spacing and embed stakes a minimum depth of 6 inches below the bottom of the trench.,
d. Maintain SCLs during construction. Replace damaged sections and remove accumulated sediment before it reaches one-half the height of the sediment control log.

C. Sediment Basin
1. Use the existing sediment basin to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site.
2. To the extent practical, divert flows from undisturbed and/or off-site areas around the sediment basin to prevent "clean" runoff from mixing with runoff from disturbed areas.

3.5 MATERIALS MANAGEMENT CONTROL MEASURES

A. Stockpile Management
1. Use Stockpile management when soils or other erodible materials are stored at the construction site.
2. Locate stockpiles away from all drainage system components and, where practical, at locations that will remain undisturbed for the longest period of time as construction progresses.
3. Stockpiles shall be constructed to a maximum height of 15 feet with side slopes no steeper than 2H:1V.
4. For stockpiles located outside constructed sediment and erosion control measures, install sediment control BMPs around the perimeter of the stockpile, such as sediment control logs, silt fence, straw bales or sand bags. If perimeter protection must be moved to access stockpile, replace perimeter controls by the end of the workday.
5. For stockpiles in active use, provide a stabilized designated access point on the up gradient side of the stockpile. Stabilize the stockpile surface with surface roughening, erosion control blankets, or soil binders.
6. Soils stockpiled for an extended period (typically for more than 60 days) shall be seeded and mulched with a temporary grass cover.

3.6 INSPECTION AND MAINTENANCE

A. Conduct daily spot checks and weekly/post-storm full inspections of BMP's to ensure that they are in place and operating effectively and in accordance with SWMP Plans and Report.

B. Maintain and repair sediment and erosion controls during course of construction.

3.7 REMOVAL OF TEMPORARY FACILITIES

A. Do not remove erosion control facilities without written approval from OWNER.

B. All erosion control facilities will be the property of CONTRACTOR, and shall be removed and disposed of offsite after all Work is complete.

END OF SECTION

SECTION 31 37 00
RIPRAP

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Section includes general information, products, and execution for riprap placement for scour berm, channel protection, embankment protection, and culvert outlets.

1.2 RELATED SECTIONS:

A. SECTION 31 23 16 – EXCAVATION

B. SECTION 31 23 23 – FILL

C. SECTION 31 25 00 – EROSION PROTECTION AND SEDIMENT CONTROL

1.3 REFERENCES

A. ASTM International (ASTM):

1. C 127 – Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
2. D 5519 – Standard Test Method for Particle Size Analysis of Natural and Man-Made Riprap Materials
3. D 7012 – Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures

1.4 SUBMITTALS

A. Shop Drawings: Describe proposed sources of riprap stone, placement methods, and placement sequence.

B. Quality Control Submittals:

1. Test results:
    a. Riprap: Provide certified results at least 7 days prior to placement and during production at the request of the OWNER:
        1) Gradation: In accordance with ASTM D 5519.
        2) Relative Density: In accordance with ASTM C 127.
        3) Unconfined compressive strength: In accordance with ASTM D 7012.

1.5 QUALITY ASSURANCE

A. Qualifications: Demonstrate Contractor experience in riprap quarry production and placement, and satisfactory performance on 3 similar projects within the past 5 years or as approved by the OWNER.

B. Scheduling and Sequencing: Complete necessary erosion protection and sedimentation control, excavation, dewatering, and fill placement, as specified in SECTION 31 23 16, SECTION 31 23 19, SECTION 31 23 23, and SECTION 31 25 00, prior to placing riprap stone.

PART 2 - PRODUCTS

SOURCE QUALITY CONTROL

A. Source(s) of onsite riprap stone must be approved by OWNER before material is used in the work.

B. Samples:

1. Provide two 1-ton samples of riprap stone at least 7 days prior to placement.

2. Provide certified test results to document conformance with Specification requirements.

Riprap:

A. Onsite, hard, durable, broken, quarried sandstone or igneous rock. Free from fractures, bedding planes, siltstone or shale layers, pronounced weathering, and earth or other adherent coatings.

B. Elongation: Minimum dimension not less than 1/3 maximum dimension.

C. Unconfined compressive strength: Minimum 4,000 psi in accordance with ASTM D 7012 on drilled core specimen.

D. Relative Density: Minimum 2.5 in accordance with ASTM C 127

E. Gradation: The size, gradation, and weight of riprap shall conform to the following requirements:

Riprap Type	Stone Size (inches)	% Smaller By Weight
Type L	15	70-100
	12	50-70
	9	35-50
	3	2-10
Type M	21	70-100
	18	50-70
	12	35-50
	4	2-10
Scour Berm Riprap	42	100
	28	50-80
	24	30-50
	20	0-30

Riprap Type	Stone Size (inches)	% Smaller By Weight
	16	0-15

F. Soil Riprap

1. Rock requirements are to comply with riprap as specified.
2. The soil material shall be native or topsoil and mixed with sixty-five percent (65%) riprap and thirty five percent (35%) soil by volume.
3. Soil riprap shall consist of a uniform mixture of soil and riprap without voids.

PART 3 - EXECUTION

Place stone to produce a well-graded mass of stone with minimum percentage of voids.

G. Place to required thickness and grades.

1. Place stone to avoid displacing the underlying material.
2. Distribute entire mass to conform to gradation specified.
3. Do not place stone by dumping or similar method likely to cause segregation.
4. Keep finished stone placement free from objectionable pockets of small stones or clusters of larger stone.
5. Hand place as necessary to obtain a well-graded distribution.
6. Place stone in schedule and sequence with excavation and embankment construction to prevent mixture of embankment and stone revetment materials.
7. Maintain stone until accepted.
8. Replace any displaced material to lines and grades shown.

END OF SECTION

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 32 31 13
CDOT DEER FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. CDOT Deer fencing and gates. This section shall consist of furnishing and installing new fence and/or removing and salvaging existing fence and restoring the same in conformance with the lines and grades and requirements shown on the DRAWINGS. Wherever the materials to be removed are not in good condition, as judged by the ENGINEER, or wherever CONTRACTOR has damaged the materials during the process of removal, equal or better quality fencing materials than the existing shall be furnished and installed by CONTRACTOR.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 00 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   The following is a list of standards which may be referenced in this section:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M111M/M111, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. M133, Standard Specification for Preservatives and Pressure Treatment Processes for Timber.
      c. M232M/M232, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      d. M281, Standard Specification for Steel Fence Posts and Assemblies, Hot-Wrought.
   2. ASTM International (ASTM):
      a. A116, Standard Specification for Metallic-Coated, Steel-Woven Wire Fence Fabric.
      b. F537, Standard Specification for Design, Fabrication, and Installation of Fences Constructed of Wood and Related Materials
   3. Federal Specification (FED): FCGS-02-1, Fencing, Wire and Post, Metal (Chain-link Fence Posts, Top Rails and Braces).

B. Qualifications:
   1. Installer bonded and licensed in the Project state.
   2. Installer shall have a minimum two years' experience installing similar fencing.
   3. Utilize only AWS certified welders.

1.3 DEFINITIONS

A. NPS: Nominal pipe size, in inches.

B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
    1. Acknowledgement that products submitted meet requirements of standards referenced.
    2. Manufacturer's installation instructions.
3. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.
4. Mill certificates.
5. Source quality control test results.

B. Contract Closeout Information:
1. Operation and Maintenance Data:
    1. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Welded Wire Fabric:
1. Fabric type:
    a. Conform to AASHTO M 279 (ASTM A116)Design # 2096-6-12.5, Grade 60, Coating type ZA, Coating Class 80.
2. Wire gage: 12.5
3. Mesh size: 6 IN.

B. Concrete:
1. ASTM C150 Type I.
2. 1 IN maximum size aggregate (ASTM C33).
3. Clean water.
4. Minimum 28-day compressive strength of 2500 PSI.
5. Not less than four sacks of cement per cubic yard.
6. 3 IN minimum slump.
7. 2 to 4 PCT entrained air.

C. Line Post:
1. Treated 5 in diameter timber

D. Corner or Terminal Posts:
1. Treated 6 in diameter timber

E. Tension Wire:
1. Top of fabric:
    1. Continuous line wire shall be high tensile (175 K min), Fixed know 13 gauge wire (60K min.) shall connect line wire with vertical stay wire.

F. Fence Fittings (Post and Line Caps, Rail and Brace Ends, Sleeves-Top Rail, Tie Wires and Clips, Tension and Brace Bands, Tension Bars, Truss Rods):
1. ASTM F626.

G. Swing Gate:
1. ASTM F900.
2. Materials as specified for fence framework and fabric.
3. Hardware:
    1. Galvanized per ASTM A153/A153M.
    2. Hinges to permit 90 DEG in and out gate opening.
    3. Provide heavy duty brass padlock with 2 keys.

2.2 SOURCE QUALITY CONTROL

A. Test related fence construction materials to meet the following standards:
   1. Posts and rails: ASTM F1043, Heavy Industrial.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with:
   1. Manufacturer's instructions.
   2. Lines and grades shown on Drawings.
   3. ASTM F567.

B. Do not start fence installation before final grading is complete and finish elevations are established.

C. Drill holes in firm, undisturbed or compacted soil.

D. Place fence with bottom edge of fabric at maximum clearance above grade, as shown on Drawings.
   1. Correct minor irregularities in earth to maintain maximum clearance.

E. Line brace posts shall be spaced at 400 ft. Intervals, where fencing is continuous and where end, corner & line brace posts are not specified.

F. Space line posts at equal intervals not exceeding 10 FT OC.

G. Provide post braces for each gate, corner, pull and terminal post and first adjacent line post.

H. Install tension bars full height of fabric.

I. All fence wire ties, brace wires, staples and other wire appurtenances shall be galvanized in conformance with MSHTD M 23 2.

J. Pull fabric taut and secure to posts and rails.
   1. Secure so that fabric remains in tension after pulling force is released.
   2. Secure to posts at not over 15 IN OC, and to tension wire at not over 24 IN OC.
   3. Bend ends of wire to minimize hazards to persons or clothing.

K. Install post top at each post.

L. Gates:
   1. Construct with fittings or by welding.
   2. Provide rigid, weatherproof joints.
   3. Assure right, non-sagging, non-twisting gate.
   4. Coat welds with rust preventive paint, color to match pipe.

END OF SECTION

SECTION 32 90 00
RESTORATION AND SEEDING

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Establishing Test Plots to support reclamation activities including:
   1. Assessing soil chemistry of growth medium materials to determine fertilizer and amendment needs.
   2. Assessing different mixtures of growth medium materials by evaluating success in establishing vegetation in the test plots.

B. Reclaiming disturbed areas within the limits of site disturbance. Disturbed areas include:
   1. Excavation cut slopes.
   2. Fill slopes.
   3. Regraded slopes.
   4. Areas disturbed as a result of the installation of the erosion protection and sediment control measures.
   5. Sediment pond.

1.2 RELATED SECTIONS

A. SECTION 31 10 00 SITE CLEARING.

B. SECTION 31 25 00: EROSION PROTECTION AND SEDIMENTATION CONTROL.

1.3 DEFINITIONS

A. Reclaiming disturbed areas shall mean regrading, hauling, placing and spreading growth medium materials; applying fertilizers, soil amendments and seed; applying mulch and/or mulch stabilizers and maintaining all seeded areas.

B. Subsoils shall mean onsite existing fill or overburden, consisting of fine-grained soils or weathered, fine-grained, residual sedimentary rock materials.

C. Soil amendments shall mean a local source of peat, manure, compost, biosolids or other organic materials as approved by the OWNER.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Reclamation Plans showing sequence and limits of site reclamation.
   2. Test Plot Plan showing location, layout, plans and details of test plots.

B. Products:
   1. Tags from all seed and soil amendment materials shall be provided to and approved by the OWNER.
   2. Certificate of analysis and weight for all commercial fertilizers.

C. Samples:
   1. Onsite subsoils proposed for reclamation.
   2. Soil amendments proposed for reclamation, taken at the source.

D. Soil Testing:
   1. Soil testing results from Colorado State University Soil, Water and Plant Testing Laboratory:
      a. Onsite subsoils.
      b. Soil amendments.

1.5 QUALITY ASSURANCE

A. Qualifications: Demonstrate CONTRACTOR or SUBCONTRACTOR education, training, and experience in revegetation, reclamation, and satisfactory performance on three similar projects within the past five years or as approved by the OWNER.

1.6 PROTECTION

A. Protect from erosion damage caused by other construction.

B. Reclaim any disturbance of vegetation or native ground outside of the limits of site disturbance.

PART 2 - PRODUCTS

2.1 SUBSOIL

A. Subsoil shall be as defined in this specification.

B. Subsoil shall be from on-site stockpiles representative of material to be generated during test plot development and reclamation. Subsoils shall be consistent with on site materials observed supporting vegetation.

C. Subsoil shall not contain toxic materials harmful to vegetation growth.

D. Subsoil used for test plots shall be stockpiled and thoroughly mixed prior to placement in the four plots, to provide uniform, consistent, materials for all plots.

2.2 SOIL AMENDMENTS

A. Soil amendments shall be as defined in this specification.

B. Soil amendments shall be from a local source of material to be generated during test plot development and reclamation.

C. Caked or lumpy soil amendments will not be accepted.

D. Manure shall be dry cow, horse or sheep manure that has been stockpiled a minimum of one (1) year. Manure shall not be so caked or lumpy that it cannot be spread uniformly.

E. Compost manure shall be stabilized through at least one heating cycle (120 to 140 F degrees), turned at least once, and windrow for at least 45 days and stockpile for a least 2 months.

F. Biosolids or compost biosolids, containing municipal biosolids, shall meet Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-64 Biosolids Regulation No. 64, including permitting and regulatory approval procedures.

G. Soil amendments shall not contain pathogens or toxic materials harmful to human health or vegetation growth.

2.3 INORGANIC FERTILIZERS

A. Commercial grade nitrogen, phosphorus, or other inorganic based fertilizer.

B. Free flowing, suitable for application with hydraulic- or pneumatic-type equipment or fertilizer spreaders and conforming to applicable Colorado State Fertilizer laws.

C. Fertilizer types and application rates to be determined base on soil testing results.

2.4 SEED

A. Weeds classified by Colorado Department of Agriculture as noxious weeds in accordance with the Noxious Weed Act:
   1. List A and List B noxious weed species: None
   2. List C weed species: 0.5 percent maximum, by weight.

B. Seed containers: Sealed and labeled to comply with Colorado State Seed Laws and Regulations or in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act, if shipped in Interstate Commerce.
   1. Identify seed origin on label. Each delivery shall be accompanied by seed bag tags or equivalent. Tags shall show the guaranteed percentages of purity, weed content germination, net weight, date of seed testing, and date of shipment.
   2. Seed Mixture:
      a. Purity: 85 percent minimum.
      b. Germination:
         1) 85 percent minimum
         2) Germination test less than 1 year old at time of seeding.
      c. Uniform mixture shown in
      d. Table 32 90 00.1 – Upland (Area 1) Seed Mixture.
      e. Table 32 90 00.2 – Floodplain (Area 2) Seed Mixture

TABLE 32-90 00.1 – LYONS QUARRY REVEGETATION – NATIVE UPLAND (AREA 1) SEED MIXTURE

Common Name	Latin name	Variety (Granite Seed)	% of mix	# PLS/Acre	% of mix	#PLS
Side Oats Grama	*Bouteloua curtipendula*	Vaughn	10	1.82	7	0.07
Blue Grama	*Bouteloua gracilis*	Hachita	15	0.63	2	0.02
Mountain Mahogany*	*Cercocarpus montana*	VNS	5	3.68	19	0.18
Griffith's Wheatgrass*	*Elymus albicans*	Trailhead	12	2.72	10	0.1
Canada Wildrye	*Elymus canadensis*	Mandan	10	3.03	13	0.12
Squirreltail	*Elymus elymoides*	Pueblo	14	2.72	11	0.11
Slender Wheatgrass	*Elymus trachycaulus*	San Luis	9	4.38	19	0.18
Rabbitbrush	*Ericameria nauseousus*	VNS	8	0.38	2	0.02
Little Bluestem	*Schizachyrium scoparium*	Cimarron	8	1.07	4	0.04
Needle and Thread Grass	*Stipa comata*	VNS	9	2.73	11	0.11
		Totals	**100**	**23.16**	**99**	**1.0**

Rates are for broadcasting. If using a seed drill, reduce rates by half. PLS = Pure Live Seed
*** - Local sourced seed may be provided by BCPOS for full scale reclamation**

TABLE 32-90 00.2 – LYONS QUARRY REVEGETATION – NATIVE FLOODPLAIN (AREA 2) SEED MIXTURE

Common Name	Species Name	Variety	% of Mix	#PLS/ Acre
Canada Wildrye	*Elymus canadensis*	Mandan	12	3.64
Blue Grama	*Bouteloua gracilis*	Native, Alma, or Hachita	14	0.59
Slender Wheatgrass	*Elymus trachycaulus*	San Luis or First Strike	10	2.19
Squirrel Tail	*Elymus elymoides*	Pueblo	12	2.18
Thickspike Wheatgrass	*Elymus trachycaulus*	Critana	10	2.26
Sandberg Bluegrass	*Poa secunda*	Colorado Plateau	5	0.38
Switchgrass	*Panicum virgatum*	Blackwell or Nebraska 28 or BOCO	9	0.81
Green Needlegrass	*Stipa viridula*	Lodorm or Native	8	1.54
Fringed Sage	*Artemesia frigida*	VNS	4	0.03
Hairy Golden Aster	*Heterotheca viliosa*	VNS	5	0.20
Rocky Mtn. Bee Plant	*Cleome serrulata*	VNS	4	2.12
Rabbitbrush	*Ericameria nuaseousus*	VNS	7	0.61
		Totals:	**100**	**16.55**

2.5 MULCHES

A. Mulch shall consist of native grass hay:
   1. Certified noxious weed free.
   2. Approximately 30 percent by weight of the mulch material shall be ten inches (10") in length or longer.
   3. Rotted, caked, decayed or moldy material will not be accepted.

PART 3 - EXECUTION

3.1 TEST PLOTS

A. Develop test plots using the soil types and slopes anticipated for reclamation. The test plots shall be seeded in the fall and maintained for a minimum of two seasons.

B. Test Plot Size:
   1. Test Plots shall be 30 by 30 foot plots, subdivided into two 15 ft. X 30 ft. subplots, allowing testing of two variables per plot.

C. Test Plot Location and Orientation:
   1. To facilitate reclamation schedule considerations, test plots shall be located such that they do not interfere with reclamation earthwork. Test plots shall be located as near to the reclamation area as practical. Test plots shall be established at the same elevation and aspect (northeast facing slopes and northwest facing slopes) as the reclamation slopes.

D. Test Plot Protection
   1. Secure test plots with wire fencing (minimum 10 feet height) to keep wildlife out. The fence will have a gate for access.

E. Test Plots Setup:
   1. Developed four test plots with two subplots per test plot (8 total subplots) (Table 32 90 00.2 – Test Plot Setup).
   2. Select soil amendments. Use only a single soil amendment type in a subplot. Soil amendment types shall not be mixed.
   3. Test plots treatments are as follows:
      a. All treatments require placement of on-site subsoil representative of material to be generated during reclamation and consistent with the material observed supporting vegetation at the site.
      b. Treatment 1 (T1) – 12 inches of subsoil only.
      c. Treatment 2 (T2) – 12 inches of subsoil with 5 percent by volume amendments. Amendment source will be either compost or biosolids.
      d. Treatment 3 (T3) – 12 inches of subsoil with 15 percent by volume amendments
      e. Treatment 4 (T4) – 12 inches of subsoil with inorganic fertilizer
   4. Soil amendments shall be thoroughly and uniformly mixed with subsoil.
   5. Determine inorganic fertilizer types and application rates based on subsoil test results from Colorado State University.
   6. Fertilizer will only be added to T4 plots. However, if soil test reports recommend other soil amendments (e.g. addition of lime), OWNER will evaluate the need for adding amendments to all plots at same rate.

F. Test Plot Preparation and Seeding
   1. Following placement of subsoil and amendments, surface shall be lightly scarified to allow for suitable surface bed for receiving seeds.
   2. Seeds shall be broadcast using a calibrated hand spreader or similar calibrated seed spreading device and applied at recommended rates.
   3. Mulch using native grass hay (certified noxious weed-free). The mulch will be applied so it is dense enough to shade the soil and prevent wind desiccation, but not so dense as to retard grass seedling emergence. Properly applied hay mulch should form a porous layer with some soil still visible. This thickness of mulch should correspond to an application rate of 2 tons per acre. Any type of hay or straw will be crimped into the soil to minimize loss of hay by wind or water erosion.

4.

TABLE 32-90 01 – TEST PLOT SETUP

Test Plot	1		2		3		4	
Subplot	1A	1B	2A	2B	3A	3B	4A	4B
Subsoil (inches)	12	12	12	12	12	12	12	12
Amendments (Percent by volume)	None	5	15	None	None	15	5	None
Inorganic fertilizer	None	None	None	None	Per Recom.	None	None	Per Recom.
Treatment	T1	T2	T3	T1	T4	T3	T2	T4

Treatments:
T1 – 12 in. of subsoil only, subplots 1A and 2B
T2 – 12 in. of subsoil with 5 percent volume amendments, subplots 1B and 4A
T3 – 12 in. of subsoil with 15 percent volume amendments, subplots 2A and 3B
T4 – 12 in. of subsoil with inorganic fertilizer 2A and 4B

Volume Calculations:

1 foot thick subsoil on 15 X 30 ft. plot is 450 ft^3 or 17 yd^3 per subplot. 17 yd^3 X 8 subplots = **136 yd^3 total subsoil**
5 percent amendments = 0.05 X 17 yd^3 = 0.9 yd^3 per subplot X 2 subplots = 1.8 yd^3
15 percent amendments = 0.15 X 17 yd^3 = 2.6 yd^3 per subplot X 2 subp0lots = 5.2 yd^3
Total amendments volume = 1.8 + 5.2 yd^3 = **7 yd^3 total amendments**

G. Test Plot Irrigation
   1. No irrigation is required if seeding is done in fall (a spring seeding is feasible only if ground is wet and there is sufficient moisture to obtain germination).

H. Test Plot Monitoring
   1. Test plots shall be monitored twice per year, spring and fall. Monitoring activities include:
      a. Photographs of plots and plants
      b. Vegetative survey that includes identification of plant types, plant heights, plant density, overall vegetation density, presences of weeds.

I. Test Plot Soil Testing
   1. Samples shall be collected in the fall for each plot and tested for routine soil nutrient assessment by Colorado State University including major plant nutrients and micronutrients.

3.2 GENERAL

A. The general order of execution shall be:
   1. Test plot development and soil amendment determination
   2. Amended subsoil placement
   3. Seedbed preparation
   4. Seed application
   5. Mulch application
   6. Maintenance

B. Seeding shall be accomplished between September 1 and May 1. No seeding shall take place when soils are frozen, snow covered, or excessively wet or dry, or when wind velocities prevent uniform application of the materials.

C. Grade all areas to drain. The maximum slope steepness shall be 2H:1V unless otherwise shown on the Drawings or approved in writing by OWNER.

D. Remove all CONTRACTOR'S equipment, debris, office, temporary fences or gates, and all other CONTRACTOR'S properties.

E. Eliminate uneven areas and low spots. Remove debris, roots, branches and stones in excess of 3-inch size.

F. Scarify and loosen subgrade soil to a minimum depth of 3 inches where amended subsoil is required. Scarify and loosen areas to receive seed that have been disturbed or compacted by equipment.

3.3 PLACING SUBSOIL

A. Place subsoil over all areas disturbed during construction.

B. Spread subsoil evenly over the disturbed area, or as required by OWNER.

C. Do not place subsoil in water or while frozen or muddy conditions exist.

D. Grade final surface of the amended subsoil to a relatively smooth surface using mechanical or hand raked methods. There shall not be any localized low spots that will allow water to accumulate.

3.4 FERTILIZERS AND SOIL AMENDMENTS

A. Immediately prior to seedbed preparation, fertilizers and amendments shall be uniformly applied over the areas designated for seeding and immediately incorporated into the soil by tilling methods as discussed below. Commercial fertilizer and soil amendments shall be applied at the rates indicated by the results of the test plots.

B. Cultivate soil amendments into top 6-inches of soil.

C. Organic Compost Soil Amendment shall be applied at a maximum rate of three (3) cubic yards per one-thousand (1,000) square feet. Actual application rates will be deterimined by the results of the test plots.

D. Commercial Fertlizer Amendment shall be applied at a maximum rate of three-hundred (300) lbs. per acre. Actual application rates will be deterimined by the results of the test plots.

3.5 SEED BED PREPARATION

A. The seedbed shall be firm and any trash, weeds or other debris that could interfere with seeding operations shall be removed and disposed of as approved by OWNER.

B. Where equipment can operate, the seedbed shall be adequately loosened four to six inches (4" to 6") deep and smoothed. Chiseling, discing, harrowing or cultipacking may be required. Work shall be done on the contour where practicable.

C. Where equipment cannot operate, the seedbed shall be hand raked or otherwise prepared by hand by scarifying to a minimum depth of one inch (1") to provide a roughened surface so that seed will stay in place.

D. Seedbed preparation shall be suspended when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by OWNER.

3.6 SEED APPLICATION

A. Apply seed by broadcast seeding within 10 days following soil preparation.
   1. Apply seed mixture at rate specified in Table 32 90 00 – Seed Mixture.

B. Broadcast seeding:
   1. Mechanical broadcasting:
      a. Equipment:
         1) Centrifugal type.
         2) Pull type similar to fertilizer spreader.
      b. Designed and regulated to apply seed uniformly at proper rate per acre.

2. Hand Broadcasting:
    a. By hand broadcaster.
    b. By hand.
    c. Uniformly applied.
3. Cover seed with soil to depth of ¼-inch to ½-inch immediately after broadcasting.
    a. Use hand rake or float.
    b. Do not use log chain or similar device.

3.7 MULCHING

A. Native grass hay mulch shall be applied uniformly at the rate of two (2) tons per acre over seeded areas. Hydromulch (with 150 gal/acre tackifier emulsion) shall be applied at the rate of one and a half (1-1/2) tons per acre. Mulch shall be applied to the designated areas immediately after seeding and not later than 24 hours after seeding has been performed. Mulching shall not be done when the wind velocity exceeds fifteen (15) miles per hour.

3.8 STABILIZING MULCH

A. On areas flatter than 3H:1V, unless prohibited by access or topography, a mulch crimper shall be used to stabilize or anchor the mulch into the soil after mulch has been spread. The crimper shall be equipped with scrapers to keep the blades clean. Spacing of crimper blades shall not exceed nine inches (9").

B. On areas steeper than 3H:1V, hydromulch shall be applied.

C. On areas where access or topography prohibits machine mulching or hydromulching, crimping shall be achieved by hand with a suitable tool, such as a spade, on 18" centers, or the mulch shall be tied down with properly anchored jute netting.

3.9 IRRIGATION

A. No irrigation is proposed assuming seeding is done in fall (a spring seeding may be feasible if done when ground is wet and there is sufficient moisture to obtain germination).

B. The sedimentation pond is to remain in place until the end of reclamation in order to provide irrigation if deemed necessary.

C. If irrigation is determined to be necessary for germination success, the estimated amount of water necessary to water planted grasses would be 0.2 to 0.8 acre feet to establish vegetation with the goal of no watering once plants are established. The focus of revegetation is native plant species adapted to area climate. The water would be pumped from the existing pond at rates of 40 to 80 gallons per minute, depending upon the irrigation system setup, season, and weather conditions.

3.10 MAINTENANCE AND PROVISIONAL ACCEPTANCE

A. The CONTRACTOR shall keep all seeded areas in good condition during the construction season, reseeding and mulching if and when necessary until growth is established over the entire area seeded, CONTRACTOR shall maintain these areas in an approved condition until provisional acceptance.

B. On slopes, the CONTRACTOR shall prevent washouts by an approved method. Any washout which occurs shall be regraded and reseeded at no additional expense to OWNER. Maintain seeded area until vegetation is established.

C. The OWNER will inspect all work for provisional acceptance during the following construction season, upon the written request of the CONTRACTOR, received at least 10 days before the anticipated date of inspection.

D. An area will be considered to be satisfactorily reclaimed when:
1. Soil erosion resulting from the operation has been stabilized.
2. A vegetative cover has been established.

E. The inspection by the OWNER will determine whether maintenance shall continue in any area or manner.

F. After all necessary corrective work and clean-up has been completed, the OWNER will certify in writing the provisional acceptance. The CONTRACTOR'S responsibility for maintenance shall cease on receipt of provisional acceptance.

3.11 GUARANTEE PERIOD AND FINAL ACCEPTANCE

A. All seeded areas shall be guaranteed by the CONTRACTOR for not less than 1 full year from the time of final project acceptance.

B. At the end of the guarantee period, inspection will be made by the OWNER upon written request submitted by the CONTRACTOR at least 10 days before the anticipated date. Areas not demonstrating satisfactory reclamations as outlined above, as determined by the OWNER, shall be renovated, reseeded, and maintained meeting all requirements as specified herein.

C. After all necessary corrective work has been completed, the OWNER shall certify in writing the final acceptance.

END OF SECTION

SECTION 32 31 13
CDOT DEER FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. CDOT Deer fencing and gates. This section shall consist of furnishing and installing new fence and/or removing and salvaging existing fence and restoring the same in conformance with the lines and grades and requirements shown on the DRAWINGS. Wherever the materials to be removed are not in good condition, as judged by the ENGINEER, or wherever CONTRACTOR has damaged the materials during the process of removal, equal or better quality fencing materials than the existing shall be furnished and installed by CONTRACTOR.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 00 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   The following is a list of standards which may be referenced in this section:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M111M/M111, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. M133, Standard Specification for Preservatives and Pressure Treatment Processes for Timber.
      c. M232M/M232, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      d. M281, Standard Specification for Steel Fence Posts and Assemblies, Hot-Wrought.
   2. ASTM International (ASTM):
      a. A116, Standard Specification for Metallic-Coated, Steel-Woven Wire Fence Fabric.
      b. F537, Standard Specification for Design, Fabrication, and Installation of Fences Constructed of Wood and Related Materials
   3. Federal Specification (FED): FCGS-02-1, Fencing, Wire and Post, Metal (Chain-link Fence Posts, Top Rails and Braces).

B. Qualifications:
   1. Installer bonded and licensed in the Project state.
   2. Installer shall have a minimum two years' experience installing similar fencing.
   3. Utilize only AWS certified welders.

1.3 DEFINITIONS

A. NPS: Nominal pipe size, in inches.

B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
    1. Acknowledgement that products submitted meet requirements of standards referenced.
    2. Manufacturer's installation instructions.
3. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.
4. Mill certificates.
5. Source quality control test results.

B. Contract Closeout Information:
1. Operation and Maintenance Data:
    1. See Specification Section 01 33 04 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Welded Wire Fabric:
1. Fabric type:
    a. Conform to AASHTO M 279 (ASTM A116)Design # 2096-6-12.5, Grade 60, Coating type ZA, Coating Class 80.
2. Wire gage: 12.5
3. Mesh size: 6 IN.

B. Concrete:
1. ASTM C150 Type I.
2. 1 IN maximum size aggregate (ASTM C33).
3. Clean water.
4. Minimum 28-day compressive strength of 2500 PSI.
5. Not less than four sacks of cement per cubic yard.
6. 3 IN minimum slump.
7. 2 to 4 PCT entrained air.

C. Line Post:
1. Treated 5 in diameter timber

D. Corner or Terminal Posts:
1. Treated 6 in diameter timber

E. Tension Wire:
1. Top of fabric:
    1. Continuous line wire shall be high tensile (175 K min), Fixed know 13 gauge wire (60K min.) shall connect line wire with vertical stay wire.

F. Fence Fittings (Post and Line Caps, Rail and Brace Ends, Sleeves-Top Rail, Tie Wires and Clips, Tension and Brace Bands, Tension Bars, Truss Rods):
1. ASTM F626.

G. Swing Gate:
1. ASTM F900.
2. Materials as specified for fence framework and fabric.
3. Hardware:
    1. Galvanized per ASTM A153/A153M.
    2. Hinges to permit 90 DEG in and out gate opening.
    3. Provide heavy duty brass padlock with 2 keys.

2.2 SOURCE QUALITY CONTROL

A. Test related fence construction materials to meet the following standards:
   1. Posts and rails: ASTM F1043, Heavy Industrial.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with:
   1. Manufacturer's instructions.
   2. Lines and grades shown on Drawings.
   3. ASTM F567.

B. Do not start fence installation before final grading is complete and finish elevations are established.

C. Drill holes in firm, undisturbed or compacted soil.

D. Place fence with bottom edge of fabric at maximum clearance above grade, as shown on Drawings.
   1. Correct minor irregularities in earth to maintain maximum clearance.

E. Line brace posts shall be spaced at 400 ft. Intervals, where fencing is continuous and where end, corner & line brace posts are not specified.

F. Space line posts at equal intervals not exceeding 10 FT OC.

G. Provide post braces for each gate, corner, pull and terminal post and first adjacent line post.

H. Install tension bars full height of fabric.

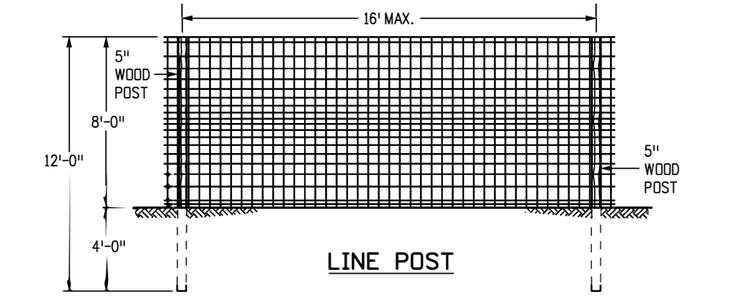
I. All fence wire ties, brace wires, staples and other wire appurtenances shall be galvanized in conformance with MSHTD M 23 2.

J. Pull fabric taut and secure to posts and rails.
   1. Secure so that fabric remains in tension after pulling force is released.
   2. Secure to posts at not over 15 IN OC, and to tension wire at not over 24 IN OC.
   3. Bend ends of wire to minimize hazards to persons or clothing.

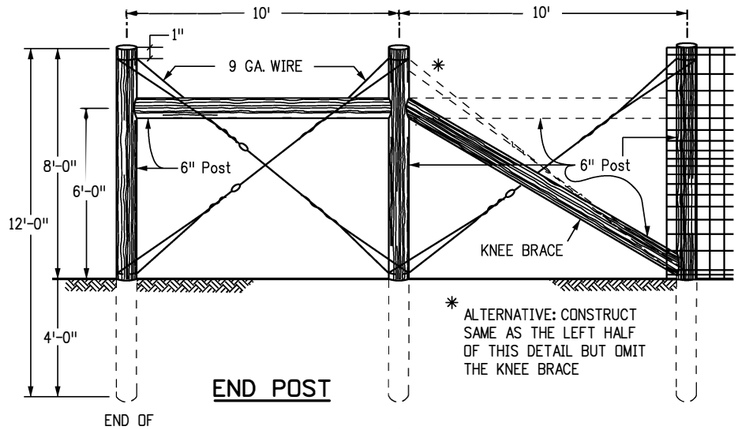
K. Install post top at each post.

L. Gates:
   1. Construct with fittings or by welding.
   2. Provide rigid, weatherproof joints.
   3. Assure right, non-sagging, non-twisting gate.
   4. Coat welds with rust preventive paint, color to match pipe.

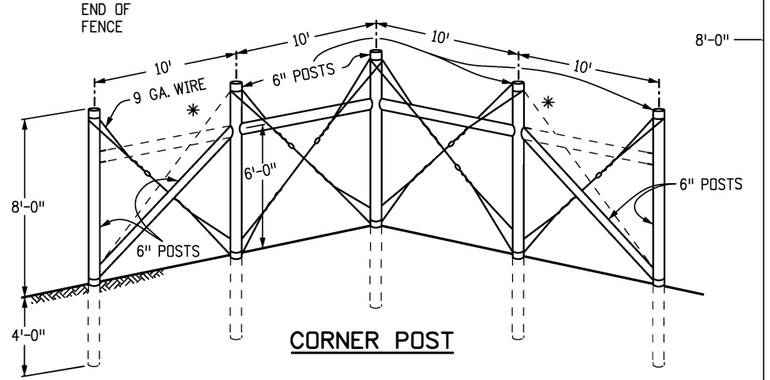
END OF SECTION



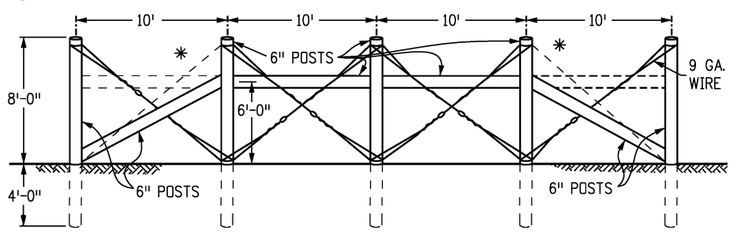
LINE POST



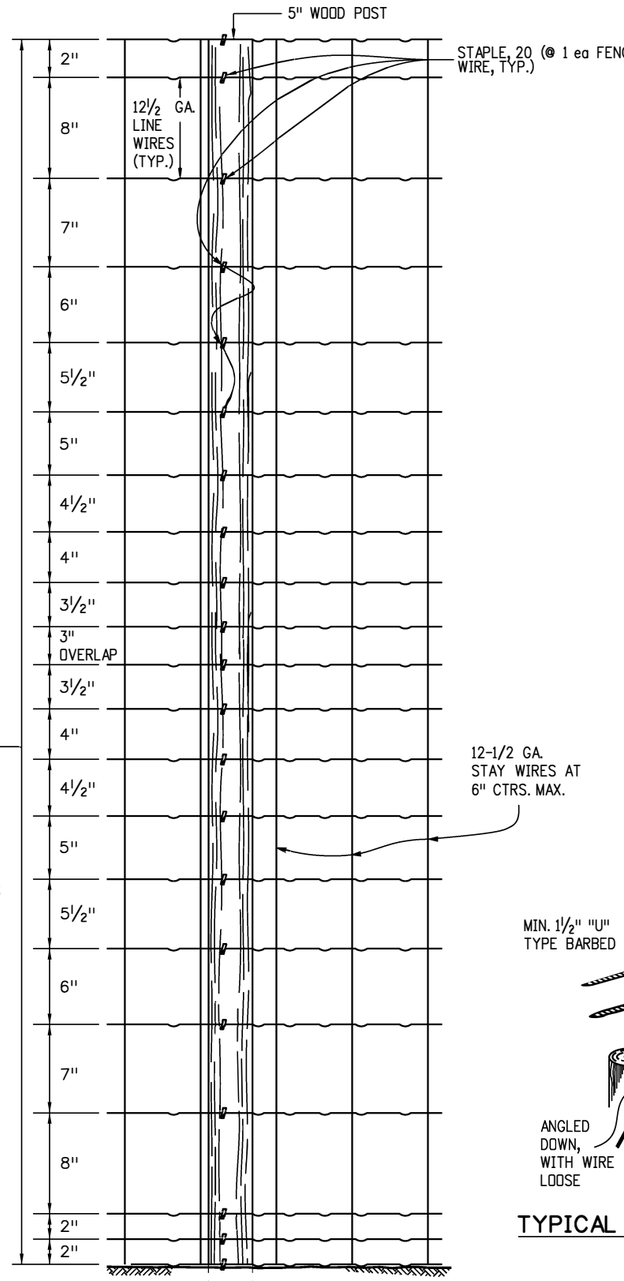
END POST



CORNER POST



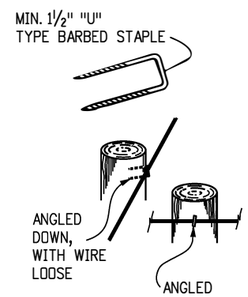
LINE BRACE POST



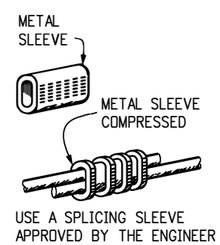
DEER FENCE WIRE FABRIC

GENERAL NOTES

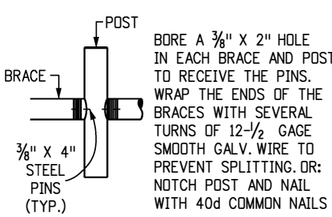
1. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A BARRIER FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE. THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF ½ IN. AND 8 FT. IN LENGTH, AND DRIVEN AT LEAST 7½ FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
2. END POST, CORNER POST, AND LINE BRACE POST SHALL BE ASSEMBLED BY THE UNIT AND PAID FOR AS SUCH. ALL WORK AND MATERIAL ASSOCIATED WITH EACH ASSEMBLY, SHALL BE INCLUDED IN THE UNIT PRICE FOR THAT ASSEMBLY.
3. LINE BRACE POSTS SHALL BE SPACED AT 400 FT. INTERVALS, WHERE FENCING IS CONTINUOUS AND WHERE END, CORNER & LINE BRACE POSTS ARE NOT SPECIFIED.
4. ALL LINE POSTS SHALL BE 5 IN. MIN. DIAMETER AND 12 FT. LONG. ALL END, CORNER AND LINE BRACE POSTS SHALL BE 6 IN. MIN. DIAMETER AND 12 FT. LONG. ALL POSTS AND BRACES SHALL BE TREATED IN ACCORDANCE WITH SUBSECTION 710.07.
5. FENCE WIRE MAY BE PLACED ON EITHER THE ROAD SIDE OR THE FIELD SIDE OF POSTS, DEPENDING ON LOCAL CONDITIONS; i.e., ON CURVES, THE WIRE SHOULD BE PLACED ON THE SIDE WHICH WOULD RESULT IN THE LEAST AMOUNT OF TENSION ON THE STAPLES. THIS ALSO APPLIES WHERE WIND DRIFT OR OTHER CONDITIONS WOULD EXERT UNUSUAL PRESSURE AGAINST THE WIRE.
6. WHERE CONCRETE STRUCTURES ARE USED AS A DEER PASS, THE FENCE SHALL END AT EYEBOLTS IN WINGS OF THE STRUCTURE. EYEBOLTS IN FRESH CONCRETE SHALL BE MADE OF ½ IN. ROUND BARS AND EMBEDDED A MINIMUM OF 6 IN. WITH A HOOKED OR BENT END. IN EXISTING CONCRETE, THE ½ IN. ROUND BARS SHALL BE DEFORMED AND GROUTED INTO DRILLED HOLES. EYEBOLTS SHALL HAVE A MINIMUM OF 1 IN. INSIDE EYE DIAMETER AND SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. COST OF EYEBOLTS SHALL BE INCLUDED IN THE CONTRACT PRICE FOR FENCING.
7. WOVEN WIRE FENCE FABRIC SHALL CONFORM TO AASHTO M 279 (ASTM A 116). DESIGN NO. 2096-6-12½, GRADE 60, COATING TYPE ZA, COATING CLASS 80.
8. ALL FENCE WIRE TIES, BRACE WIRES, STAPLES AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232.
9. THE CONTRACTOR SHALL RE-ESTABLISH DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY IN ACCORDANCE WITH SUBSECTION 625.08 OF THE STANDARD SPECIFICATIONS.
10. CONTINUOUS LINE WIRE SHALL BE HIGH TENSILE (175 K MIN.). CONTINUOUS STAY WIRE SHALL BE MID-TENSILE (125 K MIN.). FIXED KNOT 13 GAUGE WIRE (60K MIN.) SHALL CONNECT LINE WIRE WITH THE VERTICAL STAY WIRE.
11. DEER GATE AND TOP BRACES SHALL BE PAINTED WITH GREEN PAINT ACCORDING TO SUBSECTION 708.03 AND COLOR NO. 14109 OF FEDERAL STANDARD 595B.



TYPICAL STAPLING



WIRE SPLICE



CROSS BRACE DOWELING

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 04/30/15 Initials: LTA	(R-X)	04/30/15	Created new M Standard: M-607-4 - Deer Fence, Gates, and Game Ramps
Full Path: www.coloradodot.info/business/designsupport	(R-X)		
Drawing File Name: 607040105.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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DEER FENCE, GATES, AND GAME RAMPS

Issued By: Project Development Branch March 4, 2015

STANDARD PLAN NO.

M-607-4