SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Demolition, removal, salvage and disposal of existing site features, piping, structures and materials where indicated on the drawings and as specified in this section

B. Demolition and removal of concrete foundations, sidewalks, concrete and asphaltic paving

1.2 RELATED SECTIONS

A. Section 01500 – Construction Facilities and Temporary Controls

B. Section 02300 – Earthwork

C. Section 02950 - Seeding

1.3 SUBMITTALS

A. Permits and Certificates.
   1. Permits and notices authorizing demolition
   2. Certificates of severance of utility service
   3. Permit for transport and disposal of debris

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1 specifications

B. Accurately record actual locations of capped utilities and subsurface obstructions

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, and disposal

B. Obtain required permits from authorities

C. Notify affected utility companies before starting work and comply with their requirements

D. Do not close or obstruct roadways, sidewalks, or hydrants without written permission from Owner

E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials

1.6 SCHEDULING

A. Schedule and submit under provisions of Division 1 specifications

B. Provide detailed descriptions for demolition and removal procedures

C. Notify Engineer and Owner of any demolition work one (1) week prior to commencement

D. Coordinate all demolition work with Engineer and Owner

PART 2 PRODUCTS

2.1 SALVAGE OF MATERIALS

A. Remove and return to Owner the following Equipment and Materials:
   1. Manhole rings and covers

B. All existing construction and items not salvaged to Owner shall be considered waste and shall become the property of Contractor for off-site disposal

C. Remove and reinstall as indicated on Drawings and herein the following Equipment and Materials:
   1. Landscape ground cover and any underlying weed barriers

2.2 HANDLING AND STORAGE

A. Contractor shall carefully disassemble Equipment and Materials that are to be reused and returned to Owner in such a way to avoid any damage. Contractor shall store such Equipment and Materials in such a way to avoid any damage, corrosion, or staining

2.3 FILL MATERIALS

A. Fill Material: Use on site fill material under provisions of Section 02300 and in accordance with Geotechnical recommendation

PART 3 EXECUTION

3.1 INSPECTION

A. Verify areas to be demolished are unoccupied and discontinued in use

B. Do not commence work until conditions are acceptable to Engineer and Owner

C. Existing conditions of Equipment and Materials, structures, surfaces, or properties that could be misinterpreted as damaged as a result of demolition work shall be photographed and filed with Owner and Engineer prior to commencement of Work

3.2 PREPARATION

A. Provide, erect, and maintain temporary barriers, enclosures, security fences and shoring at demolition locations in accordance with Division 1 and other related specifications to protect personnel

B. Protect existing structures and utilities which are not to be demolished

C. Provide temporary wiring and connections to maintain existing telephone, electrical, instrumentation and control systems in service during construction

D. Protect existing electrical and controls equipment and cabinets from dust and debris intrusion. Set up temporary barriers to preclude dust from being introduced into cabinets and equipment. Additionally, seal all cabinets and equipment while demolition is occurring. Control and or turn off existing heating and ventilation systems that will introduce or distribute dust and debris from the demolition operations.

E. Mark location of existing utilities

3.3 GENERAL REQUIREMENTS

A. Sprinkle Work with water to minimize dust where applicable. Provide hoses and water connections for this purpose.

B. Do not use water to extent causing flooding, contaminated runoff, or icing

C. Remove demolished material from the site

D. Repair damage to adjacent structures

E. Remove existing exposed piping and electrical wiring and conduit to be abandoned to structural surface, cut flush, and finish to match existing surfaces

F. Remove buried piping, wiring, and conduit to be abandoned as required for the Work. Plug the remainder flush.

3.4 DISPOSAL

A. Do not store or burn waste materials on-site

B. Transport demolition debris to designated off-site disposal area

C. If hazardous materials are encountered during demolition work, Contractor shall comply with applicable regulations and laws regarding the removal, handling, and protection of environment and human health

3.5 CONNECTION TO EXISTING CONSTRUCTION

A. Cut and remove portions of existing construction as necessary to allow for proper installation of new construction Equipment and Materials

B. Shore and brace existing structures to maintain safe structure conditions and until permanent structures and supports are completed
   1. Contractor shall repair all damage in result of installation of shoring and bracing

C. Cap, seal or abandon pipe and cable as indicated on Drawings and specified herein

3.6 CLEANUP AND REPAIR

A. Contractor shall remove tools, equipment and demolished materials from Site upon completion of demolition work
   1. Remove protections
   2. Interior areas shall be broom clean
   3. Inspect and clean all electrical control cabinets, interior and exterior, exposed to dust and debris during the demolition process

B. Contractor shall repair demolition performed in excess of that required or indicated
   1. Surfaces and structures to remain shall be repaired to the existing conditions prior to commencement of demolition work

3.7 SITE DEMOLITION

A. Disconnect, remove, cap and identify designated utilities within demolition area

B. Remove asphalt paving, parkway, and other concrete work to facilitate construction. Remove concrete to nearest joint beyond demolition area.

C. Remove sanitary sewer items where shown on the Drawings.

D. Backfill areas excavated caused as a result of demolition, in accordance with Section 02300

E. Rough grade and compact areas affected by demolition to maintain site grades and contours as shown on drawings

F. Remove demolished materials from site

G. Do not burn or bury materials on site, unless otherwise directed by Owner. Leave site in clean condition.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, and Division One and other related specification sections apply to work of this section.

1.2 SECTION INCLUDES

A. Clearing, grubbing and site preparation

B. Removal and disposal of debris

C. Handling, storage, transportation, and disposal of excavated material

D. Sheeting, shoring, bracing and protection work

E. Pumping and dewatering as required or necessary

F. Backfilling

G. Pipe embedment

H. Construction of fills and embankments

I. Trench Stabilization

J. Final grading

K. Slope Stabilization

L. Appurtenant work

1.3 RELATED SECTIONS

A. Section 02370 – Erosion and Sedimentation Control

B. Section 02510 – Water Distribution System

C. Section 02740 – Flexible Paving

D. Section 02750 – Rigid Paving

E. Section 02950 – Seeding

1.4 REFERENCES

A. City of Grand Junction Engineering Division Standard Specifications for Construction of Underground Utilities – Waterlines, Sanitary Sewers, Storm Drains, Underdrains, and Irrigation Systems

B. City of Grand Junction Engineering Division Standard Specifications for Road and Bridge Construction

C. American Association of State Highway and Transportation Officials (AASHTO)

D. American Society for Testing and Materials (ASTM):
   1. C33 – Concrete Aggregates
   2. C136 – Sieve Analysis of Fine and Coarse Aggregates
   3. D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12-Inch Drop
   4. D1241 – Material for Soil Aggregate Subbase, Base and Surface Courses
   5. D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
   6. D4253 – Test Methods for Maximum Index Density of Soils and Unit Weight of Soils Using a Vibratory Table
   7. D4254 – Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
   8. D4318 – Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
   9. D6938 – Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

E. American Concrete Institute (ACI):
   1. 229 – Controlled Low-Strength Materials

F. Council of American Building Officials/American National Standards Institute (CABO/ANSI):
   1. A117.1 – Accessible and Useable Buildings and Facilities Standards

G. Colorado Department of Transportation (CDOT)

H. Occupational Safety and Health Administration (OSHA):
   1. Part 1926 – Safety and Health Regulations for Construction

1.5 SUBMITTALS

A. Submit under provisions of Division One specifications.

B. Product Data: Submit on all products or materials supplied herein

C. Test Reports: Indicate supplier, sieve analysis, optimum moisture content and density in accordance with ASTM D698 if appropriate for crushed rock or gravel, pipe embedment and material for fills and embankment

1.6 REGULATORY REQUIREMENTS

A. Burning will not be allowed on-site. Comply with all applicable codes, regulations, and laws.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

C. Obtain and comply with all requirements of City of Grand Junction and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

D. For public improvements only, in the event of a conflict between municipal standards and this specification, municipal standards for products and installation will govern.

E. Excavation work will be performed in compliance with City of Grand Junction and current OSHA requirements.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling

B. Protect work from erosion or other similar types of damage until the project has been accepted. Leave protection in place for subsequent contractors' use.

C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35°F and rising

D. Do not use frozen materials, snow, or ice in any backfill or fill area

E. Do not backfill or construct fill on frozen surfaces

F. Protect excavated material from becoming frozen

G. Do not backfill or construct fills or embankments during periods of heavy rainfall or precipitation when soil moisture conditions will not allow proper compaction to be achieved

H. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities

I. Provide temporary bridges for roadways, walkways, driveways, etc.

1.8 QUALITY ASSURANCE

A. All imported material to be free of hazardous and organic wastes, "clean" as defined by EPA, and approved for its intended use by the Owner or project Geotechnical Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. General - Soil materials, whether from sources on or off the site must be approved by the Geotechnical Engineer as suitable for intended use and specifically for required location or purpose.

B. Classification of Excavated Materials:
   1. No classification applies. Remove and handle all excavated materials regardless of its type, character, composition, condition, or depth. This includes all material that is not classified as rock excavation as described in Paragraph 2.1.B.2 Rock Excavation is included herein.
   2. Rock excavation shall be conducted according to Part 103.11 of the City of Grand Junction Standard Specifications for the Construction of Underground Utilities.
   3. Waste Materials:
      a. Waste materials are considered unacceptable materials for compaction or placement fill. Site fills will not include environmental pollutants, hazardous substances or waste, hazardous products or by-products.
      b. Transport and properly dispose of any rubble and waste materials found in excavation off the Owner's property
      c. If hazardous, transite or asbestos containing materials are found in excavation, stop work immediately and notify the Owner within one hour of discovery. Comply with special handling requirements.

C. Fills and Embankments
   1. To the maximum extent practical use excess earth from onsite excavation for fills and embankments.
   2. Free from rocks or stones larger than 12 inch in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials
   3. Fill and embankment material must be acceptable to Engineer
   4. No rocks or stones larger than 6 inch in upper 18 inches of fill or embankment. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.

D. Imported Fill for Fills and Embankments:
   1. The Contractor is responsible for obtaining additional material for fills and embankments as necessary to meet the requirements shown on the Drawings.
   2. Imported fill conforming to the following:
      a. Gradation (percent finer by weight ASTM C136): 3" – 100% passing, No. 4 Sieve – 50-100% passing, and No. 200 Sieve – 35% passing (maximum)
      b. Liquid Limit: 35 (maximum), Plasticity Index: 15 (maximum), Group Index: 10 (maximum)

E. Topsoil
   1. Topsoil is defined as fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of rocks, stumps, stones

larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth for areas to be seeded or planted. Coordinate testing requirements with Owner.
2. Clean topsoil free of plants and seeds will be spread to 4-inch minimum depth or as specified by Drawings, whichever is greater.

F. Grubbings
1. Grubbings are defined as the first 1 inch of surface vegetation and topsoil consisting of primarily existing grass groundcover free of roots, brush, and other objectionable material and debris.
2. Reuse grubbing and surface topsoil containing plants and seeds in designated revegetation areas only.

G. Pipe Embedment: Graded gravel
1. Comply with City of Grand Junction requirements for pipe bedding for public utilities.

H. Compacted Trench Backfill
1. Comply with City of Grand Junction requirements for backfilling pipe.

I. Coarse Base Rock
1. Granular material, maximum 3 inches, less than 10% passing 1-inch sieve.
2. Free of trash, clay and dust

J. Road Base
1. Will meet ASTM specification for Class II aggregate base and CDOT Class 6 gradation

Sieve Size	Percent Passing by Weight
3/4"	90-100
No. 4	30-65
No. 8	22-55
No. 200	3-12

2.2 ACCESSORIES

A. Controlled Low Strength Material (Flow Fill)
1. Comply with City of Grand Junction requirements and ACI 229 for the use of flowable fill within the right-of-way or for public utility trench backfill.
2. Product will be a lean, sand-cement slurry, “flowable fill” or similar material with a 28-day unconfined compressive strength between 50 and 200 psi.

B. Non-woven geotextile fabric
1. Needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Product must be inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Product must meet AASHTO M288-06 Class 3 for elongation > 50%.

a. Mirafi 140N or accepted substitution

PART 3 EXECUTION

3.1 EXAMINATION

A. Field verify the location of all underground utilities, pipelines and structures prior to excavation

3.2 PERFORMANCE — GENERAL

A. Contractor to verify quantities of cuts and fills and perform all earthwork required to meet the grades as shown on the Drawings, including but not limited to, additional import or export required to handle compaction, building and pavement subgrade preparation, and pipe bedding.

B. Perform work in a safe and proper manner with appropriate precautions against hazard

C. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

D. Contain all construction activity on the designated site and within the limits of work. Cost of restoration offsite will be the responsibility of the Contractor

E. Maintain service to pipelines and utilities indicated on Drawings during construction

3.3 PREPARATION

A. Clearing and Grubbing
   1. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris.
   2. Strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil. Strip and stockpile all on-site material meeting the topsoil definition for all areas receiving grading where shown on Drawings
   3. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.
   4. Remove and dispose of tree stumps and roots over 3 inches in diameter to a minimum depth of 18 inches below the natural surface or 5 feet below finished surface level, whichever is lower.
   5. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted
   6. Backfill all excavated depression include grub holes with approved material

B. Preservation of Trees
   1. Do not remove trees outside fill or excavated areas, except as authorized by Engineer

2. Protect trees and their roots within the drip line that are to remain from permanent damage by construction operation
3. Trim standing trees in conflict with construction operations as directed by Owner and Engineer.

C. Topsoil Stripping
1. Strip onsite material meeting the topsoil definition to minimum depth of 4 inches from areas to receive grading as shown on Drawings.
2. Stockpile topsoil in areas designated by Owner and indicated on Drawings where it will not interfere with construction operations and activities and existing facilities
3. At the completion of work in each area, place and grade topsoil to maintain gradient as indicated and required. Roughen surface as required for erosion control.

D. Waste and Debris
1. Stockpile all acceptable grubbing for reuse in native revegetation areas
2. Remove and dispose of all waste materials and debris from clearing, grubbing, stripping and demolition off site

E. Stockpiles
1. Segregate materials suitable for the following:
   a. Topsoil
   b. Embankments and fills
   c. Backfill
   d. Spoils and waste only
2. No excavation will be deposited or stockpiled at any time so as to endanger stability of banks or structures, health of trees and shrubs to be protected, or portions of the Work, either by direct pressure or indirectly by overloading banks contiguous to the operation
3. Stockpile soil materials away from edge of excavations
4. Do not obstruct or prevent access to roads, driveways, ditches, natural drainage channels, and utility control devices
5. If in result of adjacent structures, easement limitations, or other restrictions sufficient storage is not available within Project limits, Contractor will arrange for off-site areas for stockpiling and for moving material to and from the storage area at no additional cost to the Owner

3.4 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations will be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work.

B. Backfill will be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs will be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional costs to the Owner

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage will be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Engineer, will be borne by the Contractor at no additional expense to the Owner

3.5 DEWATERING

A. General
   1. All dewatering activities in accordance with all federal, state, and local regulations regarding site drainage, dewatering, and erosion and sediment control including permitting requirements
   2. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom and/or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a "quick" or "boiling" condition. System will not be dependent solely upon sumps and/or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability
   3. Provide and maintain adequate dewatering equipment including power supply, if necessary, to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the Work
   4. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow all Work to be installed in a dry condition
   5. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary to these purposes, lower water level in advance of excavation, utilizing wells, wellpoints, jet educators, or similar positive methods
   6. Keep each excavation dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result
   7. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least 12 inches below the bottom of the excavation
   8. Design, furnish, install, test, operate, monitor and maintain dewatering system of sufficient scope, size and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of groundwater and permit excavation and construction to proceed on dry, stable subgrades
   9. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property
   10. Maintain all drainage pipes, keep clean and free of sediment during construction and final cleanup

11. Open pumping with sumps and ditches will be allowed, provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes
12. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head
13. Dewatering to surface waterways requires Colorado Department of Public Health and Environment dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, including water treatment prior to discharge, if necessary

B. Design
   1. Contractor will be responsible for the accuracy of the Drawings, design data, and operational records required
   2. Contractor will be solely responsible for the design, installation, operation, maintenance, and any failure of any component of the system

C. Damages
   1. Contractor will be responsible for and will repair without cost to the Owner any damage to work in place, or other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system
   2. Remove sub grade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Owner

D. Maintaining Excavation in Dewatered Condition
   1. Dewatering will be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted
   2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance
   3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner
   4. System maintenance will include supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition

E. System Removal

1. Remove dewatering equipment from the site, including related temporary electrical service
2. Wells will be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction

3.6 SHEETING, SHORING AND BRACING

A. Bracing and sheeting of trenches shall be conducted according to Part 103.4 of the City of Grand Junction Standard Specifications for the Construction of Underground Utilities.

B. All sheeting, shoring and bracing in accordance with OSHA and IBC requirements

C. Prevent undermining and damage to all structures, buildings, underground facilities, pavements and slabs

D. Contractor will responsible for obtaining all required permits or easements for encroachments into the public right-of-way and for coordinating any encroachments onto adjacent properties.

E. If sheet pile cut off walls are required, submit design calculations, stamped by a Colorado licensed Professional Engineer

F. Contractor will be solely responsible for proper design, installation, operation, maintenance, and any failure of any system component
   1. Engineer review of Contractor's design and data does not relieve the Contractor from full responsibility for errors or from the entire responsibility for complete and adequate design and performance of the sheeting, shoring and bracing system

G. Provide proper and substantial sheeting, shoring, and bracing, in accordance with OSHA Standards as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities

H. Design, furnish, build, maintain and subsequently remove, to extent required a system of temporary supports for cut and cover, open cut, temporary bypass road, or trench excavations, including bracing, dewatering, and all associated items to support the sides and ends of excavations where excavation slopes may endanger in-place or proposed improvements, extend beyond construction right-of-ways or as otherwise specified or indicated in the Drawings
   1. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure
   2. Design and build sheeting, shoring and bracing to be rigid, maintain shape and position under all circumstances.

I. Design excavation support system and components for the following to allow safe and expeditious construction of permanent structures without movement/settlement of the ground and to prevent damage to or movement of adjacent buildings, structures, other improvements and underground facilities
   1. To support lateral earth pressures

2. Loads from utilities, traffic, construction, buildings and surcharge loads

J. Provide sheeting, shoring and bracing equipment and materials onsite prior to start of excavation in each section, making adjustments as required to meet unexpected conditions

K. Contractor will make his own assessment of existing conditions including adjacent property, the possible effects of his proposed temporary works and construction methods, and will select and design support systems, methods, and details as will assure safety to the public, adjacent property, and the completed Work.

L. Employ caution in areas of underground facilities, which will be exposed by hand or other excavation methods acceptable to Owner or Engineer.

M. Space and arrange sheeting and bracing as required to exclude adjacent material and according to the stability of excavation slopes

N. Do not pull trench sheeting before backfilling

O. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe

P. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed

Q. Damages
1. Contractor will document and all existing damage to adjacent facilities and submit written documentation to Owner and Engineer prior to performing any excavation. Documentation will include written description of existing damages, measurements, diagrams, maps and associated photographs
2. Repair all damage resulting from excavation and remove and place any existing structure or underground facility damaged during shoring and sheeting and all undermined pavements with Owner-approved equal, concrete or asphalt, at no cost to the Owner.

3.7 TRENCH STABILIZATION

A. Thoroughly compact and consolidate subgrades for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities

B. Remove all mud and muck during excavation

C. Reinforce subgrades with crushed rock or gravel if they become mucky during construction activities

D. Finished elevation of stabilized subgrades are to be at or below subgrade elevations indicated on Drawings

E. Allow no more than ½ inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

F. Scarify trench subgrade to a depth of 6 to 8 inches before compaction

3.8 PAVEMENT OVEREXCAVATION AND SUBGRADE PREPARATION

A. Excavate subgrade for asphalt pavement areas per the lines, grades, and dimensions indicated on Drawings within a tolerance of plus or minus 0.10 foot. Excavate subgrade for concrete pavement areas per the lines, grades, and dimensions indicated on Drawings within a tolerance of plus or minus 0.05 foot.

B. Overexcavate and scarify existing soil as required under pavement areas, slabs, curbs and walks to meet the moisture and compaction specifications herein to depth shown on Drawings.

C. Extend subgrade preparation a minimum of one foot beyond back of proposed pavement, slabs, curbs and walks.

D. Extend subgrade preparation a minimum of two feet beyond back of proposed structure foundation limit.

E. Proof roll with a pneumatic tire equipment with a minimum axle load of 18 kips per axle a maximum of 24 hours prior to paving to locate any soft spots that exhibit instability and deflection beyond subgrade tolerances listed above. Areas that are observed to have soft spots in the subgrade, where deflection is not uniform or is excessive as determined by the Geotechnical Engineer, will be ripped, scarified, dried or wetted as necessary and recompacted to the requirements for density and moisture at the Contractor's expense. After recompaction, these areas will be proof rolled again and all failures again corrected at the Contractor's expense.

F. If the Contractor fails to place the sub base, base course, or initial pavement course within 24 hours or the condition of the subgrade changes due to weather or other conditions, proof rolling and correction will be performed again at the Contractor's expense.

3.9 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure as described herein.

C. Percentage of Maximum Dry Density Requirements: Moisture treat and compact soil to not less than the following percentages of maximum dry density and to within the specified moisture content range of optimum moisture content according to ASTM D698 as follows:

Surface Improvement	Compaction %	Moisture Content
Structures	98%	-2 to +2
Paved Areas	95%	-2 to +2
Utility Trenches	95%	-2 to +2
Lawns or Unpaved Areas	90%	-2 to +2
Public Right-of-way	Per municipal standards	

1. Do not deposit or compact tamped or otherwise mechanically compacted backfill if frozen or if in water.
2. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters, or other surface construction.

3.10 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Use excess excavated materials in fills and embankments as indicated on the Drawings to the extent needed. Coordinate with Owner and Engineer on locations for excess material placement.

B. The Contractor is responsible for disposing of all excess excavated materials from the site to a location approved by the Owner or Engineer and permitted with the local authorities.

C. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots, and other unsuitable material from the site and dispose of it.

3.11 BLASTING

A. Blasting or other use of explosives is not permitted without City of Grand Junction approval

3.12 TRENCH EXCAVATION

A. Establish alignment and grade or elevation from offset stakes provided by the Contractor's surveyor.

B. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the Drawings

C. Comply with pipe specification sections regarding vertical and horizontal alignment and maximum joint deflection

D. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation

E. Do not open more trench in advance of pipe laying than is necessary to expedite the work; not more than 200 feet

F. Total length of open trench will be limited to 200 feet unless otherwise approved by the Engineer

G. Except where tunneling or boring is indicated on the Drawings, specified, required by jurisdictional agency or permitted by Engineer, excavate trenches by open cut from the surface

H. Limiting trench widths
   1. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment
   2. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than 1 foot above the top of the pipe
   3. Stipulated minimum clearances are minimum clear distances, not minimum average distances
   4. Maximum trench width from six inches above the top of pipe to trench bottom is the pipe outside diameter plus 24 inches
   5. Limiting trench widths and permissible clearances from 6 inches above top of pipe to trench bottom for installed pressure and non-pressure piping

Pipe Size (inch)	Minimum Trench Width	Maximum Trench Width
3	1’ 6”	2’ 6”
4	1’ 6”	2’ 6”
6	1’ 6”	2’ 6”
8	1’ 8”	2” 8”
10	2’ 0”	3’ 0”
12	2’ 0”	3’ 0”
16	2’ 8”	3’ 8”
18	3’ 0”	4’ 0”
24	3’ 6”	4’ 6”
36	4’ 6”	5’ 0”

   6. If the width of the lower portion of the trench exceeds the maximum permitted, provide special pipe embedment, or concrete encasement as required by loading conditions
   7. No excessive trench widths will be allowed to avoid the use of sheeting or shoring and bracing

I. Trench Side Walls
   1. Will be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the federal, state, and local ordinances and regulations
   2. Sheet and brace where necessary and as specified herein
   3. Excavate without undercutting

J. Trench Bottom

1. Will be thoroughly protected and maintained when suitable natural materials are encountered
2. Will be thoroughly compacted and in approved condition prior to placing gravel bedding, if required
3. Where in earth, trench bottoms for 6 inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support between bell holes or end joints of the installed pipe at the Contractor's option
4. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material approved by Engineer
5. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined
6. PVC pipe will not be laid directly on trench bottom

K. Mechanical excavation
   1. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas
   2. Use mechanical equipment of a type and design which can be operated to provide the following:
      a. Rough trench bottom to a controlled elevation
      b. Uniform trench widths and vertical sidewalls are obtained from 1 foot above the top of the installed pipe to the bottom of the trench
      c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls
   3. Do not undercut trench sidewalls
   4. Recompact trench bottom disturbed by bucket teeth prior to placement of embedment material

L. Except as otherwise required, excavate trenches below the underside of pipes as indicated in the Drawings to provide for installation of granular embedment pipe foundation material

M. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material as Engineer may direct

N. For unstable soils, provide concrete or other bedding as directed by Engineer

O. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined

P. Cuts in existing surface construction
   1. No larger than necessary to provide adequate working space
   2. Cut a clean groove not less than 1½ inch deep along each side of trench or around perimeter of excavation area
   3. Remove pavement and base pavement to provide shoulder not less than 6 feet wide between cut edge and top edge of trench

4. Do not undercut trenches, resulting in bottom trench width greater than top widths
5. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation
6. Remove pavement for connections to existing lines or structures only to the extent required for the installation
7. Replace the pavements between saw cuts to match original surface construction

3.13 PIPE EMBEDMENT

A. Embed pipes above and below the bottom of pipe as indicated on the Drawings and as specified herein

B. Granular embedment
   1. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints.
      a. Level bottom layer at proper grade to receive and uniformly support pipe barrel throughout length
      b. Barrel of pipe will have a bearing for its full length
   2. Form depressions under each joint to permit the proper jointing. No part of joint will be in contact with trench when pipe is placed in position
   3. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe to hold the pipe in proper position and alignment during subsequent operations
   4. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent displacement
   5. Complete embedment promptly after jointing operations and approval to proceed by Engineer
   6. Granular embedment compaction by slicing with shovel or vibrating
      a. Maximum uncompacted thickness of layers: 6 inch
   7. Compacted embedment will be compacted to 90 percent maximum density per ASTM D1557
      a. Maximum uncompacted depth thickness of horizontal layers: 8 inch

C. Arch and concrete encasement
   1. Include in locations indicated on Drawings or where over-width trench conditions need correction as approved by Engineer
   2. Install and form as indicated on Drawings or as specified
   3. Concrete will have a 28-day minimum 3,000 psi compressive strength

D. Do not backfill until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems

3.14 TRENCH BACKFILL

A. Backfilling will be conducted in a continuous manner to prevent damage to the pipe and its coating and kept as close to the pipe laying operation as possible. Backfilling

procedures will be in accordance with additional requirements, if any, of local authorities or private right-of-way agreements.

B. Compacted backfill
   1. Provide full depth of trench above embedment at all locations
   2. Beneath pavements, surfacing, driveways, curbs, gutters, walks or other surface construction or structures
   3. In street or highway shoulders
   4. Beneath fills and embankments

C. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench

D. Site excavated materials
   1. Place job excavated materials in 8 inches maximum uncompacted thickness, uniform layers
   2. Increased layer thickness may be permitted for incohesive material if Contractor demonstrates to Engineer's satisfaction that specified compacted density will be achieved
   3. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe
   4. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

E. Graded gravel
   1. Deposit in uniform layers of 9 inches maximum uncompacted thickness
   2. Compact with suitable vibrating roller or platform vibrator to not less than 70 percent relative density per ASTM D4253/D4254

F. Uncompacted backfill
   1. Compaction of backfill above pipe embedment in locations other than those specified, is required only to prevent future settlement
   2. May be placed by any method acceptable to Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on, and will not result in displacement of installed pipe
   3. Until compacted depth over conduit exceeds 3 feet, do not drop fill material over 5 feet. Distance may be increased 2 feet for each additional 1 foot of cover

G. Finish the top portion of backfill with at least 4 inches of topsoil or as specified by landscaping specifications, whichever is greater, corresponding to, or better than, that underlying adjoining turf areas.

H. Trench backfill within the public right-of-way will conform to municipal street and utility standards.

I. Trench backfills through unimproved areas should be restored to previous conditions and left 3” above adjacent grades to allow for settlement. Seed all disturbed areas according to erosion control and landscape specifications.

J. Protection of trench backfill
   1. Where trenches are constructed in ditches or other water courses, protect backfill from erosion
   2. Install ditch checks where the ditch grade exceeds 1 percent
      a. Minimum depth: 2 feet below the original ditch or water course bottom for the full bottom width
      b. Minimum width: 18 inches into the side slopes
      c. Minimum thickness: 12 inches

3.15 DRAINAGE MAINTENANCE

A. Do not backfill trenches across roadways, drives, walks or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid

B. Backfill so that water does not accumulate in unfilled or partially filled trenches

C. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours

D. Do not obstruct surface drainage any longer than necessary

E. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic

F. Provide adequate storm flow conveyance through the site at all times during construction to avoid flooding of any buildings or adjacent property. Provide overland drainage routing when storm sewer inlets are not fully functioning due to erosion and sediment control measures.

3.16 FINAL GRADING

A. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the indicated elevations, slopes and contours, all areas being graded on site

B. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work

C. Grade all surfaces for effective drainage, provide a 2 percent minimum slope except as otherwise shown on the Drawings

D. Provide a smooth transition between adjacent existing grades and new grades

E. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances

F. Slope grades to direct water away from buildings and prevent ponds from forming where not intended

G. Finish subgrades at lawns and unpaved areas to required elevations within a tolerance of plus or minus one (1) inch

H. Finish grades will be no more than 0.1 foot above or below those indicated

I. Finish all ditches, swales and gutters to drain readily

J. Coordinate final subgrade depth with finish landscape treatment and required topsoil depths

K. Topsoil
   1. Clean topsoil, free of plants and seed will be spread to 4-inch minimum depth.
   2. Reuse grubbings and surface topsoil containing plants and seeds in designated revegetation areas only.

3.17 SLOPE AND CHANNEL STABILIZATION

A. Cover channel banks, slopes, bottom and thalweg (water flowline at lowest point in channel) with erosion control fabric mat where grade is steeper than 4H to 1V and where indicated on the Drawings

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6-inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil

C. Secure outside edges and overlaps at 48 inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches

F. Maintain integrity of erosion control fabric

G. Prior to laying fabric, seed disturbed areas under provisions of related seeding and landscaping specification sections or as specified on Drawings.

3.18 SETTLEMENT

A. Warranty for settlement of all fills, embankments, and backfills is stipulated in the General Conditions from final completion of Contract under which Work is performed

B. Repair or replace within 30 days after notice by Engineer or Owner

3.19 FIELD QUALITY CONTROL

A. Provide under provisions of General Conditions and Division One Specifications

B. Coordinate testing with Owner. Owner will employ testing agency for field testing to determine compliance of in-place and backfill materials and compaction in accordance with the specifications, and to verify design bearing capacities.

C. It is the Contractor's responsibility to initiate, coordinate and accommodate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing requirement with testing agency and provide the testing agency 48 hour advance notification to schedule tests.

D. Fills and Embankment Testing
   1. Two moisture-density relationship tests, ASTM D698, on each type of fill material
   2. One in-place compaction test for each 5,000 square feet every 1.5 feet of vertical lift of material placed
   3. Additional in-place compaction tests at the discretion of the Owner

E. Pipe Embedment and Backfill Testing
   1. Two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material
   2. One in-place compaction test every 200 lineal feet of trench in the compacted embedment zone and at every 1.5 feet of vertical lift of backfill materials, per ASTM D6938
   3. One in-place compaction test near top of trench for trench depth of 2 feet or less, per ASTM D6938
   4. Additional in-place compaction tests at the discretion of the Owner

F. Pavement and Structural Subgrade Testing
   1. At a minimum, two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate and adequate for each type backfill material proposed.
   2. Perform tests for each footing, concrete site feature, and drainage structure subgrade. Perform tests at every 100 linear feet of subgrade of foundation walls, retaining walls, and every 150 feet for curbing, pans, drainage features, walks, etc. (or portions thereof). Perform tests every 2,000 square feet required of building slab area, exterior slabs and pavement/flatwork areas (with no less than 3 tests). Test at subgrade and at every vertical lift of backfill materials placed.
   3. Additional in-place compaction tests at the discretion of the Owner

G. Inspection and approval
   1. A qualified Geotechnical Engineer will inspect the natural soil at bottom of excavations for structures

2. Do not prepare subgrade or place concrete until Geotechnical Engineer's inspection has taken place and any resulting recommendations of the Geotechnical Engineer have been fulfilled or until the inspection has been waived by the Geotechnical Engineer
3. Prior to placement of structural fill, overexcavated foundations subgrades will be observed and tested by a qualified Geotechnical Engineer to ensure suitable bearing materials exist
4. Geotechnical Engineer will provide a letter to Engineer to confirm the presence of suitable subgrade material and properly placed fill materials by Contractor in accordance with Drawings and geotechnical report.

H. Retesting of failed compaction will be performed by Geotechnical Engineer for Owner, but paid for the Contractor

END OF SECTION

SECTION 02370

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This work consists of temporary measures needed to control erosion and water pollution. These temporary measures will include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. These temporary measures shall be installed at the locations where needed to control erosion and water pollution during the construction of the project and during site restoration, and as directed by ENGINEER, and as shown on the drawings.

B. The Erosion Control Plan presented in the drawings serves as a minimum for the requirements of erosion control during construction. Contractor has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the project. Therefore, if the provided plan is not working sufficiently to protect the project areas, then Contractor shall provide additional measures as required to obtain the required protection.

1.2 RELATED SECTIONS

A. Section 01500 – Construction Facilities and Temporary Controls

B. Section 02220 – Demolition

C. Section 02300 – Earthwork

D. Section 02740 – Flexible Paving

E. Section 02740 – Rigid Paving

F. Section 02950 – Seeding

1.3 REFERENCES AND STANDARDS

A. City of Grand Junction Engineering Division Standard Specifications for Construction of Underground Utilities – Waterlines, Sanitary Sewers, Storm Drains, Underdrains, and Irrigation Systems

B. City of Grand Junction Engineering Division Standard Specifications for Road and Bridge Construction

C. CDOT – Colorado Department of Transportation

D. UDFCD – Urban Drainage and Flood Control District

E. CDPHE – Colorado Department of Public Health and Environment

1.4 SUBMITTALS

A. Submit under provisions of Division One specifications.

B. Submit the following information:
   1. Erosion Control Plan,
   2. Construction schedule for Erosion Control per Article Scheduling,
   3. Sequencing Plan per Article Scheduling,
   4. All applicable permits for Erosion Control.

C. Product data: Submit on all products or materials supplied herein.

1.5 REGULATORY REQUIREMENTS

A. Obtain and comply with all requirements of City of Grand Junction and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

B. 401 Construction Dewatering Industrial Wastewater Permit (Construction Dewatering Permit 401):
   1. Contractor shall apply for and obtain a Construction Dewatering Permit 401 from the Colorado Department of Public Health and Environment.
   2. All costs for this permit shall be the responsibility of Contractor.
   3. This permit requires that specific actions be performed at designated times.
   4. Contractor is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
   5. Contractor shall allow the Colorado Department of Public Health and Environment or other representatives to enter the site to test for compliance with the permit.
   6. Non-compliance with the permit can result in stoppage of all work.

C. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.6 SCHEDULING

A. Sequencing Plan:
   1. Contractor shall submit a sequencing plan for approval for erosion control in conformance with Contractor's overall Construction Plan for approval by Owner.
   2. Changes to the Erosion Control Sequencing Plan may be considered by Owner only if presented in writing by the Contractor.

B. Temporary Erosion Control:

1. When so indicated in the Contract Documents, or when directed by Owner. Contractor shall prepare construction schedules for accomplishing temporary erosion control work including all maintenance procedures.
2. These schedules shall be applicable to clearing and grubbing, grading, structural work, construction, etc.

C. Contractor shall submit for acceptance the proposed method of erosion control on haul roads and borrow pits and a plan for disposal of waste material.

D. Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Temporary erosion control measures shall then be used to correct conditions that develop during construction.

E. Work shall not be started until the erosion control schedules and methods of operations have been accepted.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with all applicable municipal or local Municipal Separate Storm Sewer System (MS4) requirements.

B. All materials shall be submitted for approval prior to installation.

C. Natural or biodegradable materials shall be reasonably clean, free of deleterious materials, and certified weed free. Materials may include, but are not limited to, hay bales, straw, fiber mats, fiber netting, wood cellulose, fiber fabric, gravel.

D. Grass Seed:
1. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover.
2. All grass seed shall be approved by Owner and Engineer and in accordance with local regulations prior to installation.

E. Fertilizer and soil conditioners shall be approved by Owner and in accordance with local regulations prior to installation.

F. Silt Fence Fabric: woven polypropylene
1. Mirafi 100X, "Envirofence"
2. Or accepted substitution

G. Temporary Slope Stabilization Mat (short term): 1.5 pound photodegradable polypropylene top and bottom nets, 100% straw fiber matrix, with a longevity of 12 months.

1. North American Green S150
2. Or accepted substitution

H. Temporary Slope Stabilization Mat (extended term): 3.0 pound UV-stable polypropylene top net, 1.5 pound photodegradable polypropylene bottom net, 70% straw/30% coconut fiber matrix with a longevity of 24 months.
1. North American Green SC150
2. Or accepted substitution

I. Biodegradable Slope Stabilization Mat (short term): 9.3 pound leno-woven biodegradable jute top net, 7.7 pound woven biodegradable jute bottom net, 100% straw fiber matrix with a longevity of 12 months.
1. North American Green S150BN
2. Or accepted substitution

J. Biodegradable Slope Stabilization Mat (extended term): 9.3 pound leno-woven biodegradable jute top net, 7.7 pound woven biodegradable jute bottom net, 70% straw/30% coconut fiber matrix with a longevity of 18 months.
1. North American Green SC150BN
2. Or accepted substitution

K. Permanent Channel Stabilization Mat [flow velocities between 9.5 (unvegetated) and 15 (vegetated) fps]: 5.0 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 70% straw/30% coconut fiber matrix.
1. North American Green SC250
2. Or accepted substitution

L. Permanent Channel Stabilization Mat [flow velocities between 10.5 (unvegetated) and 20 (vegetated) fps]: 8.0 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 100% coconut fiber matrix.
1. North American Green SC350
2. Or accepted substitution

M. Permanent Channel Stabilization Mat [flow velocities between 12.5 (unvegetated) and 25 (vegetated) fps]: 24 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 100% polypropylene fiber matrix.
1. North American Green P550
2. Or accepted substitution

PART 3 EXECUTION

3.1 GENERAL

A. All temporary and permanent erosion and sediment control practices will be maintained and repaired as needed to ensure continued performance of their intended function.

B. Owner will monitor Contractor's erosion control methods. If the overall function and intent of erosion control is not being met, Owner will require Contractor to provide additional measures as required to obtain the desired results.

C. The erosion control features installed by Contractor shall be adequately maintained by Contractor until the project is accepted.

3.2 PROTECTION OF ADJACENT PROPERITES

A. Properties adjacent to the site of a land disturbance shall be protected from sediment deposition.

B. In addition to the erosion control measures required on the drawings, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:
   1. Vegetated buffer strip around the lower perimeter of the land disturbance.
      a. Vegetated buffer strips may be used only where runoff in sheet flow is expected and should be at least twenty (20) feet in width.
   2. Sediment barriers such as straw bales, erosion logs, and silt fences.
   3. Sediment basins and porous landscape detention ponds.
   4. Combination of above measures.

3.3 CONSTRUCTION

A. Stabilization of Disturbed Areas:
   1. Temporary sediment control measures shall be established within five (5) days from time of exposure or disturbance.
   2. Permanent erosion protection measures shall be stablished within five (5) days after final grading of areas.

B. Stabilization of Sediment and Erosion Control Measures:
   1. Sediment barriers, perimeter dikes, and other measures intended to either trap sediment or prevent runoff from flowing over disturbed areas shall be constructed as a first step in grading and be made functional before land disturbance takes place.
   2. Earthen structures such as dams, dikes, and diversions shall be stabilized within five (5) days of installation.
   3. Stormwater outlets shall also be stabilized prior to any upstream land disturbing activities.

C. Stabilization of Waterways and Outlets:
   1. All onsite stormwater conveyance channels used by Contractor for temporary erosion control purposes shall be designed and constructed with adequate capacity and protection to prevent erosion during storm and runoff events.
   2. Stabilization adequate to prevent erosion shall also be provided at the outlets of all pipes and channels.

D. Storm Sewer Inlet Protection: All storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site shall be protected from sediment deposition by the use of filters.

E. Construction Access Routes:
   1. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.
   2. Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day.
   3. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area.
   4. Street washing shall be allowed only after sediment is removed in the manner described above.

3.4 DISPOSITION OF TEMPORARY MEASURES

A. All temporary erosion and sediment control measures shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary measures are no longer needed as determined by Owner.

B. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion.

C. Substantial Completion of Erosion Control Measures:
   1. At the time specified in the Contract Documents, and subject to compliance with specified materials and installation requirements, Contractor shall receive a Substantial Completion Certificate for temporary erosion control measures.
   2. Maintenance of Erosion Control Measures after Substantial Completion: Contractor shall be responsible for maintaining temporary erosion control measures as specified in the drawings and Contract Documents until such time as work has been accepted by Owner and as specified in Division 1 for Closeout Procedures.

PART 4 MEASUREMENT FOR PAYMENT

4.1 LUMP SUM

A. Contractor shall include in the bid price for erosion and sedimentation control work a minimum of all items shown on the Erosion Control Plan, as required by City of Grand Junction, and any additional items that may be needed to control erosion and water pollution throughout all phases of the project.

END OF SECTION

SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Buried pipe, fittings, hydrants, valves, appurtenances, and associated accessories for water distribution and transmission lines

1.2 RELATED SECTIONS

A. Section 02300 – Earthwork

B. Section 02676 – Disinfection of Water Systems

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. A36 – Standard Specification for Carbon Structural Steel
   2. A48 – Standard Specification for Gray Iron Castings
   3. A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
   4. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   5. A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
   6. A242 – Standard Specification for High-Strength Low-Allow Structural Steel
   7. A276 – Standard Specification for Stainless Steel Bars and Shapes
   8. A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
   9. A449 – Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
   10. A536 – Standard Specification for Ductile Iron Castings
   11. A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
   12. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   13. A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
   14. B62 – Standard Specification for Composition Bronze or Ounce Metal Castings
   15. B88 – Standard Specification for Seamless Copper Water Tube
   16. B96 – Standard Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels

17. B763 – Standard Specification for Copper Alloy Sand Castings for Valve Applications
18. B843 – Magnesium Alloy Anodes for Cathodic Protection
19. C33 – Standard Specification for Concrete Aggregates
20. C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
21. C150 – Standard Specification for Portland Cement
22. C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
23. C1227 – Standard Specification for Precast Concrete Septic Tanks
24. D429 – Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates
25. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kn-m/m3))
26. D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses
27. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
28. D1330 – Standard Specification for Rubber Sheet Gaskets
29. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
30. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
31. D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
32. D2000 – Standard Classification System for Rubber Products in Automotive Applications
33. D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
34. D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
35. D2467 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
36. D2454 – Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
37. D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing
38. D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping
39. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
40. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
41. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
42. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
43. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

44. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
45. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
46. D3950 – Standard Specification for Strapping, Nonmetallic (and Joining Methods)
47. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
48. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
49. D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
50. E8 – Standard Test Methods for Tension Testing of Metallic Materials
51. F412 – Standard Terminology Relating to Plastic Piping Systems
52. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
53. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
54. G97 – Standard Test Method for Laboratory Evaluation of Magnesium Sacrificial Anode Test Specimens for Underground Applications

B. American Water Works Association (AWWA)
1. B300 – Standard for Hypochlorites
2. B301 – Standard for Liquid Chlorine
3. B302 – Standard for Ammonium Sulfate
4. B303 – Standard for Sodium Chlorite
5. C104 – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
6. C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
7. C110 – Standard for Ductile-Iron and Gray-Iron Fittings
8. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
9. C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
10. C116 – Standard for Protective Fusion-Bonded Epoxy Coatings for Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
11. C150 – Standard for Thickness Design of Ductile-Iron Pipe
12. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast
13. C153 – Standard for Ductile-Iron Compact Fittings
14. C200 – Standard for Steel Water Pipe 6 In. (150 mm) and Larger
15. C203 – Standard for Coal-Tar Protective Coatings & Linings for Steel Water Pipes
16. C206 – Standard for Field Welding of Steel Water Pipe
17. C207 – Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
18. C213 – Standard for Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
19. C214 – Standard for Tape Coatings for Steel Water Pipelines
20. C219 – Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
21. C500 – Standard for Metal-Seated Gate Valves for Water Supply Service
22. C502 – Standard for Dry-Barrel Fire Hydrants
23. C504 – Standard for Rubber-Seated Butterfly Valves
24. C509 – Standard for Resilient-Seated Gate Valves for Water Supply Service

25. C515 – Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
26. C550 – Standard for Protective Epoxy Interior Coatings for Valves and Hydrants
27. C600 – Standard for Installation of Ductile Iron Mains and Their Appurtenances
28. C604 – Standard for Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger
29. C605 – Standard for Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
30. C651 – Disinfecting Water Mains
31. C700 – Standard for Cold-Water Meters – Displacement Type, Metal Alloy Main Case
32. C800 – Standard for Underground Service Line Valves and Fittings
33. C900/C905 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm) for Water Transmission and Distribution
34. C901 – Standard for Polyethylene (PE) Pressure Pipe and Tubing 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service
35. C906 – Polyethylene (PE) Pressure Pipe and Fittings 4 in. (100 mm) Through 63 In. (1,600 mm) for Water Distribution and Transmission
36. M11 – Steel Pipe: A Guide for Design and Installation
37. M17 – Standard for Installation, Field Testing, and Maintenance of Fire Hydrants
38. M23 – Standard for PVC Pipe Design and Installation
39. M41 – Standard for Ductile-Iron Pipe and Fittings

C. Colorado Department of Transportation (CDOT)

D. National Fire Protection Agency (NFPA)

E. Occupational Safety and Health Administration (OSHA)

F. NSF International:
   1. Standard 60 – Drinking Water Treatment Chemicals – Health Effects
   2. Standard 61 – Drinking Water System Components – Health Effects

G. Surface Preparation Standards (SSPC)

H. American Welding Society (AWS):
   1. D1.1 – Structural Welding Code – Steel

I. National Association of Corrosion Engineers (NACE):
   1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   2. SP0286 – Electrical Isolation of Cathodically Protected Pipelines

J. Uni-Bell PVC Pipe Association:
   1. Uni-Pub-8: Tapping Guide for PVC Pressure Pipe

K. Plastics Pipe Institute (PPI):

1. TR-4 – HDB / HDS / SDB / PDB / MRS Ratings for Thermoplastic Piping Materials or Pipe
2. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
3. Handbook of Polyethylene Pipe
4. Material Handling Guide

L. Ductile Iron Pipe Research Association (DIPRA):
1. Thrust Restraint Design for Ductile Iron Pipe

M. American Railway Engineering and Maintenance-Of-Way Association (AREMA)

N. International Plumbing Code (IPC)

O. International Code Council (ICC)

P. Underwriters' Laboratories (UL)

1.4 SUBMITTALS

A. Submit under provisions of Division 1 Specifications

B. Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications

C. Shop Drawings: Provide sufficient data to verify compliance with the specifications and to illustrate construction and assembly of precast vault

D. Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight. Indicate pressure ratings for pipe, fittings, valves
1. Pipe materials
2. Special, fitting, and coupling details
3. Joint restraint system
4. Valves
5. Laying and installation schedule
6. Specifications and data sheets
7. Affidavits of compliance for protective shop coatings and linings

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.

F. Test Reports: Submit reports of field pressure and disinfection tests under provisions of Section 01340

G. Test Reports: Indicate disinfection results comparative to specified requirements

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1 Specifications

B. Accurately record actual locations of piping mains, valves, connections, top of pipe elevations, and any mapped or unmapped utilities

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

D. Disinfection report; record:
   1. Type and form of disinfectant used
   2. Date and time of disinfectant injection start and time of completion
   3. Test locations
   4. Initial and 24 hour disinfectant residuals (quantity in treated water) in parts per million (ppm) or milligram per liter (mg/L) for each outlet tested
   5. Date and time of flushing start and completion
   6. Disinfectant residual after flushing in ppm for each outlet tested

E. Bacteriological report; record:
   1. Date issued, project name, and testing laboratory name, address, and telephone number
   2. Time and date of water sample collection
   3. Name of person collecting samples
   4. Test locations
   5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested
   6. Coliform bacteria test results for each outlet tested
   7. Bacteriologist's signature and authority

1.6 QUALITY ASSURANCE

A. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

B. All PVC pipe, regardless of diameter, shall be supplied by a single manufacturer

C. Perform Work in accordance with AWWA C651, and the Colorado Department of Public Health and Environment (CDPHE), Mesa County, and City of Grand Junction

D. Contractor shall conduct visual inspection before installation

E. Provide manufacturer's name and pressure rating marked on piping and valves

F. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational water lines

1.7 REGULATORY REQUIREMENTS

A. Conform to all municipal codes and ordinances, laws and regulations of Mesa County, CDPHE, the notes and details on the drawings and as specified herein, and CDPHE Stormwater Management and/or Construction Dewatering Permit

B. Conform to AWWA C651, as appropriate, and CDPHE Design Criteria for Potable Water Systems for performing the work of this Section

C. In case of apparent conflict, CDPHE requirements govern over these specifications

D. In absence of State and local regulations, International Plumbing Code applies

E. NFPA Compliance: Install fire water systems in accordance with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances"

F. UL Compliance: Provide fire hydrants that comply with UL 246 "Hydrants for Fire-Protection Service," and are listed by UL.

G. Contractor, not Owner, shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 specifications

B. Delivery
   1. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct sunlight

C. Storage
   1. Store pipe, fittings and gaskets in clean locations protected from environmental conditions such as: direct sunlight, mud, etc.
   2. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months
   3. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging
      a. Do not stack pipe higher than 5 feet

D. Storage: Use the following precautions for valves, during storage:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage
      a. Protect valves from weather by storing indoors or support valves off ground or pavement in watertight enclosures when outdoor storage is necessary

E. Handling
   1. Handle so as to insure installation in sound undamaged condition

2. Use equipment, tools and methods for unloading, reloading, hauling and laying that do not damage pipe or cause an impact. Damaged pipe will be cause for rejection.
3. Use hooks or straps with broad, well-padded contact surfaces for lifting sections of pipe

F. Preparation for Transport: Prepare valves, for shipping as follows: Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends, flange faces, and weld ends. Set valves in best position for handling. Set valves closed to prevent rattling

G. Deliver and store valves and accessories in shipping containers with labeling in place in accordance with AWWA C500

H. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation

I. Seal valve ends to prevent entry of foreign materials into valve body

J. During loading, transporting and unloading, exercise care to prevent damage to material
1. Use nylon slings only
2. Do not drop pipe or fittings
3. Do not roll or skid against pipe already on ground
4. Repair any damage done to coating or lining
5. Handle per manufacturer's recommendations
6. Store rubber gaskets in cool dark location
7. Store all material on wood pallets or timbers

K. Adequately tag or otherwise mark all piping, fittings, and valves as to size per AWWA C509 and C905

L. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of and at no additional cost to the Owner

M. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the Engineer shall be repaired in accordance with these Specifications and at no additional cost to the Owner

1.9 JOB CONDITIONS

A. All work which requires the interruption of active water service lines must be completed as quickly as possible in order to minimize inconvenience to customers and risk to the City of Grand Junction and coordinated as specified in Division 1

B. Underground Obstructions
1. Underground Obstructions known to Engineer are shown on Drawings

a. Locations shown may prove inaccurate and other obstructions not known to Engineer may be encountered
b. Contractor shall field locate and verify all obstructions where or not shown on the Drawings

2. Notify each utility owner and request utility be field located by surface reference at least 48 hours prior to trenching or excavation
3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of a conflict
   a. Notify Engineer and Owner in case of a conflict
   b. In case of a conflict, the proposed work may be changed by Engineer
4. Maintain, protect, and support by shoring, bracing or other means existing utilities and appurtenances

C. Verify existing system operation, pressures, and valve settings (open or closed) prior to construction

PART 2 PRODUCTS

2.1 PIPE, FITTINGS, AND ACCESSORIES

A. Comply with the most current City of Grand Junction standards and specifications for the public water system products and accessories.

2.2 AIR RELEASE VALVE

A. Manufacturers:
   1. Val-matic VM-200C

B. Provide combination air release and vacuum breaker valves as indicated on Drawings
   1. Provide integral type that functions as both an air release and a vacuum breaker valve
   2. Provide a shutoff valve
      a. 2" and smaller valve size: ball valve
      b. Larger than 2" valve size: flanged butterfly valve connected to flanged tee

C. CERTIFICATIONS
   1. NSF 372 Certified lead free
   2. NSF 61 Certified for drinking water
   3. Meets AWWA C512

2.3 BUTTERFLY VALVE

A. Manufacturers:
   1. Mueller
   2. Kennedy

B. AWWA C504 Class 150B for direct bury service

1. Valve body shall be constructed of cast iron ASTM A126 Class B and conform to AWWA C504 in terms of laying lengths and minimum body shell thickness
2. Mechanical joint ends following AWWA C111
3. Valve disc shall be cast iron or ductile iron furnished with Type 316 stainless steel seating edge to mate with rubber seat on body
    a. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow
    b. Disc shall not creep or flutter under service conditions
4. Seat: Buna-N-Rubber
    a. 16-inch to 18-inch: Bonded seats that meet ASTM D429 Method B
    b. 24-inch and larger: Seats retained in the valve body by mechanical means without metal retainers or other devices located in the flow stream
    c. Retaining hardware for seats: type 304 or 316 stainless steel. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitation effects
5. Valve Shaft: type 304 SS, ASTM A276
    a. Shaft bearings: stainless steel in accordance with AWWA C504. Design valve shaft to withstand 3 times amount of torque necessary to open valve
    b. Packing: Standard self adjusting and wear compensating, split-V type, and replaceable without removing actuator assembly
6. Actuators:
    a. Provide manual actuators for single project, from same manufacturer
    b. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension to be fully enclosed and water tight
    c. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements
    d. Provide actuators for valves with size based on line velocity of 12 feet per second and unidirectional service.
        i) Equip with gear manual actuator
        ii) Fully enclosed, traveling-nut type. Traveling nut shall engage alignment grooves in the housing
        iii) Traveling nut actuator shall be self-locking and designed to transmit twice the required actuator torque without damages to faces of gear teeth or contact faces of nut
    e. Oil-tight and watertight actuator housing for valves, specifically designed for buried service and factory packed with suitable grease
    f. Equipped with 2-inch actuator nut
    g. Rotation: Counterclockwise to open with the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut
    h. Valve operating key: Provide one (1) for project, 7 foot length with tee handle
7. Coating
    a. Follow AWWA C550 and NSF 61

b. Coat interior and exterior ferrous surfaces of valve with epoxy suitable for potable water conditions: in accordance with AWWA C550 and coating manufacturer's recommendations
c. Provide three coats of two component, high-build epoxy with minimum dry film thickness of 12 mils

C. Extension stems
1. Provide as specified for buried valves with operating nuts more than 4.5 feet below grade
2. Non-rising stems
a. Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem
b. Connected to the valve by a flexible socket coupling
c. All other connections pinned
d. Extend stem to within 6-inch of grade
e. Provide spacers to center stem in valve box
f. Provide wrench nut

D. Valve boxes, depth as required for valve
1. Three piece cast iron (complying with ASTM A48, Class 20A) adjustable screw type, 5.25-inch diameter, minimum thickness of 3/16 inch
2. Box, cover, and base coated by dipping in asphalt varnish.
3. Cover marked with word, “WATER.”
4. Provide extension piece to permit 6-inch adjustment above finish grade
5. Manufacturers:
a. Tyler Pipe Company "Series 6860 with #160 oval base"
b. East Jordan Iron Works "8560 Series"
c. Tyler Union "6860 Series"
d. Or accepted substitution

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions under provisions of Division 1 Specifications

B. Verify locations and inverts or tops of pipe for connections to existing system as well as crossings with other utilities as indicated on the drawings. Report any discrepancies to Engineer

C. Carefully examine pipe and fittings for cracks, damage to linings, and other defects prior to installation

D. Remove all defective piping from site and replace

E. Examine areas for weak or structural defects or deviations beyond allowable tolerances for piping clearances that adversely affect excavation and quality of Work

F. Start installation only when conditions are satisfactory

3.2 PERFORMANCE - GENERAL

A. Perform work in a safe and proper manner with appropriate precautions against hazard

B. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

C. Contain all construction activity on the designated site and within the limits of work. Cost of restoration of site will be the responsibility of the Contractor

D. Contractor to verify quantities to perform all earthwork required according to Drawings, including but not limited to, additional import or export required to handle compaction, pavement subgrade preparation, and pipe bedding

E. Contractor shall take precautions to limit the removal of or damage to existing pavements, multi-use paths sidewalks, curbs, lawns, shrubbery, trees, hedges, walls, fences, buildings, or other existing improvements to the least practicable amounts and shall replace or restore such improvements to their original location and condition after the excavation has been backfilled and compacted

3.3 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations shall be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work

B. Backfill shall be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs shall be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional costs to the Owner

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage shall be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Engineer, shall be borne by the Contractor at no additional expense to the Owner

3.4 SITE PREPARATION

A. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris

B. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.

C. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted

3.5 DEWATERING

A. Comply with CDPHE Dewatering Requirements

B. Dewatering discharge to surface waterways requires CDPHE dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, if necessary

3.6 PIPE PREPARATION

A. Ream pipe and tube ends and remove burrs

B. Remove scale and dirt, on inside and outside, before assembly

C. Cut ends of metallic pipe, recoat with coating approved for potable water service and compatible with manufacturer's coatings.

3.7 BEDDING

A. Comply with City of Grand Junction standards and specifications

B. Excavate pipe trench in accordance with Section 02300 for work of this Section. Do not disturb trench bottom during excavation. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Place bedding material in accordance with Section 02300 at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent. Protect from lateral displacement by placing embedment evenly on both sides of pipe

D. Provide dewatering and backfill trench in accordance with Section 02300

3.8 PIPE INSTALLATION

A. Comply with City of Grand Junction standards and specifications. Use the manufacturer’s recommendations if the City of Grand Junction standards do not specifically apply.

B. Install PVC Pipe in accordance with AWWA M23 and AWWA C605

C. Install Ductile Iron Pipe in accordance with AWWA C600

D. Install Ductile Iron Fittings in accordance with AWWA M41

E. Route pipe as indicated on the Drawings

F. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected

G. Install as specified or in accordance with the manufacturer's recommendations

H. Cutting Pipe
   1. Cut pipe to measurement taken at the site, not from the drawings
   2. Cut pipe neatly without damage to pipe
   3. Cut smooth, straight, and at right angles to pipe axis
   4. Dress and bevel end of cut pipe to remove roughness and sharp corners
   5. Cut pipe with saw or abrasive wheel
   6. Follow state and federal safety regulations pertaining to cutting asbestos concrete pipe as necessary

I. Provide an isolation or shutoff valve and union at the water connections to each fixture and unit of equipment, whether shown on the drawings or not

J. Install pipe to indicated elevations. Maintain minimum 4.0 feet depth of ground cover and maintain minimum grade for drainage. Establish elevations of buried piping to ensure minimum cover is achieved. Maximum depth of 7.0 feet is allowed to avoid a local high point unless shown otherwise on the plans. Add additional soil in areas of future fill to provide minimal cover at all times. Report any variations from plan to Owner and Engineer
   1. Provide air release valve at all high points and blow-offs or hydrant at all low points. Coordinate locations and details with Engineer.
   2. Where minimum depth cannot be maintained, provide a minimum of 2 inch of specified insulation board per 1 foot of cover not provided. Contractor must have Owner and Engineer approval prior to installation.
      a. Place insulation board over bedding material for the width of the trench

K. Install pipe to allow for expansion and contraction without stressing pipe or joints

L. Protect from lateral displacement by placing embedment evenly on both sides of pipe

M. Do not lay pipe in water. Maintain groundwater level a minimum of 12 inches below pipe to be installed. Do not lay pipe under unsuitable weather or trench conditions

N. Make changes in horizontal, vertical, and curved alignment shown on drawings by using joint deflections in the amount permissible by manufacturer and shown on drawings

O. Do not bend pipe

P. Deflect pipe at joints

Q. Do not deflect PVC pipe at connection to ductile iron fittings

R. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main as indicated on Drawings

S. Utility crossings
   1. Whenever possible, lay water mains over sanitary and storm sewers to provide vertical separation of at least 18-inch between invert of water main and crown of sewer
   2. If standard crossing detail is not available and above separation cannot be met, provide one continuous length of watertight sewer pipe 20' long centered on water main with joints between different pipes encased in 6-inch minimum of concrete and extending 6-inch either side of joint or encase sewer pipe in 6-inch of concrete completely around pipe, for not less than 10' either side of water main
   3. Water Mains Passing Under Sanitary Sewers: If vertical separation is less than 18-inch, provide structural support for sewer. Provide concrete encasement where water lines pass under sanitary sewer line. Reference detail shown on Drawings

T. Maintain a minimum 10 feet of horizontal separation and 18 inches of vertical separation between water main and storm or sanitary sewer lines in accordance with the CDPHE
   1. Provide concrete encasement if these clearances cannot be achieved and when water line is below sanitary sewer line

U. Tracer wire and marker tape
   1. Install tracer wire continuous over top of pipe
   2. Install tracer wire test stations at maximum 500 LF of water line per City of Grand Junction requirements. Locate test station at fire hydrants, gate valves, or special test station locations in a valve box
   3. Terminate tracer wire following drawing details
   4. Tape tracer wire to top of pipe using PVC tape every 4 feet along the pipe, and on each side of fitting
      a. Tape: minimum 2 inches wide and wrapping full circumference of pipe
   5. Install identification /warning marker tape in fill area of trench above all water lines

V. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

W. Install access fittings to permit disinfection of water system, subject to approval by Engineer

X. Backfill trench in accordance to specifications herein

Y. Protect pipe from floatation or movement until completely backfilled and put into service

3.9 WATER MAIN CONNECTIONS

A. Comply with City of Grand Junction standards and specifications. Coordinate with City of Grand Junction and fire department representatives for any impacts to the existing water system and provide advanced notice to impacted properties if applicable.

B. Connect to water main per plans and referenced standards or details.

3.10 JOINTS

A. Make pipe joints carefully and neatly

B. Connect piping in accordance with manufacturer's recommendations

C. Push-on joints
   1. Lay pipe with bell ends facing the direction of laying except when Engineer authorizes reverse laying
   2. Assembly of PVC plain end into bell: follow PVC pipe manufacturer's recommendation
   3. For PVC pipe, Contractor to ensure that pipe is not inserted into the bell ends beyond the push line
      a. Utilize EBAA Mega-Stop bell protection, or approved substitution, if necessary, to ensure previously laid pipe joints are not impacted by ongoing installation
   4. Lubricate joint surfaces immediately before completing the joint
   5. Bevel spigot ends of field cut piping
   6. Groove spigot ends of field cut restrained joint piping if required by joint system
   7. Install restrained joints following manufacturer's recommendations

D. Mechanical joints
   1. Before assembling joint, clean both bell and plain end of rust and foreign matter
   2. Assemble joint following AWWA C111, C600, C605 and as specified
   3. Lubricate gasket and install in accordance with manufacturer's instructions
   4. If an effective seal is not obtained, disassemble joint, clean thoroughly, and reassemble
   5. Do not over tighten bolts to compensate for poor installation
   6. Carefully align holes in mechanical joints with restraint device to permit installation of the harness bolts
   7. Install mechanical joint pieces so the mechanical joint holes straddle the top centerline for horizontal piping, or the side centerline for vertical piping

3.11 PROTECTIVE COATING

A. Provide polyethylene tube encasement on all buried ductile iron fittings, valves, and fire hydrant extensions
   1. Encase ductile iron fittings and valves in polyethylene per AWWA C105, Method A, secured with polyethylene compatible adhesive tape. Overlap polyethylene onto PVC pipe a minimum of 6 inches
   2. Before backfilling, inspect polyethylene for rips, punctures and other damage and repair following AWWA C105

B. Coat exposed ferrous metal surfaces of joints, couplings, and uncoated steel with primer and tape coating system after installation. Do not coat stainless steel or high strength low alloy steel nuts and bolts
   1. Surface Preparation: Clean surfaces of rust, scale, soil, mud, oil, grease, and other contaminants by hand or power tool following SSPC-SP2 or SP3 and other

appropriate means as recommended by coating manufacturer Remove excess moisture and provide surface dryness as recommended by coating manufacturer

2. Application: Apply primer in uniform manner to clean and dry surfaces following coating manufacturer's recommendations
    a. Fill complex and irregular surfaces with appropriate mastic or filler tape to eliminate bridging; then apply tape/wrap to primed and filled surfaces following coating manufacturer's recommendations.
    b. When coating restraining rods or strapping, apply tape wrap longitudinally
    c. Where metal being coated enters concrete, overlap coating onto concrete by minimum of 2 inches after placement of concrete
3. Inspection: After field coating of specified items, conduct visual inspection to verify complete coverage has been accomplished.
    a. Repair damaged or incompletely coated surfaces following coating manufacturer's recommendations

3.12 CONCRETE ENCASEMENT

A. Provide where indicated on the Drawings

B. Comply with City of Grand Junction standards and specifications.

C. Suitably support and block pipe and anchor against flotation

3.13 VALVES AND HYDRANTS INSTALLATION

A. Carefully inspect valve before installation. Clean interior. Operate valve to determine parts in proper working order, with valves seating and drain valve operating properly. Set plumb and center stem in valve box and securely brace into place. Comply with AWWA C600 and referenced standards

B. Center and plumb valve box over valve. Set box cover flush with finished grade.
    1. Backfill and compact under and around valve boxes to ensure no vertical loads are transmitted to valve operators or bonnets

C. Comply with AWWA M17 for fire hydrant installation. Install with gate valve and provisions for drainage

D. Install valves, hydrants, and accessories in accordance with the manufacturer's recommendations and in accordance with referenced standards and specifications.

E. Hydrants and valves to be set plumb on solid bearing surface

F. Locate hydrant flange a minimum of 3” and maximum 6” above adjacent finished grade or flush with the adjacent top of curb. Contractor to verify final grade or adjust flange height upon the completion of final grading

G. Drainage shall be provided at the base of the hydrant by placing rock from the bottom of the trench to at least 12 inches above the barrel flange of the hydrant and to a distance of

12 inches around the elbow. The minimum distance from the bottom of the trench to the bottom of the hydrant elbow shall be 6 inches. The minimum amount of rock placed shall be 1/3 cubic yard

3.14 VALVE INSTALLATION

A. Comply with City of Grand Junction standards and specifications

B. Carefully inspect valve before installation. Clean interior. Operate valve to determine parts in proper working order, with valves seating and drain valve operating properly. Set plumb and center stem in valve box and securely brace into place. Comply with AWWA C600 and referenced standards.

C. Provide concrete collar for installations within landscaped areas

D. Protect valve box and cover during paving operations and clean any excess concrete, or asphalt, or road base from valve box and cover to ensure visibility and proper operation

3.15 TAPPING

A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for saddle tapping as per “Uni-Pub-8: Tapping Guide for PVC Pressure Pipe by Uni-Bell PVC Pipe Association"

B. All connections requiring a larger diameter than that recommended by the pipe supplier, should be made with a pipe connection as specified and indicated on the drawings.

C. Equipment used for tapping shall be made specifically for tapping PVC pipe:
   1. Tapping bits shall be slotted “shell” style cutters, specifically made for PVC pipe. ‘Hole saws’ made for cutting wood, steel, ductile iron, or other materials are strictly prohibited

3.16 WATER SERVICES

A. Water services are to be connected to the new water main per the Contract Drawings and City of Grand Junction Standards

B. Water services are to be tapped per the Contract Drawings. Direct taps are not permitted.

3.17 THRUST BLOCKS

A. Installation:
   1. Thrust blocks shall be constructed at bends and fittings that require support due to unbalanced line thrust. Care shall be taken to ensure that outlets, cover bolts, nuts, clamps, and other fittings are accessible. A bond breaker shall be placed between the pipe and the thrust block to aid in future removal. If a large thrust block is to be

placed, it shall be separated into sections by a suitable material. Bearing surface areas are minimum areas to bear against the undisturbed trench wall. If the soil bearing capacity is insufficient to provide adequate support based on minimum bearing areas established by City of Grand Junction standards and specifications, then the minimum bearing area shall be increased to a size that shall ensure support restraint. In every instance, the thrust block shall bear against undisturbed earth

2. Before placing concrete, equipment used in the mixing and transport shall be cleaned. Debris, water, or ice shall be removed from the area to be occupied by concrete. Concrete shall not be placed on frozen subgrade. Concrete shall be placed only in the presence of the Owner or Engineer unless inspection is waived prior to the placement

B. Formwork for Thrust blocks:
   1. Forming for concrete thrust blocks and anchors shall be done by bulkheading around the shape of the thrust block or anchor with wood, burlap sacks, or reinforced paper sacks that are filled with sand or earth. Sacks shall be constructed of a size easily handled when full and left in place in the trench. Wood forms shall be removed before backfilling.
   2. Horizontal struts or braces required for trench shoring shall not remain in concrete thrust blocks. Prior to placing concrete, the forms and ditch bank will be inspected and approved by Owner or Engineer
   3. When concrete is deposited against the ground without the use of forms, the ground shall be thoroughly moistened or other provisions made to prevent the ground from drawing water in from the concrete

C. Thrust block Curing Time:
   1. Newly placed concrete shall be allowed to set undisturbed for a minimum of 24 hours

D. Compaction of Fill Over Thrust blocks
   1. Backfill may be placed over thrust blocks once the surface has set sufficiently and they are able to resist the weight of the backfill. However, tamping or compacting shall not be allowed above the thrust block for a minimum of 24 hours after placement

E. Hydrostatic testing shall not be conducted until thrust blocks have fully cured, a minimum of 7 days

3.18 ABANDONMENT

A. Cap ends of main as shown. Place required concrete blocking as shown on drawing details

B. Where mains are to be abandoned and removed to a fitting or valve, cut and plug main at fitting or valve
   1. When shown on drawings, remove fire hydrants and valves, including lead joint tees when encountered; salvage and deliver removed fire hydrants and valves to the City of Grand Junction

2. Pipe, fittings, and other appurtenances that are removed, but are not required to be salvaged become property of Contractor
    a. Remove and dispose of offsite

3.19 ERECTION TOLERANCES

A. Establish invert elevations as shown on the drawings

B. Construct pipe within manufacturer’s tolerances of horizontal and vertical deflection. Refer to City of Grand Junction for allowable deflections at joints and fittings.

3.20 FIELD QUALITY CONTROL

A. Comply with City of Grand Junction standards and specifications. Test each line at the Contractor's expense in the presence and to the satisfaction of City of Grand Junction inspectors.

B. Field inspection and testing will be performed under provisions set forth by the referenced standards

C. Test each line at the Contractor's expense in the presence and to the satisfaction of Owner or Engineer at a maximum of 1,000-foot intervals

D. Water Line Disinfection
    1. Comply with AWWA C651 and provide Engineer and Owner with results.
    2. Flush water lines prior to disinfection, except when tablet method is used. Acceptable chlorine disinfectants are calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite solutions, and calcium hypochlorite tablets.
    3. After the pipe is filled with water and chlorine, the chlorinated water shall be held in contact with the pipe for 24 hours. At the end of the 24 hour period, the water in the pipeline shall be tested by the local health authority having jurisdiction, or their designated representative, to ensure a residual chlorine content in compliance with City of Grand Junction requirements. The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water. This activity requires a permit from the CDPHE WQCD prior to flushing. Comply with all provisions of the permit. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Discharges of water from blowoff assemblies or other appurtenances shall be contained or discharged in a manner approved by City of Grand Junction and the CDPHE.
    4. For fire lines, flush piping complying with NFPA 24
    5. If water in pipe does not meet the governing agency requirements, repeat disinfection procedure until acceptable. Furnish copies of acceptance forms from governing agency to Owner and Engineer.

E. Valve Testing
    1. Conduct pressure and leakage tests on all newly installed valves

2. Furnish all necessary equipment and material and make all connections to the pipe, as required. The Engineer shall monitor the tests.

F. Hydrostatic Pressure Tests
   1. Provide all necessary pumping equipment, piping connections, pressure gauges with maximum of 5 psi increments, and other required equipment, facilities, and materials
   2. All water used for pressure testing must be potable and delivered in acceptable containers
   3. Immediately locate and replace all pipe fittings, valves, pipe joints, and other materials found to be defective with new and acceptable material
   4. If tests indicate work does not meet specified requirements, remove work, replace, and retest at no cost to Owner
   5. Procedure
      a. Disconnect all fixture devices and other accessories which may be damaged by the specified test pressure
      b. Plug or cap ends as required
      c. Bleed system to eliminate all air from system
      d. No pressure testing shall be permitted until all concrete thrust blocks have adequate curing time to reach design strength, 7 day minimum
      e. Notify Owner and Engineer 48 hours prior to testing
      f. Test for 2 hours with no more than 5 psi pressure loss
      g. Leakage is the quantity of water added to a test section to maintain test pressure ±5 psi:

$$L = \frac{S \times D \times (P)^{0.5}}{133{,}200}$$

Where:
L = allowable leakage in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during test, psig

   6. Hydrostatic Test Conditions: At lowest point in the line or section under test pressure or operating pressure, whichever is greater, as scheduled below

Pipe	Test Pressure	Operating Pressure	Test Medium	System
20-inch PVC	150 psi	70 psi	Water	Transmission
8-inch PVC	150 psi	70 psi	Water	Distribution
6-inch PVC	150 psi	100 psi	Water	Distribution/Hydrant
3/4-inch Type K Copper	150 psi	100 psi	Water	Distribution/Service

   7. While the test pressure is maintained, an examination shall be made of the pipeline and any leaks located and repaired. Pipe or fittings found to be faulty shall be removed and replaced. Leakage is not allowed through the bonnet of the line valve. A valve leaking through the bonnet may be repaired in place or removed and replaced. Cutting and replacement of pavement as well as excavation and backfilling may be necessary when locating and repairing leaks discovered during pressure testing.

8. After visible leaks are stopped, repeat procedure beginning at 3.13.D.5 of this section

G. PVC Water Pipe Continuity Testing
   1. Test tracer wire for continuity, in the presence of Owner and Engineer, after backfill is complete and before Substantial Completion
   2. Notify Owner and Engineer five working days in advance to schedule testing
   3. Continuity test to consist of locating the PVC water pipe with an electronic-type pipe locator
   4. If test is negative for continuity, repair or replace as necessary to achieve continuity

H. Bac-T Testing
   1. After completion of water line disinfection as specified in Section 02676, Contractor shall take Bac-T samples to ensure pipe has been properly disinfected and submit results to Engineer
   2. If water line fails Bac-T sampling, any repeat disinfection and Bac-T testing will be at the Contractor's expense
   3. The Contractor shall receive City of Grand Junction approval before placing a water line in service

3.21 FINAL ACCEPTANCE

A. Comply with City of Grand Junction standards and specifications for placing water line in service

B. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected.
   1. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete

C. Drain all test water from the new pipe system prior to placing in service

D. Provide water tap locations (x, y, z) on the Drawings

E. Provide operation and maintenance manuals for fire hydrants

F. Provide final reports to Engineer for:
   1. Bac-T results
   2. Residual chlorine tests
   3. Hydrostatic tests for each section or pipe
   4. Tracer wire continuity test

END OF SECTION

SECTION 02676

DISINFECTION OF WATER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection of potable water piping, potable water storage facilities, treatment unit equipment and piping, pumping equipment and piping; testing and reporting results

1.2 RELATED SECTIONS

A. Section 02510 – Water Distribution System

1.3 REFERENCES

A. American Water Works Association (AWWA):
   1. B300 – Standard for Hypochlorites
   2. B301 – Standard for Liquid Chlorine
   3. C651 – Disinfecting Water Mains
   4. C652 – Disinfection of Water Storage Facilities
   5. C653 – Disinfection of Water Treatment Plants

B. National Sanitation Foundation (NSF):
   1. Standard 60 – Drinking Water Treatment Chemicals – Health Effects

1.4 SUBMITTALS

A. Test Reports: Indicate results comparative to specified requirements

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700

B. Disinfection report; record:
   1. Type and form of disinfectant used
   2. Date and time of disinfectant injection start and time of completion
   3. Test locations
   4. Initial and 24-hour disinfectant residuals (quantity in treated water) in parts per million (ppm) or milligram per liter (mg/L) for each outlet tested
   5. Date and time of flushing start and completion
   6. Disinfectant residual after flushing in ppm for each outlet tested

C. Bacteriological (Bac-T) report; record:
   1. Date issued, project name, and testing laboratory name, address, and telephone number
   2. Time and date of water sample collection

3. Name of person collecting samples
4. Test locations
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested
6. Coliform bacteria test results for each outlet tested
7. Bacteriologist's signature and authority

1.6 QUALITY ASSURANCE

A. Perform work in accordance with AWWA C651, C652, C653, and the Colorado Department of Public Health and Environment (CDPHE)

1.7 REGULATORY REQUIREMENTS

A. Conform to AWWA C651, C652, C653, as appropriate, and CDPHE regulations for performing the work of this Section

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Calcium and sodium hypochlorite shall conform to AWWA B300 and B301

B. Store hypochlorite in a cool, dark place away from flammable materials

PART 3 EXECUTION

3.1 CLEANING

A. Verify that piping has been cleaned and inspected

B. Verify that piping has been successfully pressure tested and flushed

C. Perform scheduling and disinfection activity with start-up, testing, adjusting, demonstration procedures, including coordination with related systems

3.2 DISINFECTION

A. Provide and attach required equipment to perform the work of this Section

B. Tablet, continuous, or slug disinfection may be followed in accordance with AWWA C651

C. The preferred method is continuous disinfection, summarized as follows:
1. Inject treatment disinfectant, free chlorine in liquid form into piping system to obtain 50 to 80 ppm residual
2. Bleed water from outlets to ensure distribution and test for disinfectant residual
3. Maintain disinfectant in system for 24 hours

4. If final disinfectant residual tests less than 25 ppm, repeat treatment
5. Flush, circulate and clean until residual equal to that of incoming potable water or 1.0 mg/L is achieved

D. Replace permanent system devices removed for disinfection

3.3 FINAL FLUSHING

A. Maintain a flushing velocity of 2.5 feet per second in piping

B. Collect chlorinated water for proper disposal and/or dechlorinate to less than 0.1 ppm free chlorine prior to discharge in accordance with State, County, and local regulations

C. City of Grand Junction to provide and pay for flushing water

3.4 FIELD QUALITY CONTROL

A. After final flush, and before main or equipment is placed in service, collect water samples from representative points along the main and field test for chlorine residual

B. Chlorine residual shall be within 50 percent of the chlorine residual prevailing in the source

C. If initial disinfection fails to provide satisfactory samples, repeat disinfection until satisfactory samples have been obtained

3.5 TESTING AND ACCEPTANCE

A. The Contractor will perform Bac-T sampling and testing after pipes have been disinfected and flushed as specified in Section 02510

B. If any portion of the piping fails Bacteriological testing, the Contractor is responsible for repeating disinfection procedures until passing Bac-T test is obtained

C. Contractor shall provide and pay for services of a certified laboratory to complete Bac-T testing

D. Submit test reports per Section 01700

END OF SECTION

SECTION 02740

FLEXIBLE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Full depth and/or composite hot bituminous pavement (asphalt) over prepared subgrade

B. Overlay, patch and/or pavement rehabilitation applications for streets, parking lots and other miscellaneous asphalt pavement

1.2 RELATED SECTIONS

A. Section 01020 – Geotechnical Report

B. Section 02300 – Earthwork

C. Section 02750 – Rigid Paving

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. T 230: Standard Method of Test of Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures

B. American Society for Testing and Materials (ASTM):
   1. C29: Unit Weight and Voids in Aggregate
   2. C88: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
   3. C117: Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
   4. C128: Specific Gravity Test and Absorption of Fine Aggregate
   5. C131: Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
   6. C136: Sieve or Screen Analysis of Fine and Coarse Aggregates
   7. D70: Specific Gravity of Semi-Solid Bituminous Materials
   8. D2726: Bulk Specific Gravity of Compacted Bituminous Mixtures
   9. D2041: Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
   10. D4462: Viscosity of Asphalts (Bitumens)
   11. D2172: Quantities Extraction of Bitumens from Bituminous Paving Mixtures
   12. D2419: Sand Equivalent Value of Soils and Fine Aggregate
   13. D290: Bituminous Mixing Plant Inspection
   14. D6373: Performance Graded Asphalt Binder
   15. D692: Course Aggregate for Bituminous Paving
   16. D1073: Fine Aggregate for Bituminous Paving Mixtures
   17. D1241: Materials for Soil-Aggregate Subbase, Base and Surface Courses

18. D2026: Cutback Asphalt (Slow-Curing Type)
19. D2027: Cutback Asphalt (Medium-Curing Type)
20. D2028: Cutback Asphalt (Rapid-Curing Type)
21. D2950: Density of Bituminous Concrete in Place by Nuclear Methods

C. Surface Preparation Standards (SSPC):
   1. SP-2: Superior Performing Asphalt Pavement System (Superpave) Level 1 Mix Design

D. Colorado Department of Transportation

E. Colorado Asphalt Pavement Association

F. City of Grand Junction Engineering Division Standard Specifications for Road and Bridge Construction

1.4 SUBMITTALS

A. Submit under provisions of Division One Specifications

B. Record of Work: Maintain record of time and date of placement, temperature, and weather conditions, retain until completion and furnish copy to engineer.

C. Proposed Design Job Mix Formula for each mixture required by the contract. The mixture design shall be determined using AASHTO T-312 or Colorado Procedure CP-L 5115 for the Superpave Method of Mixture Design.

D. Test Reports: Proposed Design Job Mix testing shall be performed in a materials laboratory under the direct supervision of; and shall be stamped and signed by a Professional Engineer licensed in the State of Colorado practicing in this field. In addition, the General Contractor shall submit as part of the Proposed Design Job Mix, documents to verify the following:
   1. Source of materials
   2. Gradation, specific gravity, source and description of individual aggregates and the final blend
   3. Aggregate physical properties
   4. Source and Grade of the Performance Graded Binder (PG Binder)
   5. Proposed Design Job Mix – aggregate and additive blending, final gradation shown on 0.45 power graph, optimum asphalt content
   6. Required mixing and compaction temperatures
   7. Mixture properties determined at a minimum of four asphalt contents and interpolated at optimum and graphs showing mixture properties versus asphalt content.
   8. Sampling and testing of asphalt concrete mixtures for quality control during paving operations
      a. Uncompacted asphalt concrete mix
         i) Asphalt cement content: ASTM D2172 (AASHTO T164)
         ii) Maximum Specific Gravity: ASTM D2041 (AASHTO T209)
      b. Compacted asphalt concrete mix

i) Bulk density: ASTM D1188 (AASHTO T166)

c. Perform at least one test for each day's paving but not less than one test per each 4000 sf of each lift.

1.5 QUALITY ASSURANCE

A. Materials and installation shall conform to applicable portions of Colorado Department of Transportation (CDOT) and City of Grand Junction construction specifications, standards and details.

1.6 REGULATORY REQUIREMENTS

A. For work on public streets or rights-of-way conform to the requirements of City of Grand Junction construction specifications, standards and details for the construction of concrete, curbs, gutters, sidewalks, driveways, roadways, street paving, and other public right-of-way Improvements.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle materials under provisions of Division One Specifications

B. Transport mixture from mix plant in trucks with tight, clean, smooth, non-sticking compartments. Thinly coat hauling compartments with lime-water mixture, paraffin oil or other approved release agent to prevent sticking. Petroleum distillates such as kerosene or fuel oil are not approved release agents. Elevate and drain compartment of excess solution before loading mix.

C. Cover to protect from weather and prevent loss of heat

D. Provide insulated truck beds during temperature below 50 degrees F on long distance deliveries

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply when underlying surface is muddy, frozen or wet

B. Weather conditions permit pavement to be properly placed and compacted

C. The hot mix asphalt will be placed only when both the air and surface temperatures are equal to or exceed the temperatures specified in the table below:

CDOT Table 401-3: Placement Temperature Limitations in F

Compacted Layer Thickness (Inches)	Minimum Air and Surface Temp. (Degrees F and rising)	
	Top Layer	Other Layers
1½ or less	60	50
>1½ to 3	50	40
3 to 4	45	35

Note: Air temperature shall be taken in the shade. Surface is defined as the existing base on which the new pavement is to be placed.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Pavement shall be asphalt of the plant hot mix type. Materials and construction shall comply with Section 403 and 702 of the CDOT Standards and Specifications for Road and Bridge Construction.

B. Tack Coat:
   1. SS-1 or CSS-1h
   2. AASHTO M208 or M140

C. Asphaltic Cement:
   1. Superpave Performance Graded (PG) binder of PG64-22 or PG58-28 Table 702-1 of CDOT standard section 702
   2. Will not be acidic modified or alkaline modified
   3. Will not contain any used oils that have not been refined
   4. Modifiers will not be carcinogenic

D. Aggregate for Asphaltic Concrete, General
   1. Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D692
   2. Sand, stone, or slag screening: ASTM D1073
   3. Percent wear: ASTM C131, less than 45 for aggregates retained in #10 sieve

E. Base Course Aggregates for Asphaltic Concrete
   1. Uncrushed gravel may be used in mixture if it meets design criteria specified
   2. Provide uniform quality combined aggregates with a minimum sand equivalent value of 40
   3. Provide aggregate in gradations for courses to comply with Class S and SG, Colorado Department of Transportation, ASTM C136
   4. A maximum of 20% Reclaimed Asphalt Pavement (RAP) will be allowed in (non-polymer or non-rubberized) mixes, provided that all the requirements for hot bituminous pavement are met.

a. RAP shall not be allowed in polymer modified mixes or in the permanent final lift of asphalt.

F. Surface Course Aggregates for Asphaltic Concrete
1. Provide natural sand, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions
2. Provide uniform quality combined aggregate with a minimum sand equivalent value of 50
3. Provide aggregate in gradations for courses to comply with Class SX, Colorado Department of Transportation, ASTM C136.

G. Hydrated Lime for Aggregate:
1. May be added at the rate of 1% by dry weight of the aggregate and shall be included in the amount of material passing the No. 200 sieve. Hydrated lime for aggregate pretreatment will conform to ASTM C207, Type N. Residue retained on a No. 200 sieve will not exceed 10% when determined in accordance with ASTM C110. Drying of the residue in an atmosphere free from carbon dioxide will not be required.

H. Weed Control: First application, “Roundup.” Second application, Casoron “W-50" or “G-10” with colored marker dye, manufactured by Pacific Coast Borax Company or an accepted substitute of non-flammable type.

2.2 ACCESSORIES

A. Traffic Control Devices
1. Signs.
a. Comply with City of Grand Junction standards and specifications for signs within the public right-of-way.
b. Sign faces, posts and bases shall be in conformance with the following materials specifications. All nonstandard sign faces, posts and bases must be approved by the City of Grand Junction. Private property or nonstandard signs will be maintained by the owner. Submit shop drawings for approval prior to fabrication. All signs shall conform to current M.U.T.C.D. Standards and Colorado Supplements. All signs shall be 3M-engineer grade reflective sheeting or accepted substitute.
c. Traffic/Parking Signs: Sign blanks shall be 6061 or 5052-H38 aluminum alloy .080 inches thick. Facing shall be specified reflective sheeting with standard sign colors based on standard graphics and as shown on the plans.
2. Sign Posts.
a. For large signs greater than 12”W x 18”H and for multiple signs of any size mounted on the same post: sign posts shall be two (2) inch by two (2) inch galvanized telespar tube.
b. For regular single signs 12”W x 18”H or smaller: sign posts shall be one and one-half (1-1/2) inch by one and one-half (1-1/2) inch galvanized telespar tube.
c. Galvanized telespar tube shall have 0.120-inch wall thickness, and three-eighths (3/8) inch holes drilled on one (1) inch centers, all sides over full length, ten (10) feet in length (min).

3. Sign Post Anchor Bases (Stubs). All sign post anchor bases shall be twist resistant square galvanized telespar tube post with thickness and hole pattern the same as sign posts. Use 2-1/4" by 2-1/4" anchor for large posts and 1-3/4" by 1-3/4" anchor for regular posts. Bases shall be embedded a minimum of 36" below finished grade and shall extend 3" above finished grade.
4. Signs Post Anchor Bases with concrete footing: Sign, post, base and compacted soil shall be rigid and able to withstand wind loads. Where predominantly clay soils are present which will not properly compact at sign base, install a 6" diameter by 36" deep concrete footing around signs post anchor base for all signs in landscaped areas.
5. All signs and posts shall be mounted and secured with municipal-approved vandal-proof type TL-3896 drive rivets with washers, or accepted substitute.

B. Pavement Marking. Specified pavement marking materials shall be used at locations as identified below.
1. Comply with City of Grand Junction standards and specifications for pavement marking within the public right-of-way. [
2. FS TT-P-1952, Type I Alkyd, white, blue, yellow and red color paint meeting requirements of CDOT Standard Specification 708. Verify colors and extent of painting prior to painting. Unless noted on plans, evident at existing striping or instructed, provide white in color for traffic striping, parking stalls, and other control markings on internal pavement, yellow in color for traffic control markings or restricted parking or where indicated, blue in color for accessible parking stalls, and red in color for curbs where no parking is indicated. Reflectorized paint required for traffic stripes and control markings on internal drive, road or street pavements.
3. Furnish paint with a no-pick-up maximum drying time of 20 minutes, when tested according to ASTM D711 using a wet film thickness of 0.015-inch when tested and applied at 77 degrees F.

C. Wheelstops.
1. Provide precast concrete wheelstops of approved design and locations as indicated. For concrete stops, provide concrete tests showing units made from concrete having minimum 4,000 PSI 28-day compressive strength.
2. Secure in place by driving two #5 rebar 24" long through holes in units into paving and subgrade. Seal holes with sealant as specified in related joint sealant sections with sealant for exterior asphalt use.

2.3 MIXES/SOURCE QUALITY CONTROL

A. Determine full depth design mix based upon aggregates furnished
1. Test mix by independent laboratory at Contractor's expense
2. Grade dependent on temperature during placement
3. Submit mix designs under provisions of Division One specifications for review and acceptance by Engineer

B. Submit mix design giving unit weight and to meet following requirements prior to placement of asphalt:

Property	S(75)	SX(75)
Air Voids in Mix, % (N Design)	3.5-4.5	3.5-4.5
Initial Gyrations	7	7
Design Gyrations	75	75
Hveem Stability	28 min	28 min
Voids Filled w/ Asphalt	65-80	65-80

Establish a single percentage passing each sieve size, a single percent of asphalt and a mix temperature. Maintain job mixes within following percentages of design mix:

Aggregates:	
¾" and larger	± 6%
#4 to #8	± 5%
#30	± 4%
#200	± 2%
Asphalt Content Tolerance	± 0.3%
Discharge Mix temp	± 20˚ F

PART 3 EXECUTION

3.1 EXAMINATION

A. Establish and maintain required lines and elevations. Provide grade and location stakes under this section as required for asphaltic concrete paving work.

B. Operate heavy, rubber-tired front loader over subgrade of paved areas. Where soft spots occur, remove loose materials and replace with Class 6 road base aggregate complying with CDOT standards compacted to level of subgrade.

3.2 PREPARATION

A. Prepare subgrade under provisions of Section 02300

B. Loose and Foreign Material
   1. Remove loose and foreign material from compacted subgrade surface immediately before application of paving. Clean surface with mechanical sweeper, blowers, or hand brooms, until surfaces are free from dust

C. Weed Control

1. If weeds or vegetation exist at or on the subgrade, apply “Round-up” at rates following manufacturer’s instructions. Apply “Round-up” three days prior to removal of vegetation, subgrade preparation and application of Casoron as described below to allow “Round-up” to kill all vegetation. Remove all living and dead weeds, root balls, tree/shrub roots, vegetation, and/or any organic matter from on or in the subgrade per applicable earthwork specifications prior to subgrade preparation and paving at all areas to be paved.
2. After all fine grading, checking, shaping, and compacting of the subgrade has been completed, and just prior to placing asphalt or aggregate base course, all subgrade soil in the area to receive asphalt pavement shall be thoroughly treated with Casoron soil sterilant (in addition to “Round-up” and regardless of presence of existing weeds or vegetation). Casoron shall be thoroughly sprinkled to distribute the chemical through the first two or three inches of the subgrade. For all areas to be paved, apply Casoron weed control at a minimum rate per 100 square yards of 2.4 pounds for G-10 or 4.0 pounds for 50w at rates and methods recommended by manufacturer within one day of paving.
3. The Contractor shall provide all necessary protection to prevent injury to animal, fish, or plant life and property occasioned by the application of the soil sterilant. Apply on a calm, wind-free day. The Contractor will be held responsible for all application of soil sterilant or the storage of same. Protect existing and new trees and shrubs beyond the limit of paving from damage due to weed killer or soil sterilant overspray or root contact. Extra caution is required to prevent over-application of products in areas to be paved under tree canopies. Trees and shrubs damaged or killed by weed killer or sterilant application shall be replaced by the contractor at contractor’s expense.
4. Do not apply within 20 feet of trees or shrubs

D. Tack Coat
   1. Apply in similar manner as prime coat, except as modified
   2. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphaltic concrete or portland cement concrete and surfaces
   3. Apply at rate of 0.05 to 0.15 gallons per square yard of surface
   4. Apply tack coat by brush to contact surfaces of curbs, gutters, catch basins, and other structures projecting into or abutting asphaltic concrete pavement
   5. Allow surfaces to dry until material is at condition of tackiness to receive pavement
   6. Where asphaltic concrete will adhere to surface, tack coat may be eliminated by Engineer

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to minimum depth of 1 ½-inches, or as indicated on the plans.
   2. Mill to a uniform finished surface free of gouges, grooves, and ridges of more than ¼ inch depth.
   3. Control rate of milling to prevent tearing of existing asphalt course.

4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Transport milled hot-mix asphalt to asphalt recycling facility.
7. Keep milled pavement surface free of loose material and dust.

3.4 RING/FRAME ADJUSTMENTS

A. Set ring/frames of subsurface structures to final grade as a part of this work.

B. Placing Ring/Frames
1. Surround ring/frames set to elevation with a ring of compacted asphalt concrete base prior to paving
2. Place asphalt concrete mixture up to 1-inch below top of ring/frame, slope to grade, and compact by hand tamping

C. Adjust frames to proper position to meet paving

D. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations

E. Set ring/frames to grade, flush with surface of adjacent pavement

3.5 PREPARING THE MIXTURE

A. Comply with ASTM D995 for material storage, control, and mixing and for plant equipment and operation

B. Stockpile
1. Keep each component of the various sized combined aggregates in separate stockpiles
2. Maintain stockpiles so that separate aggregate sizes will not be intermixed and to prevent segregation

C. Heating
1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture
2. Use lowest possible temperature to suite temperature viscosity characteristics of asphalt
3. Do not exceed 350 degrees F

D. Aggregate
1. Heat-dry aggregates to acceptable moisture content
2. Deliver to mixer at recommended temperature to suite penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture
3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements

E. Mix aggregate and asphalt cement to achieve 90-95 percent coated particles for base mixtures and 85-90 percent coated particles for surface mixture, per ASTM D2489

3.6 EQUIPMENT

A. Bituminous Pavers:
   1. Self-propelled, spreads without tearing surfaces, equipped with an activated screed assembly, heated if necessary, controls pavement edges to true lines without use of stationary forms and capable of spreading and finishing the asphalt plant mix material in widths applicable to the typical sections and thicknesses shown in the contract documents.
   2. Pavers will be equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, and maintaining the screed at the specified longitudinal grade and transverse slope. The sensor will be constructed to operate from either or both sides of the paver and will be capable of working with the following devices:
      a. Ski-type device at least 30 feet in length
      b. Short ski or short shoe
      c. At least 5,000 feet of control line and stakes
   3. The controls will be capable of maintaining the screed at the specified transverse slope within plus or minus 0.1 percent.
   4. Manual operation will be permitted:
      a. For constructing irregularly shaped or minor areas
      b. If the automatic controls fail or malfunction the equipment may be operated manually for the remainder of the normal working day, provided specified results are obtained. However, if specified surface tolerances cannot be achieved, paving operations will be suspended until satisfactory correction, repairs of equipment replacements are made.

B. Rolling Equipment
   1. Steel-wheel roller: Self-propelled, contact pressure of 250 to 350 psi per inch of width of roller wheel, equipped with adjustable scrapers and means for keeping wheel wet to prevent mix from sticking
   2. Pneumatic-tired rollers: Self-propelled, contact pressure under each tire of 85 to 110 psi, wheels spaced so that one pass will accomplish one complete coverage equal to rolling width of machine, oscillating wheels. Remove and replace immediately tires picking up fines

C. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools

3.7 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine

B. Complete placement over full width of section on each day's run

C. Spread mixture at minimum temperature specified by CDOT Table 401-5 for the specific binder used in the asphalt mix:
   1. PG 64-22: 320 F minimum mix discharge temperature, 235 F minimum delivered mix temperature
   2. PG 58-28: 275 F minimum mix discharge temperature, 235 F minimum delivered mix temperature
   3. The maximum mix discharge temperature will not exceed the minimum discharge temperature by more than 30 F.
   4. Delivered mix temperature will be measured behind the paver screed
   5. Hot asphalt mixture will be produced at the lowest temperature with the specified temperature range:
      a. producing a workable mix and provides for uniform coating of aggregates, in accordance with AASHTO T195
      b. allowing the required compaction to be achieved

D. Inaccessible and small areas may be placed by hand

E. Conform to the grade, cross section, finish thickness, and density indicated.

F. Lift Thickness
   1. Place in multiple lifts. Place asphalt in lifts such that each compacted lift thickness is no less than 2.0" thick and no greater than 3.0" thick. Top lift to be 2" thick.
   2. Typical Lift Thickness Sequencing:

Final Asphalt Section Required (inches)	No. of Lifts	Thickness of each Lift (inches) from bottom to top lift
2"	1	2
3"	1	3
4"	2	2-2
5"	2	3-2
6"	3	2-2-2
7"	3	3-2-2
8"	3	3-3-2
9"	4	3-2-2-2
10"	4	3-3-2-2
>10	Review with Engineer	

G. Paver Placing
   1. Unless otherwise directed, being placing along centerline of areas in crowned section and at high side on one-way slope and in direction of traffic flow
   2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips
   3. Complete base courses before placing surface courses
   4. Place mixture in continuous operation as practicable

H. Hand Placing

1. Spread, tamp, and finish mixing using hand tools in areas where machine spreading is not possible as acceptable to Engineer
2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature

I. Joints
1. Construct transverse joint at right angles to centerline when operations are suspended long enough for mixture to chill
2. Construct joints to have same texture, density, and smoothness as adjacent sections of asphalt concrete course
3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat
4. Offset transverse joints in succeeding courses not less than 24 inches
5. Cut back edge of existing pavement or previously placed course to expose an even, vertical surface for full course thickness
6. Offset longitudinal joints in succeeding courses not less than 6 inches
7. When the edges of longitudinal joints are irregular, honeycombed or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness
8. Wearing course constructed in even number of strips; place 1 longitudinal joint on centerline of road
9. Wearing course constructed in odd number of strips; place the centerline of 1 strip on centerline of road

J. Gutter: Finish surface high adjacent to concrete gutter so when compacted surface is slightly higher than edge of curb and flashing

3.8 COMPACTING THE MIX

A. All paving will be compacted to 94 +/- 2% of Maximum Theoretical (RICE) density, CP-51 or AASHTO T209: Maximum Specific Gravity of Bituminous Paving Mixtures, as determined by ASTM D 2950. RICE values will be used in calculating Relative Compaction according to CP-44 or AASHTO T166.

B. Provide pneumatic and steel-wheel type rollers to obtain the required pavement density, surface texture and rideability

C. Begin rolling operations when the mixture will bear weight of roller without excessive displacement and complete as quickly as possible after placement occurs.

D. Compaction operations will be continuous until the required density is achieved or the density requirements are not met and the mix temperature falls below 185˚ F or there is obvious surface distress or breakage. Minimum compaction temperatures may be adjusted according to the asphalt binder supplier recommendations. Adjusted minimum compaction temperatures must be shown on the approved mix design or on the asphalt binder supplier documentation kept on file at the jobsite.

E. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set

F. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers

G. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs

H. Do not roll centers of sections first under any circumstances

I. Breakdown Rolling
   1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge
   2. Operate rollers as close as possible to paver without causing pavement displacement
   3. Check crown, grade, and smoothness after breakdown rolling
   4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling

J. Second Rolling
   1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction
   2. Continue second rolling until mixture has been thoroughly compacted

K. Finish Rolling
   1. Perform finish rolling while mixture is still warm enough for removal of roller marks by combination of steel and pneumatic rollers
   2. Continue rolling until roller marks are eliminated and course has attained specified density, and required surface texture and surface tolerances
   3. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled and attained its maximum degree of hardness

L. Patching
   1. Remove and replace defective areas
   2. Cut-out and fill with fresh, hot asphaltic concrete
   3. Remove deficient areas for full depth of course
   4. Cut sides perpendicular and parallel to direction of traffic with edges vertical
   5. Apply tack coat to exposed surfaces before placing new asphaltic concrete mixture
   6. Compact by rolling to specified surface density and smoothness

3.9 JOINING TO EXISTING WORK

A. Cut sides vertically and apply tack coat to exposed asphalt surfaces before placing new pavement. Meet existing thickness of surface and base courses, but not less than specified for new work.

B. All joins shall be compacted to 92.0% +/- 2.0% of RICE, taken fully on each side of joint, every 200 lineal feet. RICE values shall be used in calculating Relative Compaction according to AASHTO T166.

3.10 FIELD QUALITY CONTROL

A. The Owner will engage a certified testing agency to perform field testing to determine compliance of in-place asphaltic concrete paving materials and compaction in accordance with Division One Specifications.

B. It is the Contractor's responsibility to initiate, coordinate and accommodate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing requirement with testing agency and provide the testing agency 48-hour advance notification to schedule tests.

C. Testing Agency will test in-place pavement for density and thickness.

D. Asphalt density testing:
   1. Every one-hundred fifty (150) lineal feet per driving lane.
   2. Every 2,000 square feet of parking lot
   3. Densities shall be between ninety-two percent (92%) and ninety-six percent (96%) of the RICE unit weight

E. Contractor to verify final surfaces are of uniform texture, conforming to required grades and cross sections

F. The Contractor will core the pavement as required by the testing agency for field density tests in accordance with AASHTO T 230, Method B, or for field calibration of nuclear density equipment in accordance with ASTM D 2950.
   1. Testing agency will take not less than 4-inch diameter pavement specimens
   2. At the testing agency's discretion, cores may be required at the beginning of placement of each pavement layer or change of mixture materials or gradation.
   3. Untested areas during placement will require cores to be taken to verify compaction
   4. Contractor to repair holes from test specimens

G. For each completed course or from locations directed by the testing agency, and at a minimum, a representative asphalt pavement sample shall be taken from the first one thousand (1,000) tons, and all mix properties shall be verified. The percent voids filled with asphalt cement, Hveem stability, and Lottman shall be verified at a minimum of every ten-thousand (10,000) tons. Asphalt testing shall comply with ASTM D1559. Two copies of all test reports shall be submitted directly to the Engineer.

H. Acceptable density of in-place course materials is between 92 and 96 percent of the recorded laboratory RICE unit weight. Immediately re-compact asphaltic concrete not conforming to acceptable density. Remove and replace all sections not in conformance density requirements

I. Thickness: Variations from drawings
   1. Base course: 1/4-inch +
   2. Remove and replace paving less than minimum thickness

J. Grade Tolerance: ±0.1 feet

K. Surface Smoothness
   1. Test using a 10-foot straight edge applied parallel to direction of drainage
   2. Advance straight edge five feet, maximum 1/4-inch per foot from nearest point of contact
   3. Do not permit pockets or depressions where water may pool
   4. Remove and replace areas, deficient in smoothness. Overlay corrections may be permitted only if acceptable to Engineer

L. Inspection: The work of this section is subject to the inspection and approval of the engineer and/or owner. The following inspections are required:
   1. Protection of adjacent property
   2. Staking and establishment of elevations
   3. Establishment and compaction of subgrade
   4. Placement and compaction of bituminous base course and wearing surface
   5. Final inspection
   6. Obtain approval of each element of work listed above in sequence of its completion before proceeding with the next item

3.11 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of Engineer

3.12 PROTECTION OF FINISHED WORK

A. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened and in no case sooner than 6 hours

B. Provide barricades and warning devices as required to protect pavement and the general public

3.13 WARRANTY

A. Provide installer's 2-year written warranty endorsed by the contractor warranting the pavement from creeping, shoring, cracking, softening, settling, ponding and other defects due to improper placing or defective materials. Replace defective materials upon notification by the owner in accordance with the requirements of the original work.

3.14 SCHEDULE OF MIX PLACEMENT:

A. Refer to City of Grand Junction Engineering Division Standard Specifications for Road and Bridge Construction.

END OF SECTION

SECTION 02750

RIGID PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Forming, jointing, placing and curing of concrete pavements, curbs, gutters, cross pans, islands and sidewalks.

1.2 RELATED SECTIONS

A. Section 02300 – Earthwork

B. Section 0274 – Flexible Paving

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. M171 – Sheet Materials for Curing Concrete

B. American Concrete Institute (ACI):
   1. 214 – Recommended Practice for Evaluating Compression Test Results of Field Concrete
   2. 301 – Specifications for Structural Concrete for buildings
   3. 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
   4. 305/305R – Hot Weather Concreting
   5. 306/306R – Cold Weather Concreting
   6. 308 – Standard Practice for Curing Concrete

C. American Society for Testing and Materials (ASTM):
   1. A1064 – Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed for Concrete
   2. A615 – Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   3. C31 – Making and Curing Concrete Test Specimens in the Field
   4. C33 – Concrete Aggregates
   5. C39 – Test Method for Compressive Strength of Cylindrical Concrete Specimens
   6. C94 – Ready Mix Concrete
   7. C143 – Test Method of Slump of Hydraulic Cement Concrete
   8. C150 – Portland Cement
   9. C260 – Air-Entraining Admixtures for Concrete
   10. C309/AASHTO M148 – Liquid Membrane-Forming Compounds for Curing Concrete
   11. C494 – Chemical Admixtures for Concrete

12. C618 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
13. C979 – Pigments for Integrally Colored Concrete
14. C1116 – Fiber Reinforced Concrete
15. D994 – Preformed Expansion Joint Filler for Concrete (Bituminous Type)
16. D1751 – Preformed Expansion Joint Fillers for Rigid Paving and Structural Construction
17. D1752 – Preformed Sponge Rubber Cork Expansion and Recycled PVC Expansion Joint Fillers for Rigid Paving and Structural Construction
18. D6690 – Joint and Crack Sealants, Hot Applied, for Concrete and Flexible Pavements
19. D7508 – Polyolefin Chopped Stands for Use in Concrete

D. CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

E. City of Grand Junction Engineering Division Standard Specifications for Road and Bridge Construction

1.4 SUBMITTALS

A. Provide under provisions of Division One Specifications

B. Product Data: Provide sufficient information on mix design and products specified to verify compliance with specifications. Provide data on joint filler admixtures and curing compounds
1. Existing data on proposed design mixes, certified and complete
2. Submit reports of field quality control testing

1.5 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301, Conform materials and installation to applicable portions of Colorado Department of Transportation, and the City of Grand Junction construction specifications, standards and details.

1.6 REGULATORY REQUIREMENTS

A. For work on public streets or rights-of-way conform to the requirements of City of Grand Junction construction specifications, standards and details for the Construction of Curbs, Gutters, Sidewalks, Driveways, Street Paving, and other public right-of-way Improvements.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

C. Obtain cementitious materials and aggregate from same source for all work

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle materials under provisions of Division One Specifications

B. Reinforcing steel: Store on supports which will keep materials from contact with the ground and cover

C. Rubber and plastic materials: Store in a cool place, do not expose to direct sunlight

D. Prepare a delivery ticket for each load of ready-mixed concrete

E. Contractor shall submit tickets for all concrete delivered to site:
   1. Quantity delivered
   2. Actual quantity of each material in batch
   3. Outdoor temp in the shade
   4. Time at which cement was added
   5. Numerical sequence of the delivery
   6. Quantity of water that can be added in the field based on mix design
   7. Free moisture in fine and coarse aggregate in percent by weight
   8. Temperature of batch

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen

B. Protect concrete from rapid loss of moisture during hot water placement

PART 2 PRODUCTS

2.1 MATERIALS

A. Form Materials
   1. Form Materials: Plywood: PS 1, waterproof resin-bonded, exterior type Douglas Fir; face adjacent to concrete Grade B or better
   2. Fiberboard: FS LL-B-810, Type IX, tempered, waterproof, screen back, concrete form hardboard
   3. Capable of supporting loads imposed by construction equipment, straight and free from warp. Clean and strong enough to resist pressure of concrete when placed and retain horizontal and vertical alignment. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete
   4. Joint filler: ASTM D1751 or D1752 type; 3/4-inch thick unless indicated otherwise

B. Reinforcement
   1. Where reinforcement is specified herein or indicated on the plans:
      a. Bars: ASTM A615, Grade 60

b. Reinforcing Welded Wire Fabric (WWF): ASTM A1064, steel, 16 gage minimum
   i) Furnish in flat sheets
c. Dowels: ASTM A615; 40 ksi yield, Grade 60, plain steel, unfinished finish
d. Fibrous reinforcement: Collated, fibrillated, polypropylene fibers, tensile strength 70,000 psi
   i) ASTM C1116 and ASTM D7508
   ii) Use minimum of 1.5 pounds per cubic yard
   iii) Fibermesh or accepted substitution

C. Weed Control: First application, “Roundup.” Second application, Casoron “W-50" or “G-10” with colored marker dye, manufactured by Pacific Coast Borax Company or an accepted substitute of non-flammable type.

2.2 ACCESSORIES

A. Curing Compound: ASTM C309, AASHTO M-148, white pigmented liquid membrane

B. Joint Sealers: Polyurethane base, elastomeric, self leveling, chemical cure, handling 50% joint movement; Sikaflex-2C-SL or accepted substitutions

C. Sheet Materials: AASHTO M171, 4 mil

D. Expansion Joint Material: 0.5-inch thick, ASTM D1751, asphalt impregnated fiber board, glass fiber or sponge, or closed cell polyethylene foam; Texmastic “vinylex 3600,” Sonneborn “Sonoflex F,” or accepted substitutions.

2.3 CONCRETE MIX

A. Comply with ASTM C94

B. Maximum Coarse Aggregate Size: 1-inch

C. Portland Cement: ASTM C150, Type II; 555 pounds minimum per cubic yard of concrete

D. Water/Cementitious Material (Cement and Fly Ash) Ratio: Less than or equal to 0.45

E. Slump: 4-inch maximum
   1. May be increased to 4.5 inches for hand work, acceptable to Engineer
   2. As low as possible consistent with proper handling and thorough compaction

F. Volumetric Air Content: 6.0%±2% after placement for 1-inch aggregate
   1. Vary air content with maximum size aggregate, ASTM C94, Table 3.

G. Strength: Compressive strength as determined by ASTM C39, 4,500 psi minimum at 28 days

H. Consistency: Uniform slump, suitable for the placement conditions with aggregate floating uniformly throughout the concrete mass, flowing sluggishly when vibrated or spaded

I. Adjust mix as required to meet specifications

J. Approved fly ash may be substituted for ASTM C150 cement up to a maximum of 25 percent Class C or Class F by weight of the cementitious material content. Fly ash for concrete shall conform to the requirements of ASTM C618 with the following exceptions:
   1. The loss on ignition shall not exceed 3.0 percent
   2. The CaO in Class F fly ash shall not exceed 18 percent

K. Admixtures: Content, batching method, and time of introduction in accordance with the manufacturer's recommendations for compliance with this specification
   1. Include a water reducing admixture
   2. Calcium chloride content shall not exceed 0.05% of the cement content by weight

2.4 SOURCE QUALITY CONTROL AND TESTS

A. Provide under provisions of Division One Specifications

B. Submit proposed mix design to Engineer for review prior to commencement of work

C. Tests on cement and aggregates will be performed to ensure conformance with specified requirements

D. Test samples in accordance with ACI 301.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads

B. Verify gradients and elevations of base are correct

C. Check completed formwork for grade and alignment to the following tolerances:
   1. Top of forms not more than 1/8-inch in 10 feet
   2. Vertical face on longitudinal axis, not more than 1/4-inch in 10 feet

3.2 PREPARATION

A. Subgrade
   1. Prepare subgrade in accordance with Section 02300
   2. Moisten subgrade to depth of 6 inches at optimal moisture not more than 12 hours prior to placement to minimize absorption of water from fresh concrete
   3. Check for soft spots by proof-rolling or other means prior to setting forms. Remove soft yielding material and replace. Compact to specifications under provisions of Section 02300

4. Check crown and/or elevation of subgrade to assure specified thickness. Compact to specification additional material used to bring to correct elevation. Remove excess material where subgrade is too high
5. Clean subgrade of all loose materials before placement of concrete. Do not disturb area inside forms after fine grading is complete
6. Weed Control
    a. If weeds or vegetation exist at or on the subgrade, apply "Round-up" at rates following manufacturer's instructions. Apply "Round-up" three days prior to removal of vegetation, subgrade preparation and application of Casoron as described below to allow "Round-up" to kill all vegetation. Remove all living and dead weeds, root balls, tree/shrub roots, vegetation, and/or any organic matter from on or in the subgrade per applicable earthwork specifications prior to subgrade preparation and paving at all areas to be paved.
    b. After all fine grading, checking, shaping, and compacting of the subgrade has been completed, and just prior to placing asphalt or aggregate base course, all subgrade soil in the area to receive flexible pavement shall be thoroughly treated with Casoron soil sterilant (in addition to "Round-up" and regardless of presence of existing weeds or vegetation). Casoron shall be thoroughly sprinkled to distribute the chemical through the first two or three inches of the subgrade. For all areas to be paved, apply Casoron weed control at a minimum rate per 100 square yards of 2.4 pounds for G-10 or 4.0 pounds for 50w at rates and methods recommended by manufacturer within one day of paving.
    c. The Contractor shall provide all necessary protection to prevent injury to animal, fish, or plant life and property occasioned by the application of the soil sterilant. Apply on a calm, wind-free day. The Contractor will be held responsible for all application of soil sterilant or the storage of same. Protect existing and new trees and shrubs beyond the limit of paving from damage due to weed killer or soil sterilant overspray or root contact. Extra caution is required to prevent over-application of products in areas to be paved under tree canopies. Trees and shrubs damaged or killed by weed killer or sterilant application shall be replaced by the contractor at contractor's expense.
    d. Do not apply within 20 feet of trees or shrubs

B. Frame Adjustment
1. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement for concrete collars
2. Set frames of structures in full grout bed to provide bearing. Set to final grade
3. Form construction joints and blockouts as indicated on drawings

3.3 PERFORMANCE AND INSTALLATION

A. Transporting mixed concrete
1. Transporting of mixed concrete shall conform to ACI 305R
2. Do not exceed manufacturer's guaranteed capacity of truck agitators. Maintain the mixed concrete in a thoroughly mixed and uniform mass during handling
3. Do not incorporate additional mixing water into the concrete during hauling or after arrival at the delivery point, unless ordered by the Engineer. If additional water is to

be incorporated into the concrete, revolve the drum not less than 30 revolutions at mixing speed after the water is added and before placing concrete.
4. Furnish a water measuring device in good working condition, mounted on each transit mix truck, for measuring the water added to the mix on the site by the Engineer
5. Provide delivery ticket and comply with delivery requirements of this section

B. Forming
1. Place and secure forms to correct location, dimension, profile, and gradient
2. Install sufficient quantity of forms to allow continuous progress of work so that forms can remain in place at least 24 hours after concrete placement
3. Join neatly and mechanically tamp to assure firm placement. Assemble formwork to permit easy stripping and dismantling without damaging concrete
4. Oil forms prior to concrete placement
5. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement
6. Set dowels, expansion joints, preformed construction joints and header boards as specified or indicated on the drawings
7. Low roll or mountable curbs may be formed without the use of face form by using a straight edge and template to form curb face
8. Backfill behind forms as required to prevent water from entering subgrade

C. Reinforcement
1. Add fiber reinforcement to mix at plant prior to delivery to jobsite. Mixing shall be as recommended by the manufacturer to distribute the product evenly throughout the concrete mix
2. Place bar or WWF reinforcement at mid-height of slabs-on-grade or as shown on the drawings
    a. Install in as long lengths as possible. Lap adjoining pieces at least one full mesh and lace with wire
    b. Support with metal chairs, brick or stone is unacceptable
3. Hold all tie and marginal dowels in proper position by sufficient supports or pins
4. Mechanically install dowels or place on supports if center longitudinal joint is sawed in lieu of placing plastic strip
5. Interrupt reinforcement at expansion joints
6. Place dowels to achieve pavement and curb alignment as detailed.
7. Provide doweled joints inch at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement
8. Grease dowels on one side of joints with caps on greased end

D. Placing concrete
1. Place concrete in accordance with ACI 301
2. Lightly moisten subgrade or base course immediately before placing concrete.
3. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed
4. during concrete placement
5. Deposit concrete near final position. Minimize segregation and damage to subgrade

6. Place concrete continuously over the full width of the panel and between predetermined construction joints. Spread mechanically to prevent segregation and separation of materials
7. Consolidate concrete with vibrators and spade next to forms to remove air spaces or honeycombs
8. Do not place concrete in forms that has begun to set
9. Do not place more concrete in one day than can be finished before dark the same day
10. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified
11. Walks: Construct sidewalks with a minimum thickness of 4-inch. Tool edges to rounded profile and finish as specified or as shown on the drawings. Pitch walks 1/4-inch per foot for cross drainage unless otherwise indicated

E. Cold weather concreting
1. Conform to ACI 306/306R, except as modified herein
2. Minimum concrete temp at the time of mixing

Outdoor Temp at Placement (in shade)	Concrete Temp at Mixing
Below 30°F	70°F
Between 30°F & 45°F	60°F
Above 45°F	45°F

3. Do not place heated concrete which is warmer than 80 degrees F
4. If freezing temp are expected during curing, maintain the concrete temp at or above 50 deg F for 5 days or 70 deg F for 3 days with forms in place
5. Do not allow concrete to cool suddenly

F. Hot weather concreting
1. Conform to ACI 305/305R, except as modified herein
2. At air temp of 90 degrees F and above keep concrete as cool as possible during placement and curing. Fog sprayers or special wetting agents may be required for protection
3. Do not allow concrete temperature to exceed 70 deg F at placement
4. Prevent plastic shrinkage cracking due to rapid evaporation of moisture
5. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 lbs per sq ft per hr as determined from ACI 305, Fig 2.1.4

G. Joints
1. Provide concrete joints per CDOT Standard Details
2. Sidewalk and pavement
   a. Contraction joints: At intervals not to exceed 10 feet and 1 1/2 inches deep, tooled or sawcut

b. Expansion joints: 1/2-inch premolded joints where sidewalks end at curb returns, against fixed objects, at points of sharp radius, and between sidewalk and driveway slabs. Place expansion joint at minimum of every 100 feet.
c. Construction joints: At all separate pours, and around all appurtenances such as manholes, utility poles, and other penetrations extending into and through sidewalks. Place backer rod and polyurethane sealant for entire joint length

3. Curb and Gutter
   a. Contraction joints: At intervals not to exceed 10 feet made by insertion of 1/8-inch template at right angles to curb and 1 1/2-inch deep.
   b. Expansion joints: At curb returns, against fixed objects, at points of sharp radius, between adjacent sidewalk and curb at all curb returns, between sidewalk and all driveway slabs, and along straight lengths every 200 linear feet. Install expansion joint filler between concrete sidewalks and any fixed structure. Extend expansion joint material for full depth of concrete, except stop 1/2-inch below finish surface.
   c. Construction joints: At all separate pours, place backer rod and polyurethane sealant for entire joint length.
4. Place expansion joint filler between paving components and buildings or other appurtenances at temperatures above 50 deg F. Clean all dust, debris and water from joint. Recess top of filler 1/2-inch for sealant placement.
5. Provide keyed joints as indicated in details.

H. Finishing
1. Run straight-edge over forms with sawing motion to fill all holes and depressions.
2. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
3. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and re-float repaired areas to provide a continuous smooth finish
4. Finish surfaces with a wooden or magnesium float. Plastering of surfaces is not permitted
5. Immediately after float finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fine hair fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the Engineer before application.
6. On inclined slab surfaces and steps, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic
7. Edge all outside edges of the slab and all joints with a 0.25-inch radius edging tool.
8. Work edges of gutters, back top edge of curb, and formed joints with an edging tool, and round to 0.5-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface
9. Brush with soft bristle brush to remove trowel marks and leave a uniform appearance just before concrete takes initial set.
10. Direction of Texturing:
    a. Curb and Gutter: At right angles to the curb line
    b. Sidewalk: At right angles to centerline of sidewalk.

11. Place curing compound on exposed concrete surfaces immediately after finishing. Apply under pressure at the rate of one gallon to not more than 135 square feet by mechanical sprayers in accordance with manufacturer's instructions acceptable to Engineer.

I. Joint sealing
   1. Seal joints and clean concrete prior to opening to traffic.
   2. Seal all expansion joints.
   3. Separate concrete from other structures with 3/4-inch thick joint filler.
   4. Place joint filler in concrete pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
   5. Extend joint filler from bottom of pavement to within 1/4-inch of finished surface.

J. Curing and protection
   1. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury
   2. Have plastic sheeting, straw, burlap and/or canvas materials available at all times to protect fresh uncured surfaces from adverse weather conditions
   3. Do not permit pedestrian traffic over sidewalks for 7 days minimum after finishing. Do not permit vehicular traffic over pavement for 14 days minimum after finishing or until 75 percent design strength of concrete has been achieved

3.4 FIELD QUALITY CONTROL

A. Comply with Division One Specifications - Quality Assurance: Field inspections and testing

B. It is the Contractor’s responsibility to initiate, coordinate and accommodate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing requirement with testing agency and provide testing agency 48-hour advance notification to schedule tests.

C. Tolerances
   1. Division One Specifications - Quality Assurance: Tolerances
   2. Maximum Variation of Surface Grade: 1/4- inch in 10 ft
   3. Maximum Variation from True Alignment: 3/8-inch in 10 ft

D. Take cylinders and perform slump and air entrainment tests as required by Division One Specifications in accordance with ACI 301. Unit weight and mix temperature will also be taken

E. The first three loads will be tested for slump and air content. If any one test fails to meet requirements, that load will be rejected and tests will continue on each load until three consecutive loads meet requirements. Thereafter, five concrete test cylinders will be taken for every 75 cu yds or less cu yds of concrete placed each day

F. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents

G. One slump and air entrainment test will be taken for each set of test cylinders taken

H. Cylinders will be tested as follows: 2 at 7 days, 2 at 28 days and one at a later date, if necessary, as directed by the Engineer

I. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken

J. Thickness of fresh concrete may be checked by Owner at random. Coring will be conducted in accordance with City of Grand Junction requirements. Where average thickness of concrete is deficient in thickness by more than 0.20-inch, but not more than 1.0-inch, payment to Contractor will be adjusted based on amount indicated in schedule of values for portland cement concrete paving as specified in the following table.

CONCRETE PAVEMENT DEFICIENCY	
Deficiency in Thickness (Determined by Cores) INCHES	**Proportional Part of Contract Price Allowed**
0.00 to 0.20	100%
0.21 to 0.30	80%
0.31 to 0.40	72%
0.41 to 0.50	68%
0.51 to 0.75	57%
0.76 to 1.00	50%
Over 1.00	NONE

Note: When thickness of pavement is deficient by more than one inch, and judgment of the Engineer is that area of such deficiency should not be removed and replaced, there will be no payment for the area retained.

K. Failure of Test Cylinders or Coring Results: Engineer may order removal and replacement of concrete as required upon failure of 28-day tests or if thickness of pavement is less than 95% of specified thickness

3.5 SCHEDULE OF CONCRETE

A. See City of Grand Junction Engineering Division Standard Specifications for Road and Bridge Construction for concrete thicknesses and subgrade preparation.

3.6 SCHEDULE OF CONCRETE REINFORCEMENT

A. Fiber reinforcement required for all concrete flatwork, including curb and gutter, sidewalk and pavement

B. Rebar reinforcement required for all cross pans. Reinforce all cross pans in conformance with City of Grand Junction standards and specifications.

C. Trash pad and dumpster locations: 8-inch thick concrete with #4 rebar, 12-inches on center, each way, three inches clear on all sides

END OF SECTION

SECTION 02920

SEEDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Soil preparation

B. Fertilization

C. Seeding methods

D. Areas to be reseeded

E. Seed Mix

F. Maintenance

G. Seed protection and slope stabilization

1.2 RELATED SECTIONS

A. Section 01500 – Construction Facilities and Temporary Controls

B. Section 02300 – Earthwork

C. Section 02370 – Erosion and Sedimentation Control

1.3 REFERENCES

A. Federal Specification (FS) O-F-241 - Fertilizers, Mixed, Commercial

B. American Association of Nurserymen - Standardized Plant Names

C. Association of Official Seed Analysts (AOSA)

D. Colorado Department of Agriculture (CDA) Seed Act

E. Colorado Department of Transportation (CDOT) Construction Specifications

1.4 SUBMITTALS

A. Submit under Division One Specifications for products related to seeding work including but not limited to seed mixes, mulches, composts, tackifiers, fertilizers and herbicides.

B. Product Data:
   1. Certified Live Seed analyses not more than 6 months old by a recognized laboratory of seed testing for grass mixtures including percent of live seed (PLS), germination, all crop seeds in excess of 1 percent, inerts and weeds
   2. Manufactures guaranteed chemical analysis, name, trade name, trademark and conformance to state and local laws of all fertilizers and herbicides

1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging

B. Provide a certificate of the PLS test of the grass seed intended for the project, certifying that the seed furnished is from a lot that has been tested by a recognized laboratory within the last 6 months

C. All brands furnished shall be free from such noxious seeds as Russian or Canadian Thistle, Coarse Fescue, European Birdweed, Johnson Grass, Leafy Spurge, field bindweed, kochia, or any state-listed, City of Grand Junction-listed or CDOT-listed noxious weed species

D. Any materials that have become wet, moldy or otherwise damaged in transit or in storage will not be used

1.6 QUALIFICATIONS

A. Applicator: Company specializing in performing work of this section with landscaping license from State of Colorado
   1. Experienced with type, elevation, topography and scale of work specified
   2. Adequate equipment and personnel to perform work

1.7 REGULATORY REQUIREMENTS

A. Comply with codes and ordinances of local regulatory agencies for fertilizer and herbicide composition and regulations of City of Grand Junction, Mesa County and the State of Colorado.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One specifications

B. All materials and products will remain in original manufacturers shipping bags or containers until they are used. All material or products will be stored in a manner to prevent them from coming into contact with water or other contaminating substance and in a manner that product effectiveness will not be impaired

C. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable

D. Commercial fertilizer or commercial herbicide: mixed in original bags or containers of the manufacturer, showing weight, chemical analysis and manufacturer name. Store in such a manner such that product effectiveness will not be impaired

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not prepare or seed frozen soils

B. Perform seeding and planting only after preceding work establishing final ground surface is completed

C. Conduct minimum of two (2) soil tests to confirm fertilizer type and application rates

1.10 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition

1.11 WARRANTY

A. All plant material and work accomplished under this section shall be guaranteed to provide a uniform stand of grass acceptable to the Owner at the end of a one (1) year time period from the completion of the Seeding and Erosion Control work

PART 2 PRODUCTS

2.1 SEED

A. In conformance with State and Federal regulations and subject to the testing provisions of the Associate of Official Seed Analysts (AOSA)

B. Seed Suppliers: Licensed Seed Dealer with Colorado Department of Agriculture

C. Provide the latest crop available in accordance with Colorado Department of Agriculture Seed Laws, Chapter 35, Article 27

D. Compensate for percentage of purity and germination by furnishing sufficient additional seed to equal the specified pure live seed product. The formula for determining the quantity of pure live seed (PLS) is as follows:

Pounds of Seed (Bulk) x Purity x Germination = Pounds of Pure Live Seed (PLS)

2.2 SEED MIX

A. See City of Grand Junction specification section 212 of the Road and Bridge Construction chapter for approved seed mixes

2.3 SOIL MATERIALS

A. Select onsite topsoil: Earth material of loose friable clay loam reasonably free of admixtures of subsoil, refuse stumps, roots, rocks, brush, weeds or other material which can be detrimental to the proper development of site revegetation

2.4 ACCESSORIES

A. Soil Additives (Fertilizer)
   1. Dry fertilizers: Primary element composition by weight of 6-10-5
      a. Nitrogen (N) six (6%) percent of which fifty (50%) per-cent inorganic, phosphoric acid (P_2O_5) ten (10%) percent, and potash (K_2O) five (5%) percent
   2. Commercial fertilizer: Primary element composition by weight of 18-46-0
      a. Nitrogen, eighteen (18%) percent, of which fifty (50%) percent is organic, and phosphoric acid (P_20_5), forty-six (46%) percent
      b. These elements may be organic, inorganic, or a combination and shall be available according to the methods adopted by the Association of Official Chemists
   3. Dry, pelletized or granular, uniform in composition and a free-flowing product. Do not use material which has caked, segregated, exceeded the expiration date of application, or be otherwise damaged
   4. Thoroughly mixed by the manufacturer. Clearly identify the contents of each container. Do not use materials and containers previously opened, exceeding the expiration date for application or otherwise damaged
   5. Minimum requirements for all disturbances to receive seeding:

Biological nutrient organic fertilizer (lbs/acre)*	**Humate (lbs/acre)**	**Compost (cys/acre) All areas <2:1 [1/2 inch depth]**	**Spray on Amendment (lbs/acre) >2:1 slopes only**
300	200	65	3,500
*Biological nutrient shall not exceed 8-8-8 (N-P-K)			

B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass

C. Mulching Material: Straw or onsite grasses from grubbing operation, dry, free from foreign matter detrimental to plant life

PART 3 EXECUTION

3.1 GENERAL

A. Seed all areas disturbed by construction, including all areas along the roadside ditches

B. Pattern for seeding and fertilization as required by field conditions. In no case shall revegetation occur within 30 days of the application of any chemical weed control substance

C. Engineer to review grading prior to seeding

3.2 SOIL PREPARATION

A. Uniformly place and spread topsoil removed during grubbing and stored on site. Provide minimum thickness of 4 inches to meet finished grade. Key topsoil to the underlying and surrounding material by the use of harrows, rollers or other equipment suitable for the purpose

B. Apply water to the topsoil for compaction purposes in a fine spray by nozzles in such a manner that it will not wash or erode the newly placed soil

C. Exercise care during soil preparation on all embankments so as not to disturb established ground cover. Areas disturbed during the soil preparation will be fertilized and seeded at the discretion of the Engineer in accordance with these documents

3.3 FERTILIZATION

A. Do not proceed with fertilization in adverse weather and unsuitable ground conditions. Examples of these respective conditions may be wind, precipitation, frozen and untillable ground or conditions detrimental to the effectiveness of the application

B. Apply fertilizer in a manner to assure uniform distribution, light watering is acceptable for dispersion

C. In cases where work progress is stopped due to the above conditions, fertilization will begin again, when appropriate conditions exist. The application will begin again with a reasonable overlapping of the previously applied area

3.4 SEEDING METHODS

A. All seeding shall be installed either by hydroseeding or drilling method. Small areas of restoration may be broadcast seeded if directed by Engineer.

B. Do not proceed with seeding in adverse weather and unsuitable ground conditions. Examples of these respective conditions may be wind, precipitation, frozen or untillable ground or conditions detrimental to the effectiveness of the application. All seeding shall

be performed between either March 1st to May 30th of the calendar year of construction unless indicated otherwise by Engineer

C. Hydroseeding:
   1. Apply seeded slurry with hydraulic seed at a rate of //160 lbs// live seed per 1,000 square feet, evenly in two intersecting directions
   2. Do not hydroseed areas in excess of that which can be mulched on same day
   3. Immediately following seeding apply mulch to a thickness of 1/8 inch
   4. Apply water with a fine sprat immediately after each area has been mulched. Saturate to four (4) inches of soil

D. Drilling:
   1. Accomplish seeding by means of an approved power drawn drill, followed by drag chains. The grass drill should be equipped with a satisfactory feeding mechanism, agitation, and double disk furrow openers. Equip drills with depth bands set to maintain a planting depth of approximately 3 to 2 inch and shall be set to space rows not more than 7 inches apart
   2. If inspections indicate that strips wider than the specified space between the rows planted have been left or other areas skipped, the Engineer will require immediate resowing of seed in such areas at the Contractor's expense. The seeding mixture shown in the Materials Section applies at a pure live seed rate per acre
   3. Immediately following seeding apply straw mulch at a rate of one (1) ton per acre
   4. Apply water with a fine spray immediately after each area has been mulched. Saturate to four (4) inches of soil depth
   5. Provide additional watering weekly until revegitation seed has germinated

3.5 AREAS TO BE RESEEDED

A. Seed all disturbed areas that are damaged or disturbed by the Contractor's activities during the entire project scope

B. Additional areas as requested by the Owner and approved by the Engineer

3.6 MAINTENANCE

A. Fertilize the seeded areas once a uniform stand of grass has been established

B. Maintain seeded areas until there is an acceptable uniform plant growth. Reseed areas that are not producing a uniform plant growth within five (5) weeks following seeding. Acceptable uniform plant growth shall be defined as that time when the scattered bare spots, not greater than 1 square foot in area, do not exceed three percent (3%) of the seeded area

C. Maintenance period - 1 year

D. Areas that are seeded late in the fall planting season which are not producing acceptable uniform plant growth, as described above, shall be reseeded during the following spring planting season. If such a condition exists, and the Contractor has diligently, in the opinion

of the Engineer, pursued the performance of his work, the Owner at his option, may extend the contract completion date and reduce contract retainage. Retainage may be reduced to less than five percent (5%) of the total contract amount, but shall be at least two (2) times the estimated cost of obtaining the required growth in the indicated areas, plus areas which are susceptible to damage by winter kill, washout or other causes

E. Contractor shall control perennial weeds, thistle, spotted and napweed, spurge and other weeds during the maintenance period

3.7 SEED PROTECTION AND SLOPE STABILIZATION

A. Cover seeded slopes with erosion control fabric where grade is 4 to 1 or greater and where indicated on the Drawings and/or Section 02300 and Section 02730. Cover seed with mulch in all other areas

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6-inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil

C. Secure outside edges and overlaps at 48 inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches

F. Maintain integrity of erosion control fabric until seed germination. If seed is washed out before germination, fertilize, reseed and restore affected areas

END OF SECTION