

STANDARD CONSTRUCTION SPECIFICATIONS

CITY OF CAÑON CITY



PREPARED BY CITY OF CAÑON CITY,
ENGINEERING DEPARTMENT

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DOCUMENT 00010

TABLE OF CONTENTS

CONTRACTOR REQUIREMENTS

00710 General Conditions & Requirements

DIVISION 1 - GENERAL REQUIREMENTS

01100 Summary

01600 Product Requirements

01700 Execution Requirements

DIVISION 2 - SITE CONSTRUCTION

02060 Aggregate

02222 Demolition

02315 Excavation

02320 Backfill

02324 Trenching

02374 Erosion Controls

02512 Water Distribution

02630 Storm Drainage

02721 Aggregate Base Course

02740 Flexible Pavement

02750 Rigid Pavement

02924 Seeding & Revegetation

DIVISION 3 - CONCRETE

3300 Cast-In-Place Concrete

DIVISION 10 – SPECIALTIES

10440 Street Signs

APPENDIX

Part 1 City of Cañon City Standard Details (W & S)

Part 2 Excerpts from City of Cañon City Municipal Code

Part 3 City of Cañon City GESC & IDDE Manuals

END OF SECTION

CONTRACTOR REQUIREMENTS

DOCUMENT 00710

GENERAL CONDITIONS & REQUIREMENTS

PART 1

1.1 SUMMARY

A. Document Includes:

1. General Contractor Licensing Provisions.
2. Affirmative Action.
3. Excavation Permit.
4. Fees.
5. Bonding and Insurance.
6. Warranty.
7. Moratorium.
8. Special Considerations.
9. Acceptance/Compensation for Non-conforming In-place Pavement.

B. Related Documents:

1. City of Cañon City Municipal Code – Chapter 5.12.
2. City of Cañon City Municipal Code – Chapter 12.12.
3. City of Cañon City Municipal Code – Chapter 13.04.
4. City of Cañon City Municipal Code – Chapter 8.70.
5. City of Cañon City – Related Codes and Ordinances.
6. Colorado Revised Statutes 24-34-301 to 308.

1.2 CONTRACTOR LICENSING

A. No person, firm, corporation, partnership, utility company, special district or other entity, unless specifically exempted herein, shall engage in the business of contractor, either general or limited, within the City of Cañon City, unless a contractor license is applied for and issued for the current year to said subject.

B. Refer to City of Cañon City Municipal Code, Chapter 5.12, Building Contractors.

1.3 NONDISCRIMINATION AND AFFIRMATIVE ACTION

A. The Contractor agrees to comply, and require all subcontractors to comply, with all provisions of the Colorado Antidiscrimination Act of 1957, as amended, C.R.S. 24-34-301 to 308, as amended, and all provisions of any other federal or state statute regarding equal employment opportunity in the performance of services rendered in accordance with this document.

1.4 PERMIT REQUIRED

A. No person, firm, corporation, partnership, utility company, special district or other entity, unless specifically exempted herein, shall excavate, install or repair underground utilities, install fill, construct or rebuild any pavement, concrete, curb, gutter or sidewalk in any street, alley, or Rights of Way within the City of Cañon City without first obtaining a permit from the City of Cañon City.

B. Refer to City of Cañon City Municipal Code, Chapter 12.12.

1.5 FEE SCHEDULE

A. Fees for excavation permits, inspections, tests and costs of concrete and pavement replacements:

1.	Permit Fee:	\$50.00
2.	Inspection Fee (per site visit):	\$70.00
3.	Compaction Tests (per test):	\$43.00
4.	Pavement and Concrete replacement costs:	
	Asphalt pavement (Minimum 24" cut)	\$8.25 / SF
	Concrete pavement	\$19.71 / SF
	Curb & Gutter (install only)	\$33.00 / LF
	Curb & Gutter (Remove & replace)	\$66.00 / LF
	Concrete Flatwork, 4 inches thick	\$9.86 / SF
	Concrete Flatwork, 6 inches thick	\$14.78 / SF
	Concrete Flatwork, 8 inches thick	\$19.71 / SF

B. Fees for installation and testing of water mains, services, and appurtenances:

1.	Standby and Inspection Fee: (work other than main installation)	\$70.00 / HR
2.	Inspection of main installation:	\$0.70 /LF
3.	Pressure test and Sampling (per test):	\$85.00 + \$0.10 / LF
4.	Tapping of water main (each tap, separate from tap fees):	
	3/4" to 2"	\$75.00 / tap
	4"	\$400.00/ tap
	6"	\$415.00/ tap
	8"	\$425.00/ tap
	12"	\$450.00/ tap
5.	Private Fire Hydrants	
	Testing and Flushing	\$70.00 / Hydrant
	Private Fire Hydrant Painting	\$40.00 /Hydrant
	Private Fire Hydrant Repair	\$70.00 / hr + parts

C. Fees – Street Damage Restoration Fee (SDRF):

1.	Arterial/Collector Street Classification:	
	Street Age: 0-5 years	\$15.00/SF
	Street Age: 0-5 years	\$10.00/SF (emergency only)
	Street Age: 5-10 years	\$9.00/SF
	Street Age: 10-15 years	\$8.00/SF
2.	Local Street Classification:	
	Street Age: 0-5 years	\$12.00/SF
	Street Age: 0-5 years	\$8.00/SF (emergency only)
	Street Age: 5-10 years	\$7.00/SF
	Street Age: 10-15 years	\$6.00/SF
3.	Chip Seal Damage (Chip Seal Age: 5 years old or less):	
	Less than 2500 SF	\$550.00
	2500-5000 SF	\$1,100.00
	Greater than 5000 SF	\$0.44/SF

4. SDRF Area will be calculated by multiplying the length of the pavement cut (+6 ft for HMA/+3 ft for PCC) by the width of the pavement cut (+6 ft for HMA/+3 ft for PCC).
5. Emergency excavations are those deemed to be necessary to protect life safety and health of the public such as a water or gas leak.
6. SDRF for excavations in roads more than 15 years old shall be the maximum fee adjusted by the Pavement Condition Index (PCI), represented in decimal form, to compensate for the existing condition of the road when cut.

Example: the restoration fee of a road with a PCI of 40 would be discounted by 60%.

7. Excavations in roads that the City plans to resurface or reconstruct within the following 18 months are exempt from the SDRF. The City will make every effort to provide utility providers with a list of planned street reconstruction 9 months prior the beginning of work.
8. Overlaid roads shall be considered new for purposes of applying the SDRF.
9. The excavator can rebuild the pavement for the entire width of the street plus an additional 50 ft from each end of the excavation in accordance with City specifications in-lieu of paying the SDRF.
10. The payment of the SDRF is required in addition to the Special Restoration required in Paragraph 1.8 of this section.
11. SDRF will be reduced by 25% if flow-fill is used to back fill trench.

D. Any inspection or testing made on any Saturday, Sunday, or holiday, or between the hours of 3:30 p.m. and 7 a.m. of any day shall require a fee of 50% higher than the fee otherwise established.

E. Some or all fees may be waived for Contractors working for the City on capital improvement projects.

Fees for larger developments with multiple lots and larger projects:

Option 1 - One permittee (General Contractor or Developer)

Wet Utilities (Water, storm, sewer, etc.)	\$50.00 X (# of lots/services)
Dry Utilities (Phone, cable, electric, etc.)	\$50.00 X (# of lots/services)
Paving	\$50.00 X (# of lots/services)
<u>Curb and Gutter</u>	<u>\$50.00 X (# of lots/services)</u>
Total	\$200.00 X (# of lots/services)

Option 2 - Multiple permittees (General contractor plus subcontractors)

Each type of excavation will be billed separately to each permittee at \$50.00 X (# of lots/services)

Each new development/project will provide their own trench inspections and density testing by an acceptable qualified third party and provide the reports/results to the City prior to surface restoration. It is the at the City's discretion on which developments/projects are large enough or qualify to be considered in this manner.

1.6 BOND AND INSURANCE REQUIRED

- A. As required per City of Cañon City Municipal Code – Chapter 5.12 & 12.12.
- B. The limits of liability for the insurance required for work in the right-of-way shall provide coverage for not less than the following amounts or greater where required by law:

Worker's Compensation:

(1) State:	Statutory
(2) Applicable Federal (e.g. Longshoreman's):	Statutory
(3) Employer's liability	\$200,000

Comprehensive General Liability:

(1) Bodily Injury	
\$1,000,000	Each Occurrence
\$2,000,000	Annual Aggregate, Products and Completed
Operation	

(2) Property Damage:

\$1,000,000	Each Occurrence
\$1,000,000	Annual Aggregate

(3) Property Damage Liability insurance will provide explosion, collapse and underground coverages where applicable

(4) Personal injury with employment exclusion deleted

\$1,000,000	Annual Aggregate
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Comprehensive Automobile Liability:

(1) Bodily Injury

(2) Property Damage:

\$1,000,000 Each Occurrence

C.

1.7 WARRANTY AND CORRECTION PERIOD

- A. If within two years after the date of Substantial Completion, or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the City of Cañon City, any Work is found to be defective, Contractor shall promptly without cost to City of Cañon City and in accordance with City of Cañon City's written instructions: (i) correct such defective Work, or, if it has been rejected by City of Cañon City, remove it from the site and replace it with Work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom.
- B. For areas in which Ordinary Backfill, Section 02060, was installed, such warranty period is extended to 5 years.

1.8 MORATORIUM AND SPECIAL RESTORATION STANDARDS

- A. Cutting of streets within the moratorium period for any reason is highly discouraged.
- B. If a street is cut within the moratorium period, then the street shall be repaired according to the Special Restoration Standards.
- C. Overlaid streets shall not be cut for two years from the time the street was overlaid.
- D. New or reconstructed streets shall not be cut for five years from the time the street was constructed or reconstructed.

E. Special Restoration Standards for asphalt streets

1. Alternate 1 – Milling and Overlay: Asphalt surface shall be milled down a minimum of two inches fifteen feet each side of the cut to the centerline of the road. For cuts crossing the centerline of the road, the milling shall extend the entire width of the street or the next lane width. The Engineer reserves the right to require an area greater than fifteen feet each way of cut or a depth greater than two inches if deemed appropriate to restore roadway to the original condition. If a fabric was placed prior to the base course placement, an approved fabric shall be placed at the same location according to the specifications. The milled area shall be overlaid per the Specifications.
2. Alternate 2 – Infrared Heating: Asphalt surface of patch and adjacent pavement shall be repaired using infrared heating repair methods as specified in Section 2740 to seal the surface and restore pavement.

1.9 SPECIAL CONSIDERATIONS

A. Backfill Specification- Trench Work Performed by, or on behalf of through contract, Governmental Utilities: Ordinary Backfill, as defined in Section 02060, may be used above the pipe zone and up to within 24 inches of the gravel surface in unpaved alleys. All Ordinary Backfill installation and compaction shall be subject to the terms and conditions of current City of Cañon City Standard Construction Specifications, specifically Sections 02060, 02320, and 02324.

1.10 ACCEPTANCE/COMPENSATION FOR NON-CONFORMING IN-PLACE PAVEMENT

A. Consideration shall be given at the discretion of the City on a case-by-case basis to accept pavement that has been installed and has some functional value but does not meet the minimum specification.

B. Thickness and Density shall be determined by calculating the average of the results of core samples taken by an independent testing laboratory at the Developer's expense. At least one core sample shall be taken per 200 linear feet of street paved.

C. Acceptance will be based on the compensation of the percent value established at the time of acceptance based on the following schedules:

1. HMA / PCC PAVEMENT THICKNESS

<u>Thickness</u>	<u>Percent Reduction</u>
> 92% Specified Thickness	0%
≥ 75% and ≤ 92% Specified Thickness	25%
> 58% and < 75% Specified Thickness	33%
≤ 58% Specified Thickness	100%

2. ASPHALT OVERLAY THICKNESS

<u>Thickness</u>	<u>Percent Reduction</u>
> 88% Specified Thickness	0%
> 63% and ≤ 88% Specified Thickness	25%
≤ 63% Specified Thickness	100%

3. HMA DENSITY / PCC STRENGTH

<u>Density/Strength</u>	<u>Percent Reduction</u>
≥ 92%	0%
< 92% but ≥ 91%	2%
≥ 90% and < 91%	5%
≥ 89% and < 90%	10%
≥ 87% and < 89%	25%
≥ 85% and < 87%	50%
≤ 85% or less	100%

END OF SECTION

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01100

SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Scope.
- B. Definitions.
- C. Authority of City.
- D. Work by City.
- E. Plan Approval and Revision.
- F. Contractor Responsibility.
- G. Contractor's Use of Site.
- H. Work sequence.

1.2 SCOPE

- A. Specifications and requirements set forth to be used in the design and construction or repair of water mains, streets, pavements, curb and gutter, sidewalks, storm sewers, culverts, and installation of utilities or any other work performed within the public right of way for approval and acceptance by the City of Cañon City.
- B. Excavation and restoration standards are required to preserve the integrity, operational safety, and function of the City rights-of-way.
- C. Future Considerations:
 - 1. Licensing of landscapers for inclusion of landscape work within the right-of-way to be covered by these specifications.
 - 2. Continuance of City/Contractor Committee meetings annually for updates and necessary revisions.

1.3 DEFINITIONS

- A. City: Shall mean the City of Cañon City, Colorado and personnel with the authority to act on behalf of the City of Cañon City.
- B. Engineer: Shall mean the City Engineer of the City of Cañon City, Colorado and authorized representatives acting on behalf of the City or the City Engineer, including but not limited to inspectors in the field.
- C. Public Works Inspector: Shall mean the Public Works Inspector of the City of Cañon City, Colorado and authorized representatives acting on behalf of the City or the Public Works Inspector.
- D. Right-of-Way (ROW or R-O-W): Shall mean the area on, below, or above a public roadway, highway, street, path way, bicycle lane and public sidewalk in which the City has an interest, including other dedicated rights of ways for travel purposes and utility easements of the City.
- E. Contractor: Shall mean a person, partnership, or corporation duly licensed in the City of Cañon City in accordance with the requirements of the laws and codes of the City of Cañon City.
- F. Excavate: Shall mean to dig into or in any way remove or physically disturb or penetrate any part of a right of way.
- G. Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, maintenance procedures, and other management practice to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, waste disposal, or drainage from material storage.

1.4 AUTHORITY OF CITY

- A. City shall have authority to ascertain that all construction of facilities is equal to or better than the minimum construction requirements set forth in these specifications.
- B. City and Engineer have authority to assign an inspector to check any and all work, including materials to be incorporated in the work, excavation, bedding, backfill, and all construction methods and practice.
- C. Inspectors are assigned to assist the Contractor to comply with these specifications and have the authority to reject defective or inferior materials and workmanship and to suspend work until the conditions in question are corrected.

1.5 WORK BY CITY

A. Work includes:

1. Approval of plans, means, and methods of construction.
2. Installation of tapping saddles, corporation stops, and tapping of water mains.
3. Blowing off and testing of chlorine residual for new water mains.
4. Pressure testing of water mains to be accepted by the City.
5. Operating existing valves and appurtenances in existing system required for construction, including filling and flushing mains to be accepted by the City.
6. Notifying public of water interruption due to construction 24 hours prior to shut off.

1.6 PLAN APPROVAL AND REVISION

- A. Plans shall be submitted for all subdivisions, new utility main installation, and all water mains and any other project the City deems is significant enough to warrant.
- B. Four copies of plans for proposed construction shall be submitted on 24-inch X 36-inch sheets (minimum scale of drawing, 1 inch = 50 feet) to Engineer for approval.
- C. Plans must be submitted digitally in DWG or DXF format. All plans must be projected to Colorado State Plane Central Zone coordinates (NAD 1983) with appropriate scale factor.
- D. The plans shall show lots and blocks to be served and the location of the water mains or other utilities and their service lines with reference to property lines. The type, size, approximate location, and number of all known underground utilities shall be shown on the drawings. Profiles may be required by Engineer, which shall give dimensions, grades, and show locations of improvements, water mains or utilities to be constructed.
- E. The Engineer shall return the plans with either a stamp of approval or a letter designating necessary revisions required for approval.
- F. No work shall proceed on that portion of the project requiring revisions until such revisions have been submitted and approved.
- G. Minor revisions may be made by written permission from the Engineer.

1.7 CONTRACTOR RESPONSIBILITY

- A. Contractor shall be responsible to read and fully comply with all the provisions of these specifications.
- B. Contractor shall perform work in a manner subject to current Occupational Safety and Health Administration and State of Colorado safety requirements. It shall be the responsibility of the Contractor to fully comply with these regulations.
- C. Contractor shall provide adequate construction signing, flagmen, barricades, etc., to warn vehicular and pedestrian traffic of work in progress and divert traffic as may be required during the course of the construction per approved traffic plan. All signing shall conform to the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD). Contractor shall notify the respective local emergency response agencies 24 hours in advance of the closure of any street.
- D. Contractor shall notify the City of Cañon City Water Distribution Supervisor at least 36 hours prior to a planned water service interruption.
- E. Contractor shall pay City for all expenses required of City personnel due to construction activities.
- F. Contractor shall protect all existing facilities and utilities within the work area and shall be liable for any damage to any such facilities and utilities due to Contractor's activities.

1.8 CONTRACTOR'S USE OF SITE

- A. Limit use of site to allow:
 - 1. City occupancy.
 - 2. Work by City.
 - 3. Use of site by the public.

1.9 WORK SEQUENCE

- A. Construct Work in stages to accommodate City's occupancy requirements during construction period. Coordinate construction schedule and operations with Engineer.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.

1.2 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by City.
- C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBMITTALS

- A. Submit three copies of each submittal for each product to the City Engineer.
- B. Product submittals are required for all construction related to subdivisions, new utility main installation, and all water mains and any other project the City deems is significant enough to warrant or as required by Specifications.
- C. Duplicate submittals will not be required if a copy is already on file with City.

1.7 PRODUCT SUBSTITUTION PROCEDURES

- A. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- B. Document each request with complete data substantiating compliance of proposed Substitution with Specifications.
- C. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to City.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Engineer for review or redesign services associated with re-approval by City.
- D. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Specifications or prior agreements and requirements.
- E. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
 - 3. Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01700
EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contractor Responsibilities.
- B. Construction Facilities.
- C. Protection of Utilities.
- D. Closeout procedures.
- E. Cleaning & site maintenance.
- F. Construction schedule, testing, and inspections.
- G. Restoration.
- H. Control of vehicular and pedestrian traffic.
- I. Protecting installed construction.
- J. Project record documents.
- K. Discovery of historical items.
- L. Construction site erosion.

1.2 CONTRACTOR RESPONSIBILITIES

- A. Contractor shall obtain an excavation permit with the City of Cañon City prior to the beginning of any work operations within the City rights of way.
- B. Contractor shall be a licensed and bonded contractor with the City of Cañon City.
- C. Contractor shall assume responsibility for disposing of removed vegetation, tree material, soil, asphalt, concrete, and other surplus materials at an acceptable site at Contractor's expense.
- D. Contractor shall assume responsibility for performing all work in a workmanlike manner with due care being taken to avoid unnecessary damage to property. Contractor shall be responsible for all damage resulting from carelessness or work performed in an irresponsible or unworkmanlike manner.
- E. Contractor shall obtain all utility locates prior to excavating, and shall be liable for all damages to existing structures and utilities and shall save the City harmless for any liability or expense for injuries, damages, or repairs.
- F. Contractor shall perform all work not covered in the Specifications to applicable industry standards.
- G. Contractor shall conform to all applicable State and local Codes and Ordinances.
- H. Contractor shall provide all construction surveying and/or staking as deemed necessary to complete the project as intended per the Specifications and approved plans.

1.3 CONSTRUCTION FACILITIES

- A. Provide and place all traffic control signs, barricades, and devices during the total construction time of the work, including time for concrete curing. Temporary fencing or other adequate measures to control pedestrian access to construction area shall be maintained.
- B. Contractor's construction activities are restricted to the area within the City rights of way and City owned property boundaries as near as practical and within any specified construction easements within private property, which are obtained by the City or the Contractor. Access must be maintained for property owners and residents and their business patrons to and from private property within the site.
- C. Protect all private and public property located within the construction site. All property disturbed by Contractor during construction will, at Contractor's expense, be repaired or replaced and left in as good a condition as originally found.
- D. All temporary utilities such as electricity, sanitation services (when practical these facilities should be located outside of the public way and screened from public view), heating, or other services required for construction and other facilities such as safety equipment, fire extinguishers, warning signs, lights, or special equipment shall be supplied as needed by the Contractor at his expense.
- E. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment. Protect site from puddling or uncontrolled running water. Provide sumps, water barriers as required to protect site from soil erosion and other potential damage to work, such as storm water accumulating on site from upstream.

1.4 PROTECTION OF UTILITIES

- A. The Contractor shall protect all public utilities encountered. These may include telephone lines, culverts, buried cables, power lines, water lines, sewer lines, irrigation laterals, gas lines and other overhead and underground utilities.
- B. Before any excavation or work is begun in the vicinity of the above-named utilities, each utility company or department concerned must be notified in advance of such work, and such work shall not be done until an authorized representative of the utility concerned is on the premises.
- C. The Contractor shall be held liable for all damages to any and all public utilities encountered on this project, which damages are due to the Contractor's operations. Such damages shall include all physical damages to utilities and also all damages due to the interruption of service of such utilities, when such damages and interruptions are caused by the Contractor's operations.
- D. Where alterations or moving of utilities is not required to permit construction of the work, the Contractor shall take such measures as the utility entity may direct to properly protect these utilities throughout his construction activities and shall cooperate at all times with the proper authorities and/or Owner in maintaining service of the above-named utilities affected by the work.
- E. The cost of damages due to the Contractor's operations, the cost of moving water or sewer service lines and the cost of protecting the utilities, where alteration or moving is not required to permit construction of the work, shall be paid for by the Contractor.
- F. Should any pipelines, water lines, gas mains, electrical conduits, sewer pipes, overhead wiring, telephone lines, buried cables, power lines, or any other such utilities not specifically mentioned and provided for elsewhere as a part of this document, have to be moved, repaired, reconditioned or revised due to construction, or moved temporarily to permit construction of work, the party or parties owning and operating such utilities shall perform the actual work of moving, repairing, reconditioning or revising such utilities, unless other agreements are reached with the utility companies involved.

G. Local utility companies and contact information:

<p>1. Colorado811 Utility Notification Center of Colorado 16361 Table Mountain Parkway Golden, CO 80403 Dial 811 Phone: 800-922-1987 Fax: 303-234-1712 www.colorado811.org</p>	<p>8. Black Hills Energy 3110 Utility Drive Cañon City, CO 81212 Phone: (719) 275-3803 www.blackhillsenergy.com</p> <p><i>Emergency Phone Number</i> 800-694-8989</p>
<p>2. Fremont Sanitation District 107 Berry Parkway Cañon City, CO 81212 Phone: (719) 269-6100 www.fsd.co</p>	<p>9. Charter/Spectrum Communications 402 Main Street Cañon City, CO 81212 Phone: (719) 275-3803 www.charter.net</p>
<p>3. Park Center Water District 1660 Reservoir Rd Cañon City, CO 81212 Phone: (719) 275-2055 Fax: (719) 275-0628 www.parkcenterwater.org</p>	<p>10. CenturyLink Communications 120 South 6th St. Cañon City, CO 81212 Phone: (719) 275-3337 www.centurylink.com</p>
<p>4. Cañon City Water Department 1525 South 9th Street/ P.O. Box 1460 Cañon City, CO 81212 Phone: (719) 269-9022 www.canoncity.org</p>	<p>11. Unite Private Networks(Fiber Optic) 7200 NW 86th Street Suite M Kansas City, MO 64153 Phone: 816-368-9039 (Locates) www.uniteprivatenetworks.com</p>
<p>5. Atmos Energy 120 South 6th St. Cañon City, CO 81212 Phone: (719) 275-3337 www.atmosenergy.com <i>Natural Gas Emergency Phone Number</i> 866-322-8667</p>	<p>12. Secom (Fiber Optic) 402 Santa Fe Ave Suite 101 La Junta, CO 81050 Phone 719-384-8583 www.secom.net</p>
<p>6. CDOT (FIBER OPTIC) www.codot.gov</p>	<p>7. Cañon City Stormwater 128 Main Street/ P.O. Box 1460 Cañon City, CO 81212 Phone: (719) 276-5265 www.canoncity.org</p>

1.5 CLOSEOUT PROCEDURES

- A. Contact City for final inspection.
- B. Provide submittals required by City to Engineer.
- C. Provide as-built plans required by City to Engineer:
 1. As-built plans shall be submitted for all subdivisions, new utility main installation, and all water mains and any other project the City deems is significant enough to warrant.
 2. Four copies of as-built plans for completed construction shall be submitted on 24-inch X 36-inch sheets (minimum scale of drawing, 1 inch = 50 feet) to Engineer.
- D. Plans must be submitted digitally in DWG or DXF format. All plans must be projected to Colorado State Plane Central Zone coordinates (NAD 1983) with appropriate scale factor.
- E. Drawings of Record Criteria:
 1. “As-Built/Drawing of Record” means a drawing, or series of drawings, that depict improvements as they were actually constructed, and that are drawn to the same scale, with the same detail, accuracy, format and form as the drawings that were submitted for original approval. Information on the project facilities shall indicate sufficient horizontal and vertical dimensional date so that the constructed improvements may be located and delineated.
 2. “As-Builts/Drawing of Records” are required of any set of plans approved by the City Engineer. It is the applicant’s responsibility to make arrangements with the Engineer of Record for the preparation and submittal of the “As-Builts/Drawing of Records”.
 3. In order to effectively comply with this requirement, it will be necessary for the Engineer of Record to provide a periodic review and inspection of the installation of those facilities within the project. The engineer may supplement his review and inspection of the project by utilizing information taken from a valid survey.
 4. The Engineer of Record, or other such Registered Professional Engineer as may apply, shall submit to the City the required number (no less than 3) of certified “As-built” or “As-Built/Drawing of Record” on media required by the City signed and stamped within 60 days of the final walk-through inspection.
 5. If any errors or omissions are discovered by the City within the “As-Built/Drawing of Record”, the engineer of record shall make corrections and resubmit the plans within 30 days of notice by the City.

6. The “As-Built/Drawing of Record” shall contain a certification from an Engineer registered in the State of Colorado that indicates that the project has been substantially completed in accordance with the approved plans and specifications, or that the deviations noted on the “As-Built/Drawing of Record” will not prevent the project from complying with the design function of the project.
7. “As-Built/Drawing of Record” shall be submitted in the same page format as the original approved plans. If revision requires the addition of a new sheet, it shall be added to the back of the existing set and the entire set renumbered accordingly. All pages must be included in the same order as the original and marked “As-Built/Drawing of Record” regardless of whether any revision applies to any particular page or not. If no changes occurred, simply write “As-Built/Drawing of Record” on the drawing.

1.6 CLEANING & SITE MAINTENANCE

- A. Public streets within the work site must be washed and swept on a daily basis or otherwise, according to the discretion of the Engineer. Anytime during the course of the Work, Contractor shall, at the discretion of the Engineer, wash, sprinkle, or wet down streets or alleys, including areas affected by work detours and construction traffic.
- B. Execute final clean-up of site prior to final project assessment.
- C. Clean debris from right of way and drainage systems.
- D. Clean site; sweep paved areas, rake clean landscaped surfaces; provide access at all driveways and cross streets.
- E. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.7 CONSTRUCTION SCHEDULE, TESTING, AND INSPECTIONS

- A. At least 24 hours prior to the start of any work, Contractor shall furnish a submittal of construction schedule to facilitate scheduling required inspections according to the specifications and to minimize the Contractor’s wait time.
- B. Reports will be submitted by independent firm or City representative to Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements. Testing does not relieve Contractor from performing Work to requirements.
- C. Retesting required because of non-conformance to specified requirements shall be performed on instructions by the Engineer and will be done at Contractor’s expense.
- D. Contractor shall be responsible for supplying the City of Cañon City, at the Contractor’s expense, with suitable soils tests from a licensed independent soils testing laboratory, with gradation and proctor density data for any material used in the work for backfill.

- E. Contractor shall be responsible for obtaining three soil tests of the existing sub grade material from a licensed independent soils testing laboratory, with gradation and Proctor density data for concrete pavement installation. Additional testing shall be repeated at the direction of the Public Works Inspector or Engineer at Contractor's expense if necessary to reflect changing soil conditions.
- F. Contractor may, at its expense, employ the services of an independent testing service to test the base course and pavement during and after installation.
- G. The City will employ an independent inspection laboratory to take random core samples of finished HMA pavement to be measured for thickness and density or finished PCC pavement for thickness & strength. Final acceptance will be based on the average thickness and density/strength determined by the core samples.

1.8 RESTORATION

- A. All excavations and improvements shall be completely restored within a period of twenty-one days subsequent to acceptance of backfill and compaction.
- B. If restoration is not complete by the end of the required time, the City will schedule to complete the restoration at Contractor's expense, after a nine-day advance notice to Contractor.
- C. The cost of such restoration by the City will be double the replacement cost plus an additional inspection fee and compaction fee as outlined in Section 00710.
- D. Restoration during times of inclement weather may be delayed at the direction of the Public Works Inspector. Temporary measures may be implemented, including but not limited to a cold asphalt patch to be replaced when weather permits.

1.9 CONTROL OF VEHICULAR AND PEDESTRIAN TRAFFIC

- A. Contractor shall be permitted to close the roadways to traffic during construction activities, if it is necessary.
- B. Contractor shall accommodate adjacent property owners and businesses by providing access and parking within the street right-of-way as near to properties as possible, except during paving operations when residents will be expected to walk.
- C. Contractor shall be fully responsible for providing qualified personnel to provide and place all traffic control signs and devices during the total construction time of the project.
- D. Contractor shall provide traffic control that shall conform to the intent and instructions provided by the Engineer, the City of Cañon City Public Works Department and the Manual of Uniform Traffic Control Devices (MUTCD).
- E. Contractor shall submit a prepared traffic control plan prepared by a Certified Traffic Control Supervisor and tentative schedule to the Engineer for approval prior to the start of any work on the project site, if required by the Engineer or Public Works Inspector.

F. Contractor is responsible for notifying the Police Department, the Fire District, and all emergency and ambulance service providers of any street closures or blockages, due to construction, prior to beginning any such activity. Contractor shall also maintain the means at all times to provide emergency access routes to all properties located along the construction site when needed.

1.10 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Prohibit traffic on newly paved surfaces.
- D. Prohibit traffic from landscaped areas.

1.11 DISCOVERY OF ARCHAEOLOGICAL AND OTHER HISTORICAL ITEMS

- A. In the event of an archaeological find during any phase of construction, the following procedure will be followed:
 1. Construction shall be halted, with as little disruption to the site as possible.
 2. The Contractor shall notify the City who shall contact the State Historic Preservation Officer
 3. The State Historic Preservation Officer may decide to have an archaeologist inspect the site and make recommendations about steps needed to protect the site, before construction is resumed.
 4. The entire event should be handled as expediently as possible in order to hold the loss in construction time to a minimum while still protecting archaeological find.

1.12 CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL MEASURES

- A. See Section 02374.
- B. Contractors and subcontractors must implement Best Management Practices (BMPs) to reduce pollutants in any storm water runoff from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of pollutants in storm water discharges from construction activity disturbing less than one acre must be included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. Contractors are further required to control construction site waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause

adverse impacts to water quality. These activities must be in compliance with all applicable State and local laws and regulations.

C. Where appropriate, the Contractor's efforts shall reflect the following engineering principles:

1. When appropriate, land grading and excavating should be kept at a minimum to reduce the possibility of creating runoff and erosion problems that require extensive control measures.
2. Whenever possible, topsoil should be removed and stockpiled before grading begins.
3. Land exposure should be minimized in terms of area and time.
4. Exposed areas subject to erosion should be covered as quickly as possible by means of mulching or vegetation.
5. Natural vegetation should be retained whenever feasible.
6. Early completion of stabilized drainage system (temporary or permanent) will substantially reduce erosion potential.
7. Appropriate structural or agronomic practices to control runoff and sedimentation should be provided during and after construction.
8. Roadways and parking lots should be paved or otherwise stabilized as soon as feasible.
9. Clearing and grading should not be started until a firm construction schedule is known and can be effectively coordinated with the grading and clearing activity.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

DIVISION 2 – SITE CONSTRUCTION

SECTION 02060

AGGREGATE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate materials.
2. Fine aggregate materials.
3. Blended aggregate materials.
4. Rip Rap

B. Related Sections:

1. Section 02320 - Backfill.
2. Section 02324 - Trenching.
3. Section 02512 - Water Distribution.
4. Section 02630 - Storm Drainage.
5. Section 02721 - Aggregate Base Course.
6. Section 02740 - Flexible Pavement.
7. Section 02750 - Rigid Pavement.
8. Section 03300 - Cast-in-Place Concrete.

1.2 REFERENCES

A. Colorado Department of Transportation:

1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

B. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. AASHTO T-24- Unconfined Compressive Strength of Drilled Core Specimen

C. American Society for Testing and Materials:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN·m/m³)).
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN·m/m³)).
4. ASTM C535- Abrasion Resistance by Los Angeles Machine

1.3 SUBMITTALS

- A. Materials Source: Submit name of imported materials suppliers.
- B. Copies of all Proctor density curves and test results showing exact location of sample collection and test sites must be furnished to Engineer.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with City of Cañon City standard.
- C. Maintain one copy of each document on site.
- D.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Coarse Aggregate Type Class 6 (Road Base): 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 703.03; within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/4 inch	100
No. 4	30 to 65
No. 8	25 to 55
No. 200	3 to 12

- B. Coarse Aggregate Type A1: No. 67 (Gravel): free of clay, shale, organic matter; within the following limits: 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 703.00; within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100
3/4 inch	90 to 100
3/8 inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate Type A2 (Sand): Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; within the following limits: 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 703.00; within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

2.3 BLENDED AGGREGATE MATERIALS

A. For use only as directed by Engineer. Also, see 1.9 Special Considerations, Section 00710 and 2.1 Fill Materials, Section 02324.

B. Blended Aggregate Type A3 (Ordinary Backfill or Select Borrow Material):

1. Ordinary Backfill - on-site material that has been excavated from the trench, which may actually contain soil, except for rubbish, frozen material, broken pavement, large stones, or other consolidated material greater than 3 inches in diameter, organic muck, or other materials considered deleterious by Engineer. Expansive clays of a plastic nature will not be considered suitable.
2. Select Borrow Material - well-graded mixture of sound mineral aggregate containing sufficient, proper bonding material which may include recycled materials; within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
No. 4	100
No. 10	80
No. 200	5 to 15

2.4 RIP RAP

- A. Rip Rap shall consist of hard, dense, and durable stone, angular in shape and resistant to weathering. Rounded stone or boulders shall not be used as rip rap material. The stone shall have a specific gravity of at least 2.5. Each piece shall have its greatest dimension not greater than three times its least dimension. Rip rap shall conform to 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 506.00. Rip rap shall conform to the gradation requirements given in Table 506-2, 2017 CDOT Standard Specifications for Road and Bridge Construction

2.4 SOURCE QUALITY CONTROL

- A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- B. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- C. Blended Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- D. Rip Rap – Testing and Analysis: ASTM C 535 LA Abrasion and AASHTO T-24.
- E. When tests indicate materials do not meet specified requirements, change material and retest.
- F. Testing shall use the Standard Proctor method. Alternatives such as Modified Proctor or Relative Density based on necessity due to material type may be used with the permission of the Engineer so long as the necessary conversion data, testing, and information has been completed and submitted prior commencement of the work.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate aggregate materials from on-site locations indicated when directed by Engineer as specified in Section 02315 and Section 02324.
- B. Stockpile excavated material meeting requirements for aggregate materials when directed by Engineer.
- C. Remove excess excavated materials, not intended for reuse, from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations designated by Engineer.

- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 02222

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolishing designated structures within City rights of way.
 - 2. Protecting items designated to remain.
 - 3. Removing demolished materials.

- B. Related Sections:
 - 1. Section 02060 - Aggregate.
 - 2. Section 02315 - Excavation.
 - 3. Section 02320 - Backfill.

1.2 QUALITY ASSURANCE

- A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, and disposal.

- B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

- C. Obtain required permits from authorities having jurisdiction.

- D. Perform Work in accordance with the City of Cañon City standards.

1.3 QUALIFICATIONS

- A. Demolition Firm: Company specializing in performing work of this section with documented experience.

1.4 PRE-DEMOLITION MEETINGS

- A. Convene minimum one day prior to commencing work of this section.

1.5 SCHEDULING

- A. Schedule Work to precede site excavation work and new construction.

- B. Describe demolition removal procedures and schedule.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Document condition of adjacent structures indicated to remain.
- B. Make arrangements with adjacent property owners and Engineer to survey existing surrounding structures and property.

3.2 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location of utilities.
- C. Do not close or obstruct roadways, sidewalks, or hydrants without permission.
- D. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.
- E. Protect existing landscaping materials, trees, appurtenances, structures, and fences indicated to remain.
- F. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

3.3 DEMOLITION REQUIREMENTS

- A. Use of explosives is not permitted.
- B. Conduct demolition to minimize interference with adjacent structures. Cease operations immediately when adjacent structures appear to be in danger. Notify authority having jurisdiction and Engineer. Do not resume operations until directed.
- C. Conduct operations with minimum interference to public or private accesses. Maintain egress and access for adjacent property at all times.
- D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.
- E. Sprinkle Work with water to minimize dust. Provide hoses and water connections required for this purpose.
- F. Provide other equipment as necessary to complete demolition work including, but not limited to, steel and concrete cutting equipment, pneumatic concrete breakers, anchoring devices, excavation, loading, lifting, and public safety equipment.

3.4 DEMOLITION

- A. Remove designated structures within area of new construction.
- B. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 01600.
- C. Backfill areas excavated due to demolition, in accordance with Section 02320.
- D. Rough grade and compact areas affected by demolition to maintain site grades and contours.
- E. Continuously clean-up and remove demolished materials from site. Do not allow materials to accumulate on site.
- F. Do not burn or bury materials on site. Leave site in clean condition.

END OF SECTION

SECTION 02315

EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating for curb and gutter.
 - 2. Excavating for paving, roads, and parking areas.
 - 3. Excavating for slabs-on-grade, including cross-pans.
 - 4. Excavating for site structures.
 - 5. Excavating for sidewalks.

- B. Related Sections:
 - 1. Section 02721 - Aggregate Base Course.
 - 2. Section 02740 - Flexible Pavement.
 - 3. Section 02750 - Rigid Pavement.
 - 4. Section 03300 - Cast-in-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with City of Cañon City Standards.

- B. Maintain one copy of each document on site.

- C. Perform work to local utility standards when working within 6 inches of utility lines.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location of utilities.
- C. Identify required lines, levels, contours, and datum.
- D. Notify utility company to remove and relocate utilities.
- E. Protect utilities indicated to remain from damage.
- F. Protect plant life, lawns, landscaping, driveways, and other features that are to remain.
- G. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 EXCAVATION

- A. Excavate subsoil to accommodate slabs-on-grade, paving, sidewalks, curb and gutter, cross-pans, culvert, drain inlets and construction operations.
- B. Remove old concrete, pavement, and related debris and dispose of in an approved disposal site. Interior sections to be removed shall be saw-cut at sufficient depth at control joints, or where designated, to avoid breaking, disturbing, or chipping adjacent concrete or pavement. Saw-cut, remove, and replace the existing asphalt pavement a minimum of 1-foot from the curb and gutter unless the pavement is determined to be in "sound" condition as determined by the Engineer.
- C. Exposed edges of existing sidewalk shall be ramped as necessary to provide a reasonably safe and accessible walkway if excavation is to be left open for any length of time prior to reconstruction.
- D. Remove all disturbed load bearing soil, which no longer has its original bearing capacity.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Trim excavation. Remove loose matter.
- G. Remove lumped subsoil, roots, stumps, loose dirt, broken asphalt or concrete, boulders, and large rock.
- H. Notify Engineer of unexpected subsurface conditions.

- I. Correct areas over-excavated with material as directed by Engineer.
- J. Remove excess and unsuitable material from site.
- K. Repair or replace items indicated to remain damaged by excavation.

3.3 FIELD QUALITY CONTROL

- A. Request visual inspection of bearing surfaces by Engineer or Public Works Inspector before installing subsequent work.

3.4 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 02320

BACKFILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backfilling site structures to subgrade elevations.
 - 2. Fill under structures.
 - 3. Fill for over-excavation.

- B. Related Sections:
 - 1. Section 02060 - Aggregate
 - 2. Section 02315 - Excavation.

1.2 REFERENCES

- A. Colorado Department of Transportation:
 - 1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

- B. American Society for Testing and Materials:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN·m/m³)).
 - 3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.

1.3 SUBMITTALS

- A. Materials Source: Submit name of imported materials suppliers.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Road Base: Type Class 6 as specified in Section 02060.
- B. Ordinary Backfill: Type A3 as specified in Section 02060, only as directed by Engineer.
- C. Stabilizing Material: Minimum of 1 ½ inch, uniformly graded, clean rock, or as directed by Engineer.
- D. Rip Rap: Stone Size; d50=12" minimum or larger as directed by Engineer.
- E. Flow-Fill: Structural Backfill that meets the requirements of 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 206.02; within the following limits:
 - 1. Components per cubic yard

Fine Aggregates (Type A2 as specified in Section 02060)	1,845 lbs.
Coarse Aggregates (Type A1 as specified in Section 02060)	1,700 lbs.
Cement	50 lbs.
Water	325 lbs.
 - 2. Slump – 6 inch minimum, 8 inch maximum
 - 3. Strength – 10 psi minimum in 1 day, 60 psi maximum in 18 days.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify subgrade is suitable for placement of backfill.
- B. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place aggregate in maximum 8 inch layers and compact to 95 percent, maximum dry density, ASTM D698, Standard Proctor, except for the top 4 feet of trench, which shall be compacted to 97 percent, maximum dry density, ASTM D698, Standard Proctor. Lift size may be increased when it is demonstrated that compaction requirements can be met using other methods. The Engineer will make final determination on the thickness of each lift in the field.
- D. Use smaller mechanical tamping equipment in areas inaccessible to compaction equipment.
- E. Place fill material in continuous layers and compact in accordance with schedule at end of this section.
- F. Employ placement method that does not disturb or damage other work.
- G. Maintain optimum moisture content of backfill materials to attain required compaction density.
- H. Backfill against supported walls. Do not backfill against unsupported walls.
- I. Backfill simultaneously on each side of unsupported walls until supports are in place.
- J. Make gradual grade changes. Blend slope into level areas.
- K. Remove surplus backfill materials from site.
- L. Leave fill material stockpile areas free of excess fill materials.
- M. Rip rap shall be placed and stacked in manner that creates a stable slope that will not impede flow of water.

3.4 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

- A. Compaction Testing: In accordance with ASTM D698.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

C. Compaction Testing for Bedding and Backfill:

1. Contractor is required to hire an independent, licensed engineer experienced in soil analysis and evaluation to perform required compaction tests in accordance with ASTM D698. Furnish copies of all Proctor curves and test results showing exact location of sample collection and test sites to Engineer. Engineer shall be informed prior to testing and he may designate areas of testing.
2. Performed by City personnel or Contractor at option of Engineer in accordance with ASTM D698.
3. Testing is to be done at various elevations in trench, which may require excavation by Contractor after backfill is installed.
4. Frequency of Compaction Tests will be specified by Engineer in field but shall be no less than every 200 feet at every 1 foot of depth of the backfill or anytime the means and methods of compaction change.
5. For trenches greater than 4 feet in depth, compaction effort shall be visually observed based on an initial test to determine a best means and methods of compaction that can subsequently be used for trench side observation. A new initial test shall be performed, whenever backfill materials or means and methods of compaction change.
6. Testing shall use the Standard Proctor method. Alternatives such as Modified Proctor or Relative Density based on necessity due to material type may be used with the permission of the Engineer so long as the necessary conversion data, testing, and information has been completed and submitted prior commencement of the work.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.6 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic during construction.
- B. All areas showing signs of settlement shall be filled and maintained by Contractor during all construction phases and for a period of two years following the date of final acceptance, except areas where Ordinary Backfill, Section 02060, was installed, for which the period is extended to 5 years.
- C. When Contractor is notified by the City or Engineer that any backfill is hazardous, the condition shall be corrected at once.

3.7 SCHEDULE

- D. Fill Behind Abutment and Wing Walls:
 - 1. Fill Type Class 6, from bottom of excavation to top of walls, compact uniformly to 97 percent of maximum density.
- E. Fill Wing Walls (ditch side):
 - 1. Fill Rip Rap, from ditch bottom to top of adjacent disturbed soil, stacked tight and stable.
- F. Fill Under Footings, Inlets, Manholes, Vaults, and other Concrete Structures:
 - 1. Fill Flow Fill, 18 inch thick to required elevations for the width of the footing.
 - 2. See Section 02630.
- G. Fill Under and Around Cast in Place Concrete:
 - 1. See Section 03300.
- H. Fill Over and Around Utilities:
 - 1. See Section 02324, 02512, 02630.
- I. Fill to Correct Over-excavation and Unstable Subgrades:
 - 1. Flow Fill, flush to required elevation, or material as directed by Engineer compacted uniformly to 97 percent of maximum density.

END OF SECTION

SECTION 02324

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for site utility lines including domestic water lines.
2. Compacted fill from top of utility bedding to top of trench.
3. Backfilling and compaction of trenches.

B. Related Sections:

1. Section 02060 - Aggregate.
2. Section 02512 - Water Distribution: Site water lines including domestic water lines.

1.2 REFERENCES

A. Colorado Department of Transportation:

1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

B. American Society for Testing and Materials:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

- A. Obtain City of Cañon City Excavation Permit prior to any excavation.
- B. Excavation Protection Plan: as required by applicable codes, laws, and standards.
- C. Materials Source: Submit name of imported fill materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with City of Cañon City and industry standards.
- B. Maintain one copy of each required document on site.

1.6 QUALIFICATIONS

- A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Colorado.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to work.

1.8 COORDINATION

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.
- B. Verify locations, types, and sizes of existing facilities that will be integrated with project Work.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Road Base: Type Class 6 as specified in Section 02060.
- B. Stabilizing Material: Minimum of 1 ½ inch, uniformly graded, clean rock, or as directed by Engineer.
- C. Blended Aggregate: Type A3 as specified in Section 02060. This backfill shall be allowed under new streets in approved subdivisions. A geotechnical engineer shall design all backfill. The developer's engineer shall provide oversight of installation and compaction including compaction testing. Native soil shall be allowed for the top 2 foot of trench backfill when trench is under an open drainage/irrigation channel for the purpose of sealing the channel and minimizing leakage.
- D. Flow-Fill As specified in Section 02320.

PART 3 EXECUTION

3.1 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
 - 1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use staking for alignment and elevation of water mains to establish lines and grades.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.
- C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Maintain and protect above and below grade utilities indicated to remain.
- E. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.
- F. Prior to excavation in paved areas, the pavement shall be cut in such a manner as to effect a smooth, straight edge and a vertical face 6 inches minimum beyond the trench wall.

3.3 TRENCHING

- A. Excavate subsoil by open cut to the depth required, unless written permission is given by Engineer to do otherwise, for utilities at the required locations.
- B. Remove lumped subsoil, boulders, and rock.
- C. When rock or hard clay is encountered, the trench shall be over-excavated 6 inches.
- D. Excavation performed within 24 inches of existing utility service shall be done in accordance with utility's requirements.
- E. Do not advance open trench more than 200 feet ahead of installed pipe, unless Engineer determines a shorter length is necessary for the safety of the public.
- F. Cut trenches to the width necessary to permit the pipe to be laid, jointed properly, inspected, and backfilled properly. No trench shall have a width of less than the diameter of the pipe plus 12 inches. The maximum clear trench width, measured 1 foot above the top of the pipe barrel shall not be greater than that shown in the following table unless otherwise specified:

<u>Pipe Diameter (inches)</u>	<u>Maximum Trench Width (inches)</u>
6	26
8	28
10	30
12	32
16	36
20	44
24	48
30	56
36	64

- G. When maximum trench widths are exceeded and Engineer determines that the design load limits of the pipe are exceeded, the Contractor will be required to either cradle the pipe in concrete or to use a pipe of a stronger class.
- H. Remove water or materials that interfere with Work. Contractor shall provide and maintain at all times ample means and devices to promptly and properly dispose of all water entering trench excavation. Water shall be disposed of in a suitable manner without damage to adjacent property or without a menace to public health and convenience. Unless authorized, in writing, trench water shall not be allowed to enter any water or sewer lines. Protect pipeline against damage from water in the event of a storm or pump failure.
- I. Excavate trenches to depth indicated on Drawings. The trench shall be excavated to a depth below the established grade equal to 1/8 the outside diameter of the pipe, but not less than 4 inches. Provide uniform and continuous bearing and support for bedding

material and pipe. A continuous trough shall be excavated to receive the bottom quadrant of the pipe barrel and bell ends. Excavate adequate space for required restraints, valves, and fittings prior to placing pipe in trench.

- J. Do not interfere with the bearing soil of foundations of existing structures.
- K. When Project conditions permit, slope side walls of excavation starting 1 foot above top of pipe. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- L. When subsurface materials at bottom of trench are loose, soft, or otherwise unsuitable, excavate to greater depth as directed by Engineer until suitable material is encountered. It shall be replaced, as directed by Engineer, with approved backfill material and methods to provide a suitable foundation for the pipe, which may include 1 ½ inch clean rock.
- M. Trim excavation. Remove loose matter.
- N. Correct areas over-excavated with compacted backfill as specified for authorized excavation as directed by Engineer.
- O. Remove excess subsoil, not intended for reuse, from site. Top soil shall be removed and piled separately for use in finish grading the site. Excavated material that is suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the trench to avoid over-loading and to prevent slides or cave-ins.
- P. Boring, Tunneling, and Jacking:
 - 1. May be required under existing sidewalk, curb and gutter, or other structures, where depth of trench and soil conditions permit.
 - 2. Written permission by Engineer is required.
 - 3. Tunneling will not be permitted for distances greater than 10 feet.
 - 4. When jacking is required, only persons experienced in such work, using suitable equipment, shall perform the operation.
 - 5. Flow-fill shall be used as backfill under any structure that has had material excavated from beneath them, been jacked, or for any tunnel.

3.4 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Design sheeting and shoring to be removed at completion of excavation work.
- C. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

- D. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BEDDING

- A. Bedding installation and material shall be in accordance to the utility's specifications. All water lines shall be bedded in Class 6 material per Section 2512.

3.6 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen, non-organic, or otherwise suitable fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact in accordance with City of Cañon City Standard Detail. Flow-fill may be used from 4 inches above the pipe barrel to the top of the trench.
- D. Compact backfill material to 95 percent, maximum dry density, ASTM D698, Standard Proctor, except for the top 4 feet of the trench, which shall be compacted to 97 percent, maximum dry density, ASTM D698, Standard Proctor.
- E. Lifts will not exceed 8 inches in depth unless a sheep's foot compactor or a hydraulic plate compactor (headshaker) mounted on excavation equipment of adequate size is used. Lift size may be increased by using this compaction equipment when it is demonstrated that compaction requirements can be met. Engineer will make final determination on the thickness of each lift in the field. Only equipment designed for the purposes of compaction shall be used.
- F. Employ placement method that does not disturb or damage utilities in trench, and other existing structures or facilities.
- G. Maintain optimum moisture content, plus or minus (\pm) 2 percent, of fill materials to attain required compaction density.
- H. Do not leave more than 25 feet of trench open at end of working day.
- I. Protect open trench to prevent danger to the public.

3.7 SURFACE RESTORATION

- A. Pavement (either asphalt or concrete), curb and gutter, sidewalks, drainage culverts, headwalls, etc., or other improved surfaces that have been removed during the course of work shall be restored to a condition as equal to or better than that prior to removal and to the same elevation and alignment.

- B. The subgrade for all restored surfaces shall be thoroughly compacted by mechanical or hand tampers weighing not less 20 pounds, by vibratory rollers, or by other means of compaction approved by Engineer.
- C. Surface restoration shall be per current applicable City of Cañon City Specifications and Standard and subject to review by Engineer.
- D. Where excavation occurs in paved areas, the pavement shall be repaired as required in Sections 00710, 02740, 02750, and 03300.

3.8 FIELD QUALITY CONTROL

- A. Compaction Testing: In accordance with ASTM D698.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest
- C. Compaction Testing for Bedding and Backfill:
 - 1. Contractor is required to hire an independent, licensed engineer experienced in soil analysis and evaluation to perform required compaction tests in accordance with ASTM D698. Copies of all Proctor curves and test results showing exact location of sample collection and test sites must be furnished to Engineer. Engineer shall be informed prior to testing and he may designate areas of testing.
 - 2. Performed by City personnel or Contractor at option of Engineer in accordance with ASTM D698.
 - 3. Testing is to be done at various elevations in trench, which may require excavation by Contractor after backfill is installed.
 - 4. Frequency of Compaction Tests will be specified by Engineer in field but shall be no less than every 200 feet at every 1 foot of depth of the trench or anytime the means and methods of compaction change.
 - 5. For trenches greater than 4 feet in depth, compaction effort shall be visually observed based on an initial test to determine a best means and methods of compaction that can subsequently be used for trench side observation. A new initial test shall be performed whenever backfill materials or means and methods of compaction change.
 - 6. Testing shall use the Standard Proctor method. Alternatives such as Modified Proctor or Relative Density based on necessity due to material type may be used with the permission of the Engineer so long as the necessary conversion data, testing, and information has been completed and submitted prior commencement of the work.

3.9 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic during construction.
- B. All areas showing signs of settlement shall be filled and maintained by Contractor during all construction phases and for a period of 2 years following the date of final acceptance.
- C. When Contractor is notified by the City or Engineer that any backfill is hazardous, the condition shall be corrected at once.

END OF SECTION

SECTION 02374
EROSION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. All Erosion Control, Construction Best Management Practices (BMPs), and Post Construction BMPs materials, methods, and installation shall be in accordance with:

1. City of Cañon City Grading, Erosion, & Sedimentation Control (GESC) Plan Manual.
2. Urban Drainage and Flood Control District (UDFCD) Criteria Manual.
3. 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 208
4. 2012 CDOT M&S Standard Plans

1.2 SUBMITTALS

A. Proprietary products may be submitted for approval on a case-by-case basis.

PART 2 PRODUCTS

2.1 See Summary.

PART 3 EXECUTION

3.1 See Summary.

END OF SECTION

SECTION 02512

WATER DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for site water lines including domestic water lines.
2. Valves.
3. Hydrants.
4. Pipe markers.
5. Precast concrete vault.
6. Bedding and cover materials.
7. Water System Accessories.

B. Related Sections:

1. Section 02060 - Aggregate: Aggregate for backfill in trenches.
2. Section 02324 - Trenching: Execution requirements for trenching required by this section.

1.2 REFERENCES

A. Colorado Department of Transportation:

1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

B. American Society for Testing and Materials:

1. ASTM A536 – Standard Specification for Ductile Iron Castings.
2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
5. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

C. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 – Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
6. AWWA C153 – Ductile-Iron Compact Fittings, 3-inch through 16-inch, for Water and Other Liquids.
7. AWWA C205 – Cement-Mortar Protective Lining and Coating for Steel Water Pipe- 4-inch and larger- shop applied.
8. AWWA C207 – Steel Pipe Flanges for Waterworks Service – Sizes 4-inch through 144-inch.
9. AWWA C502 - Dry-Barrel Fire Hydrants.
10. AWWA C504 - Rubber-Sealed Butterfly Valves.
11. AWWA C515 - Resilient-Seated Gate Valves for Water-Supply Service.
12. AWWA C550 – Protective Interior Coatings for Valves and Hydrants
13. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
14. AWWA C605 – Underground installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
15. AWWA C651 – Disinfecting Water Mains.
16. AWWA C800- Underground Service Line Valves and Fittings
17. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
18. AWWA C905 - Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch.

D. Underwriters Laboratories Inc.:

1. UL 246 - Hydrants for Fire - Protection Service.

1.3 SUBMITTALS

- A. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents "AS BUILTS": Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with City of Cañon City standards.
- B. Maintain one copy of each document on site.
- C. Valves: Manufacturer's name and pressure rating marked on valve body.
- D. Pipe: Acceptance of DI pipe that has cracks within the cement lining or PVC pipe that is "sunburned" shall be accepted at the Engineer's discretion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Pipes, fittings, valves, and accessories shall be loaded and unloaded or otherwise handled in such a manner as to minimize the possibility of damage prior to installation. All materials shall be stored at the construction site in such a way as to prevent damage and to assure they are kept as clean as possible prior to installation.

PART 2 PRODUCTS

2.1 WATER PIPING

- A. Ductile Iron Pipe: AWWA C151 and C104, Pressure Class 350, exceptions by Engineer may include Class 51 or 52.
 1. Fittings: Ductile iron, compact, AWWA C153, manufactured/cast in U.S.A., unless excepted by the Engineer.

2. Joints: AWWA C110, C111, and C153, rubber gasket, mechanical joint restraints (“Mega-lug”, retainer gland) for all connections to valves and fittings.
3. Jackets: AWWA C105 polyethylene jacket, half lapped, 8 mil (0.008 inch), polyethylene tape.
4. Coatings & Linings: AWWA C205, cement-mortar lining, bituminous seal coating.
5. Size:
 - a. Except for permanent cul-de-sacs of less than 500 feet in length, the minimum size of any new water main within the distribution system shall be eight (8) inches in diameter.
 - b. In streets that have a permanent cul-de-sac less than 500 feet in length, the Engineer may authorize a water main that is six (6) inches in diameter.
 - c. In location where the Engineer determines that a water main must be larger than eight (8) inches in diameter, the water main shall be of such size as specified by the Engineer or according to the City’s Master Plan.
 - d. Larger sizes shall be required as needed to provide proper distribution flow, pressure, and fire protection.
6. Use/Location: Allowed for use in entire system. Shall be polyethylene encased to AWWA C105 at all locations north of Arkansas River and south of Arkansas River only when aggressive or “hot” soils are shown to exist.

B. Copper Tubing: ASTM B88, Type K, annealed

1. Fittings: Flared.
2. Joints: Flared.
3. Size: $\frac{3}{4}$ inch minimum.
4. 1 $\frac{1}{2}$ inch – 2 inch service lines can be rigid copper w/ silver solder connections.

C. PVC Pipe: AWWA C900 (DR-14 & DR-18) and C905 (DR18, DR-21, &DR-25,

1. Fittings: AWWA C111, cast iron, wrapped, manufactured/cast in U.S.A., unless excepted by the Engineer.
2. Joints: ASTM D3139 compression gasket ring, AWWA C153 and C900, mechanical joint restraints ("Mega-lug") for all connections to valves and fittings.
3. Jackets: Fittings and valves only, AWWA C105 polyethylene jacket, half lapped, 8 mil (0.008 inch), polyethylene tape.
4. Size:
 - a. Except for permanent cul-de-sacs of less than 500 feet in length, the minimum size of any new water main within the distribution system shall be eight (8) inches in diameter.
 - b. In streets that have a permanent cul-de-sac less than 500 feet in length, the Engineer may authorize a water main that is six (6) inches in diameter.
 - c. In location where the Engineer determines that a water main must be larger than eight (8) inches in diameter, the water main shall be of such size as specified by the Engineer or according to the City's Master Plan.
 - d. Larger sizes shall be required as needed to provide proper distribution flow, pressure, and fire protection.
5. Thickness: DR-18 for sizes 6 inch – 12 inch or DR-14 when static pressure exceeds 100 psi, DR-25 for sizes greater than 12 inch or DR-18 when static pressure exceeds 100 psi.
6. Use/Location: Allowed for use in entire system.

2.2 VALVES

A. GATE VALVES

1. Valves: Manufactured/cast in U.S.A. to meet or exceed the requirements of AWWA C515, or latest revision, and in accordance with the following specifications:
 - a. Approved Manufacturers:
 - 1) Mueller
 - 2) AVK

- 3) Waterous
 - b. Shall be smaller than 12 inch unless excepted by Engineer.
 - c. Shall be open left
 - d. Shall be resilient seated
 - e. The wedge shall be constructed of ductile iron. The exterior of the ductile iron wedge shall be encapsulated with nitrile rubber. The wedge shall be symmetrical and seal equally well with flow from either direction. There shall be no exposed metal seams, edges, or screws within the waterway when the valve is in the fully closed position.
 - f. The stem shall be made of bronze or stainless steel in full compliance with Section 4.7, AWWA C515.
 - g. Wrench nut shall be constructed of ductile iron. Wrench nut shall have four flats at stem connection to assure even distribution of operating input torque to the stem.
 - h. All internal and external ferrous surfaces of the valve body and bonnet shall have a fusion-bonded epoxy coating, applied electrostatically prior to assembly, complying with ANSI/AWWA C550
2. Accessories: Manufactured/cast in U.S.A., unless excepted by the Engineer.

B. BUTTERFLY VALVES

1. Valves: Manufactured/cast in U.S.A. to meet or exceed the requirements of AWWA C504, or latest revision, and in accordance with the following specifications:
 - a. Approved Manufacturers:
 - 1) DeZurik
 - 2) Pratt
 - 3) Mueller
 - b. Shall be 12 inches or larger
 - c. Shall have an iron body,
 - d. Shall have a bronze disc,
 - e. Shall have a resilient, replaceable seat

- f. Shall be open left
- g. Shall have a non-rising stem
- h. Shall have a two-inch (2") square nut
- i. Shall be tested bi-directionally. Test results shall be provided prior to delivery.

2. Accessories: Manufactured/cast in U.S.A., unless excepted by the Engineer.

2.3 HYDRANT

A. Approved Hydrants:

1. Centurion 200 manufactured by Mueller Company
2. 2780 manufactured by American AVK
3. WB67 Pacer manufactured by Waterous

B. All hydrants shall fully comply with all provisions of AWWA C502 (Dry Barrel Fire Hydrants), be shop tested in accordance with AWWA C502, section 5, and meet the following:

1. Shall be of the compression type- opening against the pressure and closing with the pressure.
2. Shall be designed with an anti-friction bearing so located that it shall reduce the torque required to actuate the hydrant.
3. An all-bronze hydrant valve seat ring shall thread directly into an all-bronze drain ring and shall be located between the lower hydrant barrel and base securely retained in this position or the drain ring can be threaded into the shoe of the hydrant
4. The operating stem, safety stem coupling and main valve assembly shall be capable of withstanding an application of 200 ft. lbs. of torque against either the full opened or closed position without damage to components.
Downward stem travel shall be limited by a travel stop located in the upper housing of the hydrant.
5. Head losses through the hydrant shall not exceed 3.5 PSI at 1000 GPM (through the pumper connection) when the flow tested in accordance with Section 5, AWWA C502, as evidenced by a certified friction loss graph from the manufacturer and applicable to the specific model to be furnished.
6. Shall be of the traffic “break-away” type with safety stem coupling, frangible bolts, or safety flange that permits full rotation of the nozzle section.
7. All hydrants shall be supplied with a 6” MJ base.
8. Trench depth shall be 4 foot, 6 inches, unless otherwise specified.

9. Hydrant extensions shall be fabricated in multiples of 6 inches with rod and coupling to increase barrel length.
10. Main valve opening of the hydrant shall not be less than 5 $\frac{1}{4}$ ".
11. Hydrant nozzles shall consist of two (2), 2 $\frac{1}{2}$ " hose nozzles and one (1), 5" pumper nozzle. Threads on all nozzles shall be national standard. Nozzles not using a mechanical lock-in device shall not be accepted
12. Operation nut and nozzle cap wrench nuts shall be national standard 1- 1/2" pentagon.
13. Hydrants using the breakaway coupling on the hydrant rod as a wrench attachment to disassemble the internal valve parts shall not be accepted. The hydrant bonnet assembly shall consist of a top weather seal or cap and shall be provided with a grease/oil reservoir and lubrication system that automatically circulates lubricant to all operating stem threads and bearing surfaces each time the hydrant is operated. The system shall be completely sealed from the waterway and external contaminants by means of O-rings.
14. An arrow shall be on the hydrant bonnet with the word "open" to designate all hydrants to open left.
15. All hydrants shall be red in color.

2.4 BRASS FITTINGS

- A. All fittings and valves shall be manufactured in the U.S.A. in accordance with AWWA C800, and meet the following;
 1. Any brass part of the fitting or valve in contact with potable water shall be made of a "No-Lead Brass", defined for this specification as UNS Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C800. This "No-Lead Brass" alloy shall not contain more than nine one hundredths of one percent (0.09% or less) total lead content by weight.
 2. Any Brass part of the fitting or valve not in contact with potable water shall be made of 85-5-5-5 brass as defined for this specification as UNS Copper Alloy C83600 per ASTM B62, ASTM B584 and AWWA C-800
 3. All brass fittings and valves shall be certified by an ANSI accredited test lab per NSF/ANSI Standard 61, Drinking Water Components – Health Effects, Section 8 or NSF/ANSI Standard 372, Drinking Water System Components – Lead Content. Proof of certification is required.
 4. Brass fittings and valves shall comply with the United States Of America Safe Drinking Water Act, and the U.S. Environmental Protection Agency.

5. All brass fittings and valves shall have the manufacturers name or trademark permanently stamped or cast on it. Another marking identifying the “no lead” brass alloy, e.g., ‘NL’, shall be cast or permanently stamped on the fitting or valve.

2.5 PIPE MARKERS

A. UNDERGROUND-

1. Tracer Wire: shall be a #12 AWG (0.0808" diameter) fully annealed, high carbon 1055 grade steel, high strength solid copper clad steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. HS-CCS conductor must be at 21% conductivity for locating purposes. Break load of 452 lbs. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Manufacturers supplying copper clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used. Origin of copper clad steel manufacturer is required and steel core must be manufactured in the United States. If manufacturer has not completed 5 year corrosion testing, a 5 year warranty must be provided. Tracer wire shall be Copperhead® High Strength HS-CCS HDPE 30 mil or pre-approved equal and made in the USA.
2. Accessories: Silicon filled waterproof connectors/nuts.

B. AT SURFACE-

1. Marking Posts: Marking posts shall be installed per manufacturer’s instructions above the water main, in rural unpaved areas to be determined by Engineer, every 200 feet and at every valve and bend. The posts shall be “Rhino 3-Rail” or approved equal. The posts shall be blue in color and have UV stable, all-weather decals affixed that are marked with the international “No-Dig” symbol and have a highly visible white and blue warning that reads “WARNING WATER PIPELINE, BEFORE DIGGING IN THIS AREA CALL CITY OF CANON CITY WATER 719-269-9022”. Decals shall measure 2-7/8" X 14".

2.6 PRECAST CONCRETE VAULT

- A. Furnish materials in accordance with City of Cañon City standards.
- B. Product Description: Pre-cast vault designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories per City of Cañon City Standard Detail W-5C.

2.7 BEDDING AND COVER MATERIALS

- A. Road Base: Type Class 6 as specified in Section 02060.

2.8 Flow-Fill: As specified in Section 02320.ACCESSORIES

- A. Concrete for Thrust Restraints, Cradles, Valve Blocking, and Encasements:

1. Refer to City of Cañon City Standard Detail W-4 for restraint sizing.
2. Concrete: compressive strength of 3000 psi in 28 days.

- B. Air & Vacuum Valve Vault: Refer to City of Cañon City Standard Detail W-7.

- C. Bell Joint Restraint:

1. Restraint at push-on pipe joints for ductile iron pipe (AWWA C151) and PVC pipe (AWWA C900) shall be manufactured of ductile iron conforming to ASTM A536. The restraint devices shall be coated using MEGA-BOND™.
 - a. A split serrated ring, with a sufficient number of heat-treated Tru-Dual inserts for gripping both ductile iron pipe and PVC pipe, shall be utilized behind the pipe bell.
 - b. A split serrated ring, with a sufficient number of heat-treated Tru-Dual inserts for gripping both ductile iron pipe and PVC pipe, shall be used to grip the spigot, plain end pipe.
 - c. A sufficient number of bolts shall be used to connect the bell ring and the gripping ring.
 - d. The restraint shall be the Series 1500TD, as manufactured by EBAA Iron, Inc., or approved equal.

- D. Mechanical Joint Restraints

1. PVC: Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraint mechanism shall consist of a plurality of individual actuated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest version. Twist off nuts, sized same as tee-head bolts, shall be used to ensure proper actuating of restraining devices. The restraining glands shall have a pressure rating equal to that of the pipe on

which it is used. The restraining glands shall have been tested to ASTM F1674-96, be listed by Underwriters Laboratories, and be approved by Factory Mutual. The restraint shall be the EBBA Iron Series 2000PV or approved equal.

2. Ductile Iron Pipe: Restraint for standardized mechanical joints shall be incorporated in the design of the follower gland and shall impart multiple wedging actions against the pipe, increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by a controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A536 Grade 60-42-10. Wedges shall be contoured to provide exact fit on the pipe, and shall be manufactured of ductile iron, heat treated to a hardness of 370 BHN minimum. Dimensions of the glands shall be such that they can be used with the standardized mechanical joint bell and Tee head bolts conforming to the requirements of ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest revision. Twist off nuts shall be incorporated in the design of the wedge activation screws to insure proper torque. The mechanical joint restraining device shall have a water working pressure rating of 250 psi minimum with a safety factor of at least 2:1 against separation when tested in a dead-end situation, and shall be EBBA Iron Series 1100 Megalug Mechanical Joint Restraint or approved equal.

E. Bolts:

1. CorTen steel by U.S. Steel Company or approved equal.

F. Tapping Sleeves:

1. Shall be constructed from 304 Stainless Steel; including shell, sidebars, lugs, bolts, nuts, and washers.
2. Gasket shall be full circle and formed from a SBR rubber compounded for water service in accordance with ASTM D 2000 MAA 610.
3. Flange shall be ductile iron or stainless steel AWWA C228; and Class D ANSI 150# flange drilling pattern with gasket ,
4. Shell cutters shall have an outside diameter one-half inch ($\frac{1}{2}$) less than the nominal size of valve or fitting, unless otherwise specified.
5. Approved tapping Sleeves:
 - a. Romac "SST3"
 - b. Mueller H304 Stainless Steel

G. Valve boxes:

1. 5 1/4 inch diameter screw type, No. 564S recommended (or others for varying depth)
2. "WATER" shall be cast in valve box covers
3. Bonnet required for valves 12 inches or larger.

H. Tapping Saddles:

1. Nylon coated, ductile iron, double stainless steel straps
2. Romac 202NS or Mueller DR2S.

I. Corporations:

1. Ball type, CC threaded X flared
2. Ford or Mueller only.

J. Curb Stops:

1. Flared connections
2. Ford or Mueller only.

K. Valve Blocking:

1. Solid concrete blocks, 4-inch x 8-inch x 16-inch minimum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify connections and municipal utility water main size, location, and invert as indicated on Drawings.

3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 BORING

- A. A qualified contractor shall perform boring with proper boring equipment.
- B. Water pipe shall be installed through a steel sleeve under irrigation canals, railroads, creeks, waterways, and other structures designated by the Engineer.
- C. Steel sleeve shall be of Standard Weight, Schedule 30 steel, with a diameter adequate to receive the pipe bells and insulators.
- D. Corrosion resistant coated casing insulators with steel bands and glass reinforced plastic runners shall be installed and centered within the sleeve according to the manufacturer's instructions at the maximum allowed spacing.
- E. Rubber end seals with stainless steel bands, clamps, and screws shall be installed on both ends of the sleeve

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 02324 for Work of this Section.
- B. Minimum support for the pipe shall be directed by the Engineer to meet conditions in the field. No pipe shall be installed when the Engineer has determined that the trench conditions are unsuitable.
- C. Prior to placing concrete for cradles or encasements, temporary supports consisting of concrete blocks shall be used to support the pipe in place. Not more than two supports shall be used for each pipe length, one on either end. Inspection by Engineer is required prior to placement of concrete.
- D. Place bedding material at trench bottom per City of Cañon City Standard Detail W-3, level fill materials under pipe in one continuous layer not less than 4 inches compacted depth up to 6 inches above the top of the pipe; compact to 92 percent, maximum dry density, ASTM D698, Standard Proctor.
- E. Place fill material in accordance with Section 02324.

3.5 INSTALLATION - PIPE

- A. Carefully lower pipe and fittings into trench in such a manner as to prevent damage to the water main materials and protective coatings and linings.
- B. Prevent foreign material from entering pipe or joint space while it is installed. During installation, no debris, tools, clothing, or other materials shall be placed in the pipe. At times when installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or as directed by the Engineer. If water is in trench, the plug shall remain in place until the trench is pumped completely dry.

- C. Maintain separation of water main from sewer piping a minimum of 10 feet. At no time shall a bell or spigot PVC pipe joint be located within 5 feet of the centerline of a sanitary sewer pipe trench.
- D. When water pipeline crosses a sanitary service, perform work in accordance with City of Cañon City Standard Detail W-6. The Contractor shall physically locate the centerline of the existing sewer main and center of a full pipe joint (nominal joint length of 20 linear feet) across the sewer main (+/- 1-foot from the center of the joint). Crossings shall likely require the Contractor to cut and re-bevel the end of the previously laid pipe joint to fit. New water main shall be installed a minimum of 6-inches above the top of the existing sewer main pipe. The water main shall be blocked on both sides of the sewer pipe with concrete blocks resting on undisturbed native soil. Bedding and backfill materials within 3-feet either side of the intersection of water and sewer pipe shall be lightly compacted (less than 95% Standard Proctor density) until the water main is backfilled to approximately 6-inches above the top of the pipe, at which point normal compaction shall begin.
- E. Water mains shall be installed so that a continuous loop is provided for an alternate source of supply where deemed practical by the City.
- F. Water mains shall be placed under traveled portion of roadway if possible. Provide staking for alignment and elevation of water mains a minimum of 50 feet apart and for location of hydrants.
- G. Install pipe with a minimum of 3 1/2 feet and a maximum of 7 feet of cover from top of the pipe to the final finished grade of street. Maintain a minimum of 3 feet of cover over pipe at all times during construction.
- H. If for any reason, minimum and maximum cover cannot be maintained over existing installed water mains or water service lines; the mains and service lines so affected shall be relocated at the expense of the developer/owner.
- I. Mechanical Joint Fittings:
 - 1. Install ductile iron piping and fittings per AWWA C600 and PVC piping and fittings per AWWA 605.
 - 2. All fittings and valves used north of the Arkansas River shall be wrapped/encased with polyethylene jacket per AWWA C105.
 - 3. There shall be a minimum of 18 inches of pipe between all valves and fittings.
 - 4. Remove all oil, grit, excess coating, and foreign material from inside the fitting. Slip the follower gland on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. Place the rubber gasket on the spigot end with the thick edges toward the gland. Push the entire section of pipe forward to seat the spigot in the socket end of the fitting. Press the gasket into place within the socket. Move the follower

gland along the pipe into position for bolting. Insert all the bolts and “finger” tighten nuts. Tighten nuts spaced 180 degrees apart alternately in order to produce an equal pressure on all parts of the gland. Tighten all nuts with a torque limiting wrench according to the following torques:

<u>Bolt Size (inch)</u>	<u>Torque (ft-lb)</u>
5/8	40-60
3/4	60-90
1	70-100
1 1/2	90-120

J. Push-On Joint Pipe:

1. Remove all oil, grit, excess coating, and foreign material from inside of bell and outside of spigot.
2. Flex the circular rubber gasket inward and insert in the recess of the bell. Apply a thin film of gasket lubricant to the inside surface of the gasket and the spigot end of the pipe.
3. Install the spigot end of pipe in bell without letting it contact the ground. Push the joint together. Pipe that is not furnished with a depth mark shall be marked prior to assembly to assure that spigot is installed to the proper depth.
4. Field cut spigot ends shall be filed and ground smooth and angled to resemble the original manufactured end.

K. Water mains shall be designed to be restrained mechanically without the use of thrust blocks when at all possible:

1. Design of number and placement of mechanical joint restraints shall be by a licensed professional engineer.
2. Install “Mega-Lug” fittings or retainer glands on all fittings and valves. Form and place concrete for thrust restraints at elbow or change of direction of pipe main in addition to mechanical restraints only at the Engineer’s direction or as shown on Drawings.
3. At a minimum, install a bell joint restraint when a bell end is within 14 feet of a fitting or valve. Also, the last section of pipe at a dead end shall have a bell joint restraint, in addition to adequate blocking, if the section is less than 14 feet. Pipe sizes larger than 8 inch diameter will have different requirements.
4. A closed valve that will be pressure tested against shall be considered as a dead end. Payment for Bell joint restraints shall be incidental to the cost of the sleeve or pipe installed.

- 5. Locking gaskets (if available) may be substituted for bell joint restraints where applicable with the Engineer's approval.
- L. Route pipe in straight line at a constant depth. When pipe is laid on a grade of 10 percent or greater, the laying shall start at the lower elevation and shall proceed uphill with the bell ends of the pipe uphill.
- M. Install pipe to allow for expansion and contraction without stressing pipe or joints per pipe specifications.
- N. Concrete Thrust Restraints (when applicable):
 - 1. Concrete thrust restraints shall be necessary when connecting to existing water mains.
 - 2. Form and place concrete for pipe thrust restraints at change of pipe direction when required by Engineer or not otherwise restrained.
 - 3. Place concrete to permit full access to pipe and pipe accessories against undisturbed trench wall.
 - 4. Use plastic "bond breaker" between concrete restraint and pipe or fitting.
 - 5. Allow concrete restraint to cure for 12 hours before continuing backfill operations.
 - 6. Per City of Cañon City Standard Detail W-4.
- O. Install trace wire continuously to the top of PVC pipe taped at intervals to keep it on top of pipe during backfill operations; coordinate with Section 02324. Bring trace wire to surface at every hydrant location or at locations indicated by Engineer.
- P. Backfill trench in accordance with Section 02324 and per City of Cañon City Standard Detail W-3.

3.6 INSTALLATION - VALVES AND HYDRANTS

- A. Install valves at locations indicated on Drawings. Install a minimum of one valve every two blocks in residential areas and every block in business or high-density areas.
- B. Set valves on blocking placed on subsoil.
 - 1. Valves up to and including 8 inch: install solid concrete blocks, 4-inch x 8-inch x 16-inch minimum.
 - 2. Valves 10 & 12 inch: blocks under 10-inch and 12-inch butterfly valves shall be pre-cast concrete 3-foot wide X 3-foot wide and 6-inches thick. The blocks shall be constructed with concrete of a compressive strength of

3500 psi at 28 days and reinforcement of #4, grade 40 deformed bar at 12-inch o.c. each way. Smaller blocks will be stacked tightly onto the pre-cast block up to the bottom of the valve operator nut of all butterfly valves. Flow-fill in addition to blocking shall be installed a minimum of 8 inches under valve up to the spring line of the pipe.

3. Valves greater than 12 inch: blocks under valves shall be pre-cast concrete 4-foot wide X 4-foot wide and 6-inches thick. The blocks shall be constructed with concrete of a compressive strength of 3500 psi at 28 days and reinforcement of #4, grade 40 deformed bar at 12-inch o.c. each way. Flow-fill in addition to blocking shall be installed a minimum of 8 inches under valve up to the spring line of the pipe.
4. The Engineer may specify for valves of all sizes cast-in-place concrete blocking.

- C. Center and plumb valve box over valve. Set box cover flush with finished grade.
- D. Install hydrants at locations indicated on Plans and as required by the Fire District.
- E. When a drainage ditch deeper than 2 feet exists between a hydrant and the roadway, a culvert of appropriate size of at least 10 feet in length shall be installed centered on the hydrant per Specifications.
- F. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- G. Set hydrants to grade, with nozzles at least 16 inches above ground.
- H. Connect hydrant to water main with a 6-inch branch line (using the least amount of joints possible) controlled by an independent 6-inch gate valve. Locate control valve per Detail.
- I. Provide drainage pit 12 inches square by 12 inches deep (in clay or other impervious soil, pit shall be 36 inches square by 36 inches deep) filled with 1 ½ inch washed gravel with a waterproof barrier on top between pit and backfill. Encase elbow of hydrant in gravel to 12 inches above drain opening.
- J. Install hydrant and blow-off assemblies in accordance with City of Cañon City Standard Details W-1 and W-2. A hydrant or blow-off assembly must be installed at all dead ends on water mains.

3.7 INSTALLATION - METERS

- A. Install Work in accordance with City of Cañon City standards and Standard Details W-5A, W-5B, and W-5C.

3.8 SERVICE CONNECTIONS

- A. City of Cañon City Water Department personnel will perform the installation of taps on the water main. All required shoring and safety measures shall be in place prior to City personnel entering the trench to make the taps. The Contractor shall perform excavation, backfill, compaction, and maintenance of trenches for the water main taps and service lines.
- B. Where it is required to reconnect the existing tap to the new water main, the Contractor shall extend the existing service line to the new main. Where the Contractor encounters existing galvanized steel or lead pipe water service lines, the Contractor shall completely replace such lines with type K copper tubing of equal diameter or larger (3/4 inch minimum). This work shall include miscellaneous fittings for connection to the existing curb stop or water meter, or coupling connection at the edge of the street R-O-W, as approved by the Engineer.
- C. No service line splices are be allowed to be installed under a newly constructed, reconstructed, or over-layed street.
- D. Service lines shall be placed with a minimum of 3 1/2 feet and a maximum of 7 feet of cover from the top of line to the final finished grade of street.
- E. If for any reason, minimum and maximum cover cannot be maintained over existing installed water mains or water service lines; the mains and service lines so affected shall be relocated at the expense of the developer/owner.
- F. The Contractor is encouraged to use small diameter boring equipment wherever practical for installation of service lines.
- G. Taps will never be made on PVC water mains until such lines have been isolated and depressurized.
- H. Tapping saddles are not required on ductile iron water mains.
- I. Taps will not be made until the water main has been tested and accepted.
- J. Taps will be placed in the top quadrant of the water main at a 45 degree angle no closer than 18 inches to another tap, fitting, valve, or a spigot/bell end of pipe.
- K. A minimum of 1 foot of new pipe must be installed on the outside of a new pit on the customer side.
- L. Saddle nuts shall be tightened evenly with the following torque:

<u>Bolt Size (inch)</u>	<u>Torque (ft-lb)</u>
5/16	10-12
1/2	25-30
5/8	50-60

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system per AWWA C651 before placing new water main in service.
- B. Chlorine residual shall not be less than 50 ppm in the water after 24 hours standing in the pipe. The line shall be re-chlorinated and re-tested until the residual requirement is met.
- C. All valves or other appurtenances shall be operated while the line is filled with the chlorination agent.

3.10 FILLING AND FLUSHING DOMESTIC WATER PIPING SYSTEM

- A. It may be necessary to install temporary blow-offs to facilitate blowing off and disinfecting the new water mains before the mains can be tied into the City water system. The Contractor shall furnish all materials, labor, and equipment to install and remove the temporary blow-offs. For each blow-off, the Contractor shall install the required assembly per Standard Detail W-2 or an approved method and assembly approved by the Engineer (as the blow-off is temporary).
- B. Taps shall be made to expel air in locations at high points where no hydrant or blow-off is installed. The Engineer shall specify the size and number of taps. Such taps shall be plugged when testing is complete. Permanent high points in the water main shall have air and vacuum valves and vaults installed.
- C. All dead end portions of the main that are to be tied into existing mains after completion shall be fitted with temporary blocking of sufficient strength to withstand required test pressures.
- D. Filling and flushing of mains shall be performed by City of Cañon City Water Department personnel.
- E. All backfill operations shall be complete and all permanent concrete thrust blocks in place for a minimum of 24 hours prior to any filling or flushing operations.
- F. Following chlorination, all treated water shall be flushed from the pipeline until, upon test by City personnel, the water is proved comparable in quality to the water served to the public from the existing system.

3.11 EXISTING MAIN ABANDONMENT

- A. Existing water mains indicated by the Engineer shall be abandoned as directed.
- B. Existing water valves shall be removed if necessary to install the new main or can be left in place. Valves left in place shall have their valve boxes removed and the resulting void filled with flow fill.

- C. Existing fire hydrants to be abandoned shall be removed as a whole assembly by disconnecting it at the lateral without damage to the assembly or surrounding structures and landscape. The hydrant shall be salvaged by delivering it to the Water Department yard if directed, otherwise shall be disposed of at Contractor's expense.

3.12 FIELD QUALITY CONTROL

- A. Engineer and City personnel will perform Field inspecting and testing unless otherwise indicated. Contractor shall have a Certified Class 3 Water Distribution Technician on site any time any existing water main is cut open. The Contractor shall be billed for this service if provided by City personnel.
- B. A coliform bacteria sample shall be taken by City personnel after flushing is complete and delivered by the Contractor to a certified laboratory. Pressure testing shall be scheduled upon receipt of a negative coliform bacteria test result.
- C. Pressure test system:
 1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, the City will conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600 & AWWA C605.
 2. The Contractor shall accept full responsibility for testing against any existing valves, fire hydrants, or other appurtenances.
 3. The City will provide equipment required to perform leakage and hydrostatic pressure tests.
 4. Test Pressure: Not less than 150 psi or 1.5 times in excess of maximum static pressure, whichever is greater.
 5. Conduct hydrostatic test for at least two-hour duration.
 6. Pressure shall not vary by more than 5 psi during the hydrostatic pressure test.
 7. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks installed and plug pipe openings.
 8. The City personnel will slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.

9. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
10. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$$L = \frac{ND^2}{7,400}P$$

L = allowable, in gallons per hour
N = number of joints in section to be tested
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in pounds per square inch (gauge)

11. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

- D. Compaction testing for bedding and backfill in accordance with Section 02324.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. The pipeline may be placed in operation after all required cleaning, testing, and inspection have been completed and written permission has been granted by the Engineer. Final acceptance of the pipeline system shall take place a period of 2 years from the date written permission is given. During this 2 year period, any defects in the system resulting from defective materials, poor workmanship, or any other cause attributable to the Contractor shall be corrected at his expense and to the satisfaction of the Engineer. Should the Contractor fail to respond within 48 hours after written notification of any deficiency, the City may complete the work and bill the Contractor. In emergency situations, the City shall take whatever steps necessary to correct the problem.

END OF SECTION

SECTION 02630

STORM DRAINAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm drainage piping including irrigation lines within City rights of way.
2. Accessories.
3. Catch basins.
4. Cleanouts.
5. Manholes.
6. Head Walls.
7. Bedding and cover materials.

B. Related Sections:

1. Section 02060 – Aggregate.
2. Section 02324 – Trenching.
3. Section 03300 - Cast-in-Place Concrete.

1.2 REFERENCES

- A. City of Cañon City Grading, Erosion, & Sediment (GESC) Plan Manual.
- B. Urban Drainage and Flood Control District (UDFCD) Criteria Manual.
- C. City of Cañon City Illicit Discharge Detection & Elimination (IDDE) Manual.
- D. Colorado Department of Transportation:
 1. 2017 CDOT Standard Specifications for Road and Bridge Construction.
 2. CDOT M & S Standards 2012.
- E. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
3. ACI 305 - Hot Weather Concreting.
4. ACI 306 - Cold Weather Concreting.
5. ACI 318 - Building Code Requirements for Structural Concrete.

F. ACI 306 - Cold Weather Concreting.

G. Concrete Reinforcing Steel Institute:

1. CRSI Manual of Standard Practice.

H. American Society for Testing and Materials:

1. ASTM C76- Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
2. ASTM C443- Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
3. ASTM C478- Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
4. ASTM C923- Standard Specification for resilient Connectors Between Reinforced Concrete Manhole Structures.
5. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
6. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
7. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

1.3 SUBMITTALS

- A. Product Data: Submit data indicating pipe, pipe accessories, and shop drawings for inlet boxes, manhole covers, steps, and grates.
- B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with 2017 CDOT Standard Specifications for Road and Bridge Construction, CDOT M&S Standards 2012, and City of Cañon City Standards.

- B. Maintain one copy of each document on site.
- C. Video Inspection, at Engineer's discretion, shall be required per Engineer's inspection criteria for all new storm sewer installed.

1.6 COORDINATION

- A. Design the Work to incorporate existing storm sewers systems and City's Master Drainage Plan.
- B. All erosion, sediment, and illicit discharge control shall be in accordance with applicable Federal, State, and City regulations including the City of Cañon City GESC & IDDE Manuals.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

- A. Reinforced Concrete Pipe: ASTM C76; mesh or bar reinforcement; inside nominal diameter of 12-inches minimum, bell and spigot ends.
 - 1. Fittings: Reinforced concrete.
 - 2. Joints: ASTM C443, rubber compression gasket
- B. Corrugated Steel Pipe: Nominal diameter of 12-inches minimum, 12 gauge; helical lock seam; galvanized steel.
 - 1. Fittings: Corrugated steel.
 - 2. Joints: Corrugated steel pipe coupling bands, galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.
- C. Plastic Pipe: ASTM D3350, High Density Polyethylene (HDPE) material, A.D.S. N-12, corrugated, smooth wall interior, inside nominal diameters of 12-inches minimum, bell and spigot style ends.
 - 1. Fittings: Same material and manufacturer.
 - 2. Joints: rubber o-ring gasket, silt-tight.

2.2 ACCESSORIES

- A. Pipe and Structure Grout: Specified in Section 03300.
- B. Rip Rap Grout: 70 percent sand, 30 percent 3/8 inch aggregate, 6-9 inch slump, 5-8 percent entrained air, minimum compressive strength 3500 psi.

C. Reinforcement: Specified in Section 03300.

2.3 CATCH BASINS/INLETS AND CLEAN OUTS

A. Inlet Box & Grate:

1. Construction: Pre-cast, HS-20 loading.
2. Grate & Frame: HS-20 loading – heavy duty, bicycle safe.
3. Nominal Minimum Inside Dimension: 2 x 2 foot.

B. Type R Inlet:

1. Construction: Pre-cast, according to CDOT M & S Standards 2012. Nominal Minimum Inside Dimension: 3.5 x 3.5 foot.

C. Concrete Clean Out:

1. Construction: Cast-in-place, HS-20 loading.
2. Lid: Approved 3/8" inch steel cut to fit.
3. Nominal Minimum Inside Diameter: 2 x 2 foot.

2.4 MANHOLE

A. Construction: Pre-cast, ASTM C478, HS-20 loading.

B. Lid: Neenah R-1706-1.

C. Steps: Aluminum or gray iron and cast in place when concrete is cast and be 9 1/4 inch x 12 1/2 inch. As an alternate, steps may be polypropylene (M.A. Industries PS2-PFS or equal) and can be press fit into preformed holes.

D. Nominal Minimum Inside Diameter: for manholes 6 feet or less in depth - 4 foot, for manholes greater than 6 feet in depth - 6 foot.

E. Manhole Sections: Reinforced pre-cast concrete as specified in Drawings in accordance with ASTM C478 with gaskets in accordance with ASTM C923.

2.5 HEAD WALL

A. Concrete: Specified in Section 03300.

B. Reinforcement: Specified in Section 03300.

2.6 PRE-CAST CONCRETE

A. Provide all units shown in Plans and as needed for a complete and proper installation.

B. Design Criteria- Design units in accordance with:

1. ACI 304 and 318.
2. CRSI Manual of Standard Practice.
3. Applicable ASTM Standards.

2.7 BEDDING AND COVER MATERIALS

- A. Bedding: Flow Fill as specified in Section 02320 or uniformly graded rock wrapped in drainage fabric or Fill Type Class 6 as specified in Section 02060, see City of Cañon City Standard Detail W-3.
- B. Cover and Backfill: Fill Type Class 6 as specified in Section 02060 or Flow Fill as specified in Section 02320.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify trench cut and excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

- A. Remove old culvert, and related debris and dispose of.
- B. Hand trim excavations to required elevations. Correct over excavation with material as directed by Engineer.
- C. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 02324 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Per City of Cañon City Standard Detail.
- B. Install pipe, fittings, and accessories as indicated in accordance with ASTM D2321 with the exception that minimum cover shall be 1 foot. Seal joints watertight.
- C. Place pipe on minimum 4 inch deep bed of Type Class 6 aggregate.
- D. Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8 inch in 10 feet.
- E. Install aggregate at sides and over top of pipe as indicated. Install top cover to minimum compacted thickness of 12 inches, compact to 97 percent according to ASTM D698.

3.5 INSTALLATION - CATCH BASINS, CLEANOUTS, AND MANHOLES

- A. Lift pre-cast structures at lifting points designated by manufacturer.
- B. When lowering manholes and drainage structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- C. Form bottom of excavation clean and smooth to correct elevation, install and compact bedding material. Flow fill can be used in place of bedding material, as specified in Section 02320.

- D. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections according Section 03300.
- E. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- F. Set pre-cast structures bearing firmly and fully on bedding.
- G. Move pre-cast boxes into position in a manner that is not detrimental to the construction of the concrete or reinforcement.
- H. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
- I. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- J. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- K. Mount grate/lid and frame level in grout, secured to top section to elevation indicated.
- L. Install aggregate at sides and around box as indicated on Drawings. Compact to 97 percent according to ASTM D698.
- M. Grout flow line inverts and pipe connections the full wall width.
- N. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- O. Pipes stubbed into boxes shall be saw-cut to length such that ends do not protrude into the interior of the box in excess of 4 inches.
- P. Manholes shall be placed a minimum of every 500 feet and at connections under the traveled roadway.
- Q. Cleanouts shall be placed a minimum of every 50 feet and at connections outside the traveled roadway.

3.6 HEAD WALL

- A. Install required reinforcement as indicated.
- B. Form and place concrete to the dimensions indicated according to Section 03300.

3.7 FIELD QUALITY CONTROL

- A. Request inspection prior to and immediately after placing aggregate cover over pipe.
- B. Compaction Testing: In accordance with ASTM D698.
- C. When tests indicate work does not meet specified requirements, remove work, replace and retest.

3.8 PROTECTION OF FINISHED WORK

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
 - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
 - 2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION

SECTION 02721
AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate base course.

B. Related Sections:

1. Section 02060 – Aggregate Materials.
2. Section 02315 – Excavation.
3. Section 02740 – Flexible Pavement.
4. Section 02750 – Rigid Pavement.
5. Section 03300 – Cast-in-Place Concrete.

1.2 REFERENCES

A. Colorado Department of Transportation:

1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

B. American Society for Testing and Materials:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN·m/m³)).

1.3 SUBMITTALS

A. Materials Source: Submit name of imported materials suppliers.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Perform work in accordance with 2017CDOT Standard Specifications for Road and Bridge Construction and City of Cañon City standard.

C. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base Course: Type Class 6 as specified in Section 02060 or as specified by design engineer and approved by the City.

B. Geotextile Fabric:

1. Shall be a non-woven, spun-bonded, continuous filament, polypropylene geotextile fabric meeting the following minimum standards:

<i>TEST METHOD</i>	<i>PROPERTY</i>	<i>MINIMUM VALUE</i>
ASTM D-4751	Apparent Opening Size	140 US Sieve
ASTM D-4491	Permittivity	0.10 Sec ⁻¹
ASTM D-4491	Water Flow Rate	15 g/min/sf
ASTM D-4632	Grab Tensile Strength	240 lbs
ASTM D-4533	Trapezoidal Tear	79 lbs
ASTM D-4632	Elongation @ Break	50%

2. Geotextile fabric shall be approved by the Engineer. Additionally, other physical properties may be used by the Engineer to evaluate the geotextile including, but not limited to, CBR puncture testing, Mullen Burst testing, permeability, and puncture strength.

3. Approved Fabrics

- Typar 3601G.
- US Fabric SF65

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Scarify sub grade 6-inches minimum and compact to 97 percent Standard Proctor.

B. Compact disturbed load-bearing soil to 97 percent Standard Proctor prior to placement of fabric or base course material.

C. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

- D. Do not place fill on soft, muddy, or frozen surfaces.

3.3 GEOTEXTILE FABRIC PLACEMENT

- A. Install fabric on native sub grade below aggregate base course.
- B. The fabric shall be unrolled parallel to the alignment of the roadway.
- C. Folds and wrinkles not associated with roadway curves shall be removed prior to covering fabric.
- D. The fabric shall be pinned, stapled, or secured in place by small piles of fill prior to covering to prevent movement.
- E. Mechanical equipment shall not be allowed to operate on the surface to the fabric.
- F. Minimum overlap along fabric seams shall be as specified by the design engineer but not less than 1 foot longitudinally and 3 feet transversally.

3.4 AGGREGATE PLACEMENT

- A. Place aggregate in maximum 8 inch layers and compact to 97 percent, maximum dry density, ASTM D698, Standard Proctor. Lift size may be increased when it is demonstrated that compaction requirements can be met using other methods. The Engineer will make final determination on the thickness of each lift in the field.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Maintain optimum moisture content, plus or minus (\pm) 2 percent, of fill materials to attain required compaction density.
- D. Use adequate hand operated mechanical tamping equipment in areas inaccessible to larger compaction equipment.

3.5 TOLERANCES

- A. Maximum Variation From Thickness: 1/2 inch.
- B. Maximum Variation From Elevation: 1/4 inch.

3.6 FIELD QUALITY CONTROL

- A. Compaction Testing: In accordance with ASTM D698.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest
- C. Compaction Testing for Bedding and Backfill:

1. Contractor is required to hire an independent, licensed engineer experienced in soil analysis and evaluation to perform required compaction tests in accordance with ASTM D698. Copies of all Proctor curves and test results showing exact location of sample collection and test sites must be furnished to Engineer. Engineer shall be informed prior to testing and he may designate areas of testing.
2. Performed by City personnel or Contractor at option of Engineer in accordance with ASTM D698.
3. Testing is to be done at various elevations in trench, which may require excavation by Contractor after backfill is installed.
4. Frequency of Compaction Tests will be specified by Engineer in field but shall be no less than every 200 feet at every 1 foot of depth of the backfill or anytime the means and methods of compaction change.
5. Testing shall use the Standard Proctor method. Alternatives such as Modified Proctor or Relative Density based on necessity due to material type may be used with the permission of the Engineer so long as the necessary conversion data, testing, and information has been completed and submitted prior commencement of the work.

3.7 SCHEDULES

- A. Under Curb and Gutter, Cross Pans, Driveway Aprons, and Asphalt Patch:
 1. Compact placed aggregate materials uniformly, 6 inches thick, over sub grade.
 2. Exclude Class 6 base course material installed for all curb & gutter tied to concrete pavement. Subgrade treatment for the attached curb & gutter shall be the same as for the concrete pavement.
 3. Design engineer shall verify minimum requirements are adequate based on site conditions and propose changes to Engineer accordingly for approval.
- B. Under Sidewalk:
 1. Compact placed aggregate materials uniformly, 4 inches thick, over sub grade.
 2. Compact placed aggregate materials uniformly, 6 inches thick in driveways and under sidewalk adjacent to mountable curb and gutter, over sub grade.
 3. Design engineer shall verify minimum requirements are adequate based on site conditions and propose necessary changes to Engineer accordingly for approval.
- C. Under Asphalt Pavement:

1. Compact placed aggregate materials uniformly, 8 inches thick minimum, over geotextile fabric.
2. Design engineer shall verify minimum requirements are adequate based on site conditions and propose necessary changes to Engineer accordingly for approval.

D. Under Concrete Pavement:

1. Compact placed aggregate materials uniformly, to thickness indicated by Engineer if required, over subgrade.
2. Design engineer shall verify minimum requirements are adequate based on site conditions and propose necessary changes to Engineer accordingly for approval.

END OF SECTION

SECTION 02740

FLEXIBLE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot Mix Asphalt (HMA) pavement.
2. Hot Mix Asphalt (HMA) pavement overlay.
3. Infrared patch repair.

B. Related Sections:

1. Section 02315 – Excavation.
2. Section 02721 – Aggregate Base Course.

1.2 REFERENCES

A. Colorado Department of Transportation:

1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

B. American Society for Testing and Materials:

1. ASTM D276- Standard Test Methods for Identification of Fibers in Textiles.
2. ASTM D3776- Standard Test Method for Mass Unit Area (Weight) of Fabric.
3. ASTM D4632- Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

C. American Association of State Highway and Transportation Officials:

1. AASHTO M140- Standard Specification for Emulsified Asphalt.
2. AASHTO M208- Standard Specification for Cationic Emulsified Asphalt.

1.3 PERFORMANCE REQUIREMENTS

A. Paving: Designed for residential streets, 92-96 percent maximum density.

1.4 SUBMITTALS

- A. Product Data: Submit product information and mix design.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with 2017 CDOT Standard Specifications for Road and Bridge Construction and City of Cañon City Standards.
- B. Mixing Plant: Conform to 2017 CDOT Standard Specifications for Road and Bridge Construction.
- C. Obtain materials from same source throughout.
- D. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when ambient air or base surface temperature is less than the temperatures indicated in Table 401-3, CDOT Standard Specifications for Road and Bridge Construction.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Hot Mix Asphalt Pavement (HMA): Asphaltic cement binder- PG 64-22, uniformly mixed, well-graded aggregate- Grading SX for collector or arterial streets as determined by Engineer, $\frac{1}{2}$ Inch or Grading S for local streets, 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 401, 403, 702, and 703.
- B. Aggregate for Wearing Course Mix: $\frac{1}{2}$ inch or Grading S maximum well-graded aggregate as determined by Engineer.
- C. Tack Coat: Emulsified asphalt with the same asphaltic cement as pavement mix, SSI or equal. In accordance with requirements of AASHTO M140 or M208.
- D. Paving Fabric: Nonwoven geotextile, grab strength of 100 lbs (450 N), 4.2 oz/yd^2 (140 g/m^2), ultimate elongation of 50%, and melting point at 300 degrees F (149 degrees C). In accordance with requirements of ASTM D 4632, 3776, & 276.

2.2 SOURCE QUALITY CONTROL AND TESTS

- A. Submit proposed mix design with aggregate gradation and mix proportioning for review prior to beginning of Work. Design shall not be dated prior than three years before work start date.
- B. Thickness and density shall be determined by calculating the average of the results of core samples taken by an independent testing laboratory. At least one core sample shall be taken per 200 linear feet of street paved.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify compacted aggregate base course is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Verify manhole frames and valve boxes are installed in correct position and elevation.

3.2 BASE COURSE

- A. Fine grade and compact aggregate base course to maximum material density per Section 2721.

3.3 PREPARATION – EXISTING PAVEMENT

- A. Remove additional pavement to a painted lane stripe, gutter pan, an existing pavement patch, or an edge of the pavement if such street feature is within the two feet of the second cut.
- B. Existing adjacent pavement shall be cut square and vertical after placement of base course and prior to placement of new pavement. Milled edges are acceptable so long as the milled face is vertical and the edge is generally straight with a deviation of +/- 1 inch for every 10 feet.
- C. Existing pavement shall be rotomilled where indicated and cleaned free of all dirt, water, oil, dust, vegetation, and debris prior to placement of overlay.

3.4 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 407.
- B. Apply tack coat on all adjacent asphalt and concrete contact surfaces at uniform rate.
- C. Apply tack coat to contact surfaces of curbs, gutters, and cross-pans.
- D. Coat surfaces of manhole and valve box lids with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.
- E. Apply tack coat on all asphalt, gravel base course when curb and gutter is not present, and surfaces that are to be overlayed at uniform rate. Residual coverage shall be between 0.15 to 0.30 gallons/yd². The spray width of the tack coat shall be 6 inches greater than the fabric width. Additional tack shall be applied at fabric joints.

3.5 PREPARATION – OVERLAY PAVING FABRIC

- A. Paving fabric shall be laid with automated lay-down equipment where physically possible.
- B. The paving fabric shall be free of wrinkles and air pockets.
- C. Paving fabric shall be installed after the tack coat “breaks” but while it is still soft.
- D. Transverse and longitudinal joints should be overlapped at least 4 inches with the top flap in the direction of the paving

3.6 PLACING ASPHALT PAVEMENT

- A. Paving shall begin immediately after fabric lay down.
- B. Install Work in accordance with 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 401 & 403.
- C. The pavement shall be installed in lifts not exceeding 3 inches in compacted depth.
- D. Place asphalt within 24 hours of applying primer or tack coat.
- E. Place asphalt with a self contained, self-propelled paving machine of sufficient width. Hand placement, without separation, is permissible for small patches.
- F. Large surface aggregate shall be raked and struck off to leave a smooth, finely graded surface.

- G. The asphalt material shall be placed to the grade and thickness required for compaction after rolling such that the final grade is $\frac{1}{4}$ inch above all adjacent asphalt and concrete edges.
- H. Compact pavement by rolling to 92 percent or greater density using the number, weight, and type of rollers required providing the maximum density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- I. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.7 INFRARED PATCH REPAIR

- A. Equipment:
 - 1. Pavement Restoration Vehicle (PRV) shall be a truck mounted, self contained pavement maintenance heating system equipped with a fuel system and a heated chamber capable of maintaining the fresh asphalt at a temperature of 275 degrees or higher.
 - 2. The adjustable height infrared heating unit may be truck or trailer mounted to the PRV. The unit shall be equipped with a chamber or chambers capable of heating the existing bituminous pavement to a workable condition without oxidation or burning. There shall be no flame in direct contact with the existing bituminous surface.
 - 3. Compaction shall be achieved with a self-propelled vibratory roller of sufficient size to provide complete compaction to the full heated depth of the patched area.
- B. Materials:
 - 1. New bituminous material for patching shall conform to the specifications.
 - 2. A minimum of 20 percent of new material shall be added to all patched areas.
- C. Construction:
 - 1. Area shall be swept clean prior to setting infrared heating unit.
 - 2. The infrared heating unit shall be lowered to within 6 inches to 9 inches of the existing pavement. The heated area must extend at least 6 inches outside the area of repair. Apply heat to the area continuously until the surface is heated to a depth of approximately 2 inches. When the blacktop can be worked with a rake, proper heat penetration has been achieved.
 - 3. If it is windy, metal shields will be placed against three sides. (This is not to trap heat but to block the wind and provide for an even surface).

4. Etch an outline of the perimeter of the repair area with the back of a rake at least 3 inches beyond the edges of the repair area. Scarify the existing bituminous surface within the repair area to the full heated depth.
5. Remove enough existing bituminous material (as required by adjacent grades) to allow for the addition of 20 percent (approx. 1 inch of depth) new bituminous mix to achieve a blend of 20 percent new/80 percent existing heated material within the area of the patch. Reclamite rejuvenating agent will be sprayed evenly onto existing surface material.
6. Reshape patched area by hand with rake and lute to match grade of existing adjacent pavement.
7. Outside perimeter will be compacted as soon as possible to ensure thermal bonding. Compact new paving with the specified roller to the full depth of the heated patch. Compacted surface shall be smooth, in texture and shall have positive drainage matching the slope of the existing adjacent pavement.

3.8 TOLERANCES

- A. Flatness: Maximum variation of 3/16 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/2 inch.
- C. Variation from Indicated Elevation: Within 1/4 inch.

3.9 PROTECTION OF FINISHED WORK

- A. Immediately after placement, protect pavement from mechanical injury.

3.10 SCHEDULES

- A. HMA patch: Single course of 4 inch minimum compacted thickness.
- B. HMA pavement: Single course of 3 inch minimum compacted thickness. Design engineer shall verify minimum requirements are adequate based on site conditions and propose necessary changes to Engineer accordingly for approval.
- C. HMA pavement overlay: Single course of 2 inch minimum compacted thickness.
- D. Street widths shall be as indicated in the Major Thoroughfare Plan or as otherwise indicated by Engineer.
- E. Streets having no outlet shall be no longer than 500 feet and shall end in a cul-de-sac with a minimum radius of 45 feet center to curb flow-line.

END OF SECTION

SECTION 02750

RIGID PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Portland Cement Concrete (PCC) pavement.

B. Related Sections:

1. Section 02315 – Excavation.
2. Section 02721 – Aggregate Base Course.
3. Section 03300 – Cast-in-Place Concrete.

1.2 REFERENCES

A. Colorado Department of Transportation:

1. 2017 CDOT Standard Specifications for Road and Bridge Construction.

B. American Concrete Pavement Association (ACPA):

1. Municipal Concrete Pavement Manual.

C. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
3. ACI 305 - Hot Weather Concreting.
4. ACI 306 - Cold Weather Concreting.
5. ACI 318 - Building Code Requirements for Structural Concrete.

D. American Association of State Highway and Transportation Officials:

1. AASHTO M31- Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement .

E. American Society for Testing and Materials:

1. ASTM C39- Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. ASTM C78- Standard Test Method for Flexural Strength of Concrete.
3. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
4. ASTM C1107- Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
5. ASTM D5893- Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.3 PERFORMANCE REQUIREMENTS

- A. Paving: Designed for parking, residential streets, and main street arteries.
- B. Concrete Pavement: Required compressive strength shall be 4200 psi at 28 days per ASTM C39. Required flexural strength (modulus of rupture) shall be 600 psi at 28 days per ASTM C78, third-point loading.
- C. Surface Tolerances: Surface deviation shall not be in excess of 3/16 inch in 10 feet.
- D. Thickness Tolerances: Thickness shall not be 1/2 inch more or less than that specified for an average of no more than 30 percent of the area of the slab.
- E. Elevation Tolerances: Variation from indicated elevation within 1/4 inch.
- F. Cracking: All cracking shall occur within cut or hand tooled control joints.

1.4 SUBMITTALS

- A. Product Data: Submit data on joint filler, admixtures, and curing compounds.
- B. Concrete Mix Design: Submit current mix design with aggregate gradation, cylinder compression test results, and mix proportioning prior to beginning work. Design shall not be dated prior to three years before start date, which is indicated on the Notice to Proceed.
- C. Delivery Tickets: Submit concrete delivery tickets, indicating mix I.D. number, time water was added, elapsed time from when water was added and concrete placed, and amount of additional water added.
- D. Work Schedule: Submit schedule to allow at least 24 hours notice of work to be performed or concrete poured to allow for appropriate schedules for testing and inspection.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI, ACPA, Section 03300, and the City of Cañon City standards.
- B. Maintain one copy of each document on site.
- C. Obtain cementitious and aggregate materials from same source throughout.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F unless approved by Engineer, or surface is wet or frozen.
- B. Concrete placed in cold weather conditions shall be done in accordance with ACI 306.
- C. Conform to ACI 305 when concreting during hot weather.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Form Materials: As specified in Section 03300.

2.2 REINFORCEMENT

- A. Reinforcing Joint Steel: AASHTO M31; 40 ksi yield grade; #4; deformed billet steel bars; 24 inches long.
- B. Reinforcing (Transverse Construction Joint) Steel: AASHTO M31; 40 ksi yield grade; #5; smooth billet steel bars; 12 inches long; lubricated one end.

2.3 CONCRETE MATERIALS

- A. Concrete Materials: As specified in Section 03300

2.4 ACCESSORIES

- A. Bonding Agent: Two component, moisture insensitive epoxy.
- B. Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 in 48 hours and 7,000 psi in 28 days.
- C. Curing Compound: membrane forming, ASTM C309.
- D. Joint Sealers: Crafco Roadsaver Silicone (SL) Sealant Part No. 34903 installed with approved backer rod, meeting requirements of ASTM D5893.

2.5 CONCRETE MIX

- A. Concrete Mix and Delivery: As specified in Section 03300.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Per Section 03300.

3.2 SUBBASE

- A. Aggregate Subbase: Fine grade and compact to 97% Standard Proctor.

3.3 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole, catch basin, and valve box frames with oil to prevent bond with concrete pavement.
- C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Only one half of the street width shall be formed and placed at a time, with a longitudinal construction joint in the center of the street.

3.5 REINFORCEMENT

- A. Place reinforcement as indicated. Do not deviate from required position.
- B. Place reinforcement to achieve pavement and curb alignment as detailed.
- C. Place, support, and secure reinforcement against displacement.
- D. Provide doweled joints as indicated at interruptions of concrete (construction joint), at curb and gutter, and all longitudinal joints.

3.6 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301 and 304, and ACPA Municipal Concrete Pavement Manual.
- B. Place concrete using mechanical screed, slipform or form paving type equipment, which will strike off, consolidate, and finish the pavement to the required cross section. A minimum 10 foot bull float or “bump cutter” shall be used following any paving equipment.

- C. Ensure reinforcement, inserts, embedded parts, formed joints and manhole or valve box lids are not disturbed during concrete placement.
- D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Use a vibrator of proper speed and size to properly consolidate the concrete when screeding by hand or using a bridge deck finisher.

3.7 JOINTS

- A. Place joints at 12 foot intervals maximum both directions. Align curb, gutter, and sidewalk joints when at all possible.
- B. Joints shall be constructed by sawing concrete after it has set or by hand forming in the plastic concrete with an appropriate jointing tool. The tranverse joints at 48 foot intervals shall be hand tooled before the concrete has set.
- C. Sawing shall begin as soon as the concrete has hardened sufficiently as to not allow raveling and before uncontrolled cracking occurs. Sawing shall take place regardless of time of day or weather conditions to assure proper joints.
- D. Saw cut contraction joints to the width and depth indicated.

3.8 FINISHING

- A. Paving: Heavy broom.
- B. Direction of Texturing: Transverse to pavement direction.

3.9 JOINT SEALING

- A. Proper cleaning and preparation of joints shall be completed prior to sealing operations, including but not limited to sandblasting per the sealant manufacturer's instructions. A clean joint shall be dry and have no visible signs of residual sealant or debris on the joint face, and will leave no residual cement powder or dust on your finger after rubbing the joint face.
- B. All joints, including between pavement and curb and gutter, shall be sealed with joint sealant and backer rod.
- C. Do not install sealant when temperature is below the dew point. If rain or other inclement weather occurs during joint preparation or sealing, all operations should cease and sufficient time must be allowed so that the joints are dry prior to starting or continuing the sealing operation.

D. A field adhesion test must be performed on a test section as follows:

1. Make a knife cut horizontally from one side of the joint to the other.
2. Make two vertical cuts (from horizontal cut) approximately 3-inches long, at both sides of the joint.
3. Place a mark 1-inch from the point where the 3-inch cuts stop.
4. Grasp the 2-inch piece of sealant firmly just beyond the 1-inch mark and pull at a 90-degree angle.
5. If dissimilar substrates are being sealed, check the adhesion of sealant to each substrate separately. This is accomplished by extending the vertical cut along one side of the joint, checking adhesion to the opposite side and then repeating for the other surface.
6. The adhesion test is considered passing when 1-inch of sealant is elongated to 4-inches without bond loss.

3.10 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed in accordance with ACI 301.
- B. Provide free access to Work and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- D. Tests of concrete may be performed at random to ensure conformance with specified requirements. Engineer may request cylinder compressions, slump, aggregate sieve designation and deleterious substance tests to be performed by a qualified designee.
- E. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.11 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, wind, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Apply curing compound to unformed surfaces immediately after finishing, at a rate not to exceed 300 SF per gallon.

- D. Remove forms only after concrete has attained sufficient strength to support all dead and live loads.
- E. Contractor shall provide barricading or personnel as necessary to protect freshly finished concrete from vandalism or other damage.
- F. Do not permit vehicular traffic over pavement for 7 days minimum after finishing.

3.12 SCHEDULES

- A. Pavement: Single course of 6-inch thickness minimum. Design engineer shall verify minimum requirements are adequate based on site conditions and propose necessary changes to Engineer accordingly for approval.
- B. Street widths shall be as indicated in the Major Thoroughfare Plan or as otherwise indicated by Engineer.
- C. Streets having no outlet shall be no longer than 500 feet and shall end in a cul-de-sac with a minimum radius of 45 feet center to curb flow-line.

END OF SECTION

SECTION 02924
SEEDING & REVEGETATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil preparation, topsoil, fertilizing, seeding, mulching, erosion control products, watering and initial care, and final inspection and acceptance.
2. Plantings and landscaping.
3. Maintenance & Warranty.

1.2 REFERENCES

- A. City of Cañon City Grading, Erosion, & Sedimentation Control (GESC) Plan Manual.
- B. Urban Drainage and Flood Control District (UDFCD) Criteria Manual.
- C. 2017 CDOT Standard Specifications for Road and Bridge Construction.
- D. 2012 CDOT M&S Standard Plans
- E. Erosion Control Technology Council (ECTC).
 1. Standard Specification for Rolled Erosion Control Products
 2. Standard Specification for Hydraulic Erosion Control Products
- F. American Society for Testing and Materials (ASTM).
- G. National Resources Conservation Service- Colorado (NRCS)
- H. Colorado State University (CSU) Extension Office

1.3 SUBMITTALS

- A. Product Data: Submit product information and design.

1. Submittals shall include seed mixes and certification of seed testing dated within 6 months prior to seeding; guaranteed analysis or manufacturers certified test results for mulches, soil amendments, compost, tackifiers, etc.; certified topsoil analysis from an independent soils laboratory prior to topsoil delivery; rolled erosion control products (RECP), and any other appurtenances . The Contractor shall also submit an irrigation plan.
2. If specified materials are not obtainable, submit non-availability to City, together with a proposal for use of equivalent material.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Developer/Contractor shall have a soil sample tested by a licensed, certified soil testing company for a report that will address fertilization needs, pH balance, and agricultural chemical analysis including micro nutrients and salt content data.
- B. Specific fertilizer and amendments recommendations shall be provided by a licensed, certified soil-testing company.
- C. All products shall be installed according to the manufactures recommendation and/or industry accepted horticultural practices.
- D. Seed, soil conditioner, mulch, and fertilizer shall not be applied during inclement weather including rain and high winds, when soil is frozen, or when moisture content of soil is too high to evenly incorporate the applied materials.

1.5 QUALIFICATIONS

- A. Manufacturer/Installer: Company specializing in performing work of this section with documented experience.

PART 2 MATERIALS

- 2.1 Quality: All materials shall be new and without flaws or defects of any kind.
- 2.2 Handling and Storage: Protect all materials from damage, deterioration, or loss of any kind while in transit, storage, and during installation. All materials shall be stored, transported, and applied in accordance with Federal, State, and local regulations.
- 2.3 Topsoil: Topsoil shall consist of loose friable, fertile, natural loam soil from the zone of major root development and be reasonably free of subsoil, refuse and other litter, stumps, woody roots, brush, noxious weed seeds and plant parts from current State and county weed lists, clay lumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter which would be detrimental to its use on the project.
- 2.4 Seed: All seed shall be furnished in containers clearly labeled to show name and address of supplier, the seed name, the lot number, net weight, origin, the percent of weed seed content, guaranteed percentage of purity and germination, pounds of pure live seed (PLS) of each species, and the total pounds of PLS in the container. All seeds shall be free from noxious weed seed in accordance with current State and local lists. Seed shall be labeled in accordance with U.S. Department of Agriculture rules and regulations and Colorado State Seeding laws. Seed that has become wet, moldy, or otherwise damaged in transit or in storage shall not be accepted.

A. Seed Mixes

1. Seed mixes will be approved by the Engineer depending on location, site condition, soil conditions, availability of water, and other factors. Seed mix shall be submitted to the Engineer for approval. The Engineer may require a custom seed mix based on the conditions and desired results. Seed shall be applied at a minimum rate of 15 pounds per acre (15lbs/ac).
 - a. Areas deemed Critical Planting Areas (CPA's) are areas that have, or expected to have, high rates of erosion due to soil conditions and topography or sites that have physical or biological conditions that prevent establishment of vegetation with normal practices. These areas include, but not limited to, non-irrigated areas, road construction sites, banks of channels, and slopes. Species selected for planting in CPA's shall be suited to current site conditions and intended uses, and be resistant to diseases or insects common to the site or location. Unless noted seed submittal, seed rates for CPA's will be doubled.
2. Approved, preferred seed mixes(Alternative seed mixes may be submitted for approval:
 - a. Saline, Alkali, and Salt (Critical Planting Area Rate)

Common Name	Scientific/Botanical Name	PLS per Acre
Alkali sacaton	<i>Sporobolus airoides</i>	1
Western wheatgrass	<i>Pascopyrum smithii v. Arriba</i>	8
Galleta	<i>Pleuraphis jamesii v. Viv</i>	6
Blue Grama	<i>Bouteloua gracilis v. Hachita</i>	2

Alkaligrass	<i>Puccinellia distans</i>	1
Blacksamson echinacea	<i>Echinacea angustifolia</i>	1
American Vetch	<i>Vicia americana</i>	2
Cover/Nurse Crop	<i>Secale cereale</i>	4
	TOTAL	25

b. Dry Land(Critical Planting Area Rates)

Common Name	Scientific/Botanical Name	PLS per Acre
Western wheatgrass	<i>Pascopyrum smithii</i> v. <i>Arriba</i> or <i>Barton</i>	12.4
Blue Grama	<i>Bouteloua gracilis</i> v. <i>Hachita</i> or <i>Lovington</i>	1.2
Sideoats Grama	<i>Bouteloua curtipendula</i> v. <i>Vaughn</i> or <i>Butte</i>	3.6
Indian Ricegrass	<i>Achnatherum hymenoides</i> v. <i>Paloma</i>	4.0
	TOTAL	21.2

c. Wet Land- T.B.D.

2.5 Fertilizer: Fertilizer (plant nutrients) shall conform to the applicable State fertilizer laws. It shall be a commercial product, uniform in composition, dry, free flowing, and be delivered to the site in the original, unopened containers each bearing the manufacturers guaranteed analysis. Fertilizer that becomes caked or otherwise damaged will not be accepted. Application rates shall be based on upon recommendations of soils laboratory and shall be reviewed by the Engineer.

2.6 Soil Conditioner: Soil Conditioner shall consist of compost, biological nutrient or culture, or humate conditioners. Compost shall be weed free, totally organic product that has been aerobically and naturally processed in a facility permitted by the Colorado Department of Public Health and Environment (CDPHE). Soil conditioners shall generally conform to 2011 CDOT Standard Specifications for Road and Bridge Construction, Section 212.02.

2.7 Sod: Sod shall be nursery grown and 99 percent weed free. Species shall be approved by the Engineer. Sod that was cut more than 24 hours prior to installation shall not be used. Each load of sod shall be accompanied by a certificate from the grower stating the type of sod and the date and time of cutting.

2.8 Herbicide: Where site conditions warrant or as determined by the Engineer, an approved herbicide shall be applied in accordance with the manufacturers label and Federal, State, and local regulations.

2.9 Erosion Control Products:

A. Rolled Erosion Control Products (RECP's) shall be used in areas with slopes equal to 3:1 or steeper and in swale bottoms, areas of concentrated flows, or as otherwise directed by the Engineer. RECP's shall meet the specifications of ASTM D1117, D1388, D6525, D6475, D6567, and D6818. RECPs shall meet the guidelines of the *Erosion Control Technology Council (ECTC) Standard Specification for Temporary Rolled Erosion Control Products* for Type 2 (12 month longevity) or Type 3 (24 month longevity) as approved by the Engineer. Applications that do not fall under the guidelines of those outlined for Type 2 and Type 3 RECPs shall be submitted to the Engineer for approval on a case-by-case basis. RECP's shall be installed according to manufacturer's requirements and in a way that is not detrimental to the seeding and germination process. A product and installation submittal shall be delivered to Engineer for approval prior to installation of RECP's.

B. Hydraulic Erosion Control Products (HECP's) shall be selected in accordance with *ECTC Standard Specification for Hydraulic Erosion Control Products* based on longevity, slope grade, and slope length. HECPs will be installed in accordance with this standard and the manufacturer's application instructions and machinery recommendations. Use of HECP's shall be approved by the Engineer. A product and installation submittal shall be delivered to Engineer for approval prior to installation of HECP's

2.10 Mulch:

- A. Hay or Straw Mulch: Mulch shall be clean, certified weed free, long stem grass hay or cereal grain straw. At least sixty percent (60%) of the stubble, by weight, shall have fibers 10 inches (10") or longer upon the completion of the crimping process. Hay or straw mulch shall be used in areas with slopes flatter than 3:1 and shall not be used in drainage swales, areas of anticipated concentrated flows, or other special situations as identified by the Engineer. Hay or straw in a state of decomposition (discolored, brittle, rotten moldy) as to smother or retard the growth of grass or old, dry mulch which breaks during the crimping process will not be accepted. Hay or straw mulch shall be anchored into the soil a minimum of four inches (4") by a mechanical crimper. Areas that cannot be accessed by mechanical methods will be hand crimped. Crimping shall be performed on the contour. Application of tackifier to crimped mulch will be at the discretion of the Engineer.
- B. Hydraulic Mulch: Hydraulic mulch material shall consist of at least ninety percent (90%) virgin wood cellulose fiber and shall be clean, free of seeds of noxious weeds or undesirable grasses, and free of any substance that might inhibit the germination or growth of vegetation. Hydraulic mulch shall be dyed (green preferred) to allow visual metering of the application. The dye shall be biodegradable and not inhibit plant growth. The wood fiber mulch shall conform to 2011 CDOT Standard Specifications for Road and Bridge Construction, Section 231.02. Tackifier shall be added to the water and wood cellulose material to form a homogenous slurry.

2.11 Tackifier: Mulch tackifier shall be applied to all areas where the mulch is not mechanically anchored or as directed by the Engineer. The tackifier shall consist of a free-flowing, non-corrosive powder produced from the natural plant gum of *Plantago Insularis* (Desert Indian Wheat). The powder shall possess the following properties:

Protein Content	$1.6 \pm 0.2\%$
Ash Content	$2.7 \pm 0.2\%$
Fiber Content	$4.0 \pm 0.4\%$ %
pH (1% solution)	6.5 – 8.0%
Settleable Soils	5.0%

Follow manufacturers written recommendations for application rates and procedures. The tackifier requires 12 to 18 hour drying time. Alternative tackifier agents may be used upon approval by the Engineer.

2.12 Plantings: Plantings shall consist of trees, shrubs, and other plant material, hereinafter referred to as "plants" of the species or variety designated by the Engineer. Plants shall be in healthy condition, free of plant diseases and insect pests; with normal, well-developed branch and roots systems; and shall conform to the requirements 2011 CDOT Standard Specifications for Road and Bridge Construction, Section 214. Installation shall conform to 2011 CDOT Standard Specifications for Road and Bridge Construction, Section 214; 2012 CDOT M&S Standards; and industry approved horticulture standards.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify placement, techniques, and materials with Engineer.
- B. All disturbed areas within the extents of the project and any disturbances outside the designated area shall be reclaimed, reseeded, mulched, or otherwise permanently stabilized according the Plans and Specifications.
- C. A satisfactory stand of plantings not requiring reseeding shall be defined as a minimum of 50 grass seedlings per square foot or 70% of the prior disturbed landscaped growth.

3.2 SITE PREPARATION

- A. Landscape work shall proceed as rapidly as portions of the site become available, within season limitations. Work the soil only when moisture conditions are suitable.
- B. Rip existing soil on slopes 3:1 or flatter to a minimum depth of 6 inches in one direction using an agricultural ripper with tines spaced at no greater than 18 inches. Soil shall be worked until no clods of soil greater than 2 inches remain.
- C. Slopes 3:1 and steeper shall be raked or otherwise worked so that the top 1inch (1") of soil is loose and friable before seeding.
- D. Remove all rubble, stones and extraneous material over 2 inches in diameter.
- E. Spread the amendment over the entire area to be landscaped and incorporate into the top 2 inches (2") of soil by use of a harrow or rake until a uniform mixture is obtained with no pockets of soil or amendments remaining.
- F. Correct irregularities in the ground surface resulting from soil preparation operations and slope to drain. Confirm that all work is returned to final grade, per construction plans, prior to seeding.
- G. Developer/Contractor shall all materials and equipment to complete the seeding and revegetation operations.

3.3 SEEDING

- A. Apply seed at recommended rates.
- B. Seeding shall occur after spring thaw and before consistent ground freeze. At no time will seed be sown when the surface of the ground is frozen, during periods of high wind, or at times when the moisture content of the soil is deemed excessive.
- C. Seeding shall occur within 24 hours after soil preparation. All seeded areas must be mulched within 24 hours of seed application. Areas not mulched within 24 hours must be reseeded at the expense of the contractor.
- D. Methods:
 1. Seeding shall be accomplished by mechanical power drawn "Grass" drills equipped with agitator in the seed box, double disc opener, and depth bands followed by packer wheels. Drills shall have a depth of $\frac{1}{2}$ - $\frac{3}{4}$ inch and shall be set to space the rows not more than 7 inches apart. Seed that is extremely small shall be sown from a separate hopper adjusted to the proper rate of application.
 2. Areas not accessible to mechanical power-drawn seeders and slopes steeper than 3:1 may be seeded by broadcasting by hand, by mechanical spreaders, or other approved mechanical means and then cultipacked or rolled to provide good seed-to-soil contact. Broadcasting and manual spreaders will require seeding rates double that required of drill seeding. Distribute seed as evenly as possible. Rake in or otherwise cover seed with soil to a depth of one eighth inch (1/8") to one quarter inch (1/4").
 3. Hydraulic seeding will not be allowed unless the area to be seeded is permanently irrigated or otherwise approved by the Engineer.

3.4 MULCHING

- A. Mulch shall be required for all seeded areas. Mulch must be applied within 24 hours of seeding. Areas that are not mulched within 24 hours of seeding must be reseeded the expense of the contractor.
- B. Methods:
 1. Hay or straw mulch shall be applied uniformly at a rate of two tons per acre (2t/ac) in accordance with Section 02924.
 2. Hydraulic mulches shall be applied uniformly at a rate of one ton per acre (1t/ac) with a minimum tackifier rate of 100 pounds per acre (100lb/ac) or as recommended by the manufacturer. Hydraulic mulching shall not be done in the presence of free surface water and shall be in accordance Section 02924.

3. Slopes steeper than 3:1 shall be treated with and erosion control product in accordance with Section 02924.

3.5 MAINTENANCE & WARRANTY

- A. Maintenance and irrigation of seed and established plants is the responsibility of the Developer/Contractor for the full warranty period of two years. The Developer/Contractor shall be responsible for all maintenance and repairs necessary within the warranty period. At any time, during the maintenance period, that the City determines corrective work and replacement materials are necessary in accordance with the Contract, the Contractor shall take corrective measures within 10 days of notice by the City. Maintenance and repairs shall include:
 1. Control of weed competition by mowing (at proper times and to proper heights to control many annual weeds).
 2. Application of herbicide, when deemed necessary and directed by the Engineer, to control noxious weeds, some annual weeds, and perennial weeds.
 3. Protection of seeded areas from unnecessary vehicle or pedestrian traffic until the vegetation is well established through the use of fences, barricades, signage, or other approved methods.
 4. Installation and maintenance of any additional erosion control measures which are necessary for the successful establishment of vegetation.
 5. Installation and maintenance of an irrigation system. The Developer/Contractor shall submit a plan for irrigation, which may include pumps, temporary sprinkler pipes, sprinklers, siphon pipes, gate pipe, etc.
- B. A warranty bond in the amount of line item prices for the seeding for the two-year warranty period may be required for assurance that the seed will be grown and maintained. This warranty bond shall be received by the City prior beginning any work.

END OF SECTION

DIVISION 3 – CONCRETE

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:

1. Rigid Pavement (PCC).
2. Curb and Gutter.
3. Driveway Aprons.
4. Sidewalk and Sidewalk Ramps.
5. Cross-Pans.

B. Related Sections:

1. Section 02060 – Aggregate Materials.
2. Section 02315 – Excavation.
3. Section 02721 – Aggregate Base Course.
4. Section 02740 – Rigid Pavement.

1.2 REFERENCES

A. Colorado Department of Transportation:

1. 2017 CDOT Standard Specifications for Road and Bridge Construction.
2. 2012 CDOT M&S Standard Plans

B. Concrete Reinforcing Steel Institute:

1. CRSI – Manual of Standard Practice.
2. CRSI – Placing Reinforcing Bars.

- C. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 304 – Measuring, Mixing, Transporting, and Placing Concrete.
 - 3. ACI 305 - Hot Weather Concreting.
 - 4. ACI 306 - Standard Specification for Cold Weather Concreting.
 - 5. ACI 318 - Building Code Requirements for Structural Concrete.
- D. American Society for Testing and Materials:
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 2. ASTM C67 - Standard Test Methods for Sampling & Testing Brick and Structural Clay Tile.
 - 3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 - 4. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 5. ASTM C150 - Standard Specification for Portland Cement.
 - 6. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 7. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 8. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 9. ASTM C902 - Standard Specification for Pedestrian and Light Traffic Paving Brick.
 - 10. ASTM C936 - Standard Specification for Solid Concrete Interlocking Paving Units.
 - 11. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
- E. 2010 Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- F. 2011 Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG)

1.3 SUBMITTALS

- A. Product Data: Submit data on joint filler, admixtures, accessories and curing compounds.
- B. Concrete Mix Design: Submit current mix design with aggregate gradation, cylinder compression test results, and mix proportioning prior to beginning work. Design shall not be dated prior to three years before start date, which is indicated on the Notice to Proceed.
- C. Delivery Tickets: Submit concrete delivery tickets indicating mix I.D. number, time water was added, elapsed time from when water was added and concrete placed, and amounts of additional water added.
- D. Work Schedule: Submit schedule to allow at least 24 hours notice of work to be performed or concrete poured to allow for appropriate schedules for testing and inspection.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Maintain one copy of each document on site.
- C. Acquire cement and aggregate from one source for Work.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F unless approved by Engineer, or surface is wet or frozen.
- B. Concrete placed in cold weather conditions shall be done in accordance with ACI 306.
- C. Conform to ACI 305 when concreting during hot weather.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type II – Moderate, low alkali, maximum tricalcium aluminate content of 8%.
- B. Aggregates: ASTM C33; 2 percent maximum soft particles.

- C. Water: Clean; not detrimental to concrete; free of oils, acids, alkalis, salts, or organic materials.

2.2 ADMIXTURES

- A. Furnish materials in accordance with 2017 CDOT Standard Specifications for Road and Bridge Construction.
- B. Air Entrainment: ASTM C260.
- C. Fly Ash: Substitution of 20 percent of cement material shall be allowed.

2.3 ACCESSORIES

- A. Bonding Agent: Two component, moisture insensitive epoxy.
- B. Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 in 48 hours and 7,000 psi in 28 days.
- C. Curing Compound: membrane forming, ASTM C309.
- D. Detectable Warning Paver: ASTM C67, C902, C936; ADA compliant; compressive strength of 8000 psi or greater, water absorption maximum of 5%; Pavestone ADA Compliant Paver (Product No. 200), providing a minimum visual contrast of 70 percent in light reflectance between the paver and adjoining surface, i.e. Red for grey sidewalks, Pewter for red sidewalks.
- E. Paver Bedding and Joint Sand: ASTM C33 for Bedding Sand; ASTM C144 for Joint Sand; clean, non-plastic, free of deleterious or foreign material.

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Expansion Joint Devices: resilient filler strip with hardness to permit plus or minus 25 percent joint movement with full recovery.

2.5 FORM MATERIALS

- A. Forms shall be straight, uniform width and thickness, waterproof, free from knots, offsets, holes, dents, and other surface defects.

2.6 REINFORCEMENT

- A. Reinforcing Joint Steel (Cross Pans): ASTM A615; 40 ksi yield grade, as specified; #5 as specified; deformed billet steel bars; chairs and spacers sized and shaped for strength and support reinforcement.

- B. Reinforcing Joint Steel (Driveway Aprons): ASTM A615; 40 ksi yield grade, as specified; #5 as specified; deformed billet steel bars; chairs and spacers sized and shaped for strength and support reinforcement.
- C. Reinforcing Joint Steel (Pavement or Cross Pan Repair): ASTM A615; 60 ksi yield grade, as specified; #5 as specified; smooth billet steel bars; 12-inches long.
- D. Tie Wire: 16 gage minimum; annealed type.
- E. Rigid Pavement (PCC):
 - 1. See Section 02750.

2.7 CONCRETE MIX

- A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.
- B. Provide concrete to the following criteria: Conform to Class B or BZ of Section 601.02 and 601.03 of the 2017 CDOT Standard Specifications for Road and Bridge Construction.
- C. Rigid Pavement (PCC): Conform to Class P, with No. 67 or 57 coarse aggregate, of Section 601.02 and 601.03 of the 2017 CDOT Standard Specifications for Road and Bridge Construction. See Section 02750.
- D. Final mix shall contain a minimum of 565 pounds of cement per cubic yard of concrete, with a water-cement ratio not to exceed 0.45.
- E. Slump shall be 4 inches \pm 1 inch.
- F. Admixtures: Include admixture types and quantities indicated in concrete mix designs approved through submittal process.
 - 1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
 - 2. Use calcium chloride only when directed by Engineer.
 - 3. Use set retarding admixtures during hot weather.
 - 4. Add air-entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.

- B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.
- C. The Engineer prior to concrete placement shall approve final form grades.

3.2 PREPARATION

- A. Excavate and prepare base course according to Section 2315 and Section 2721.
- B. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
- C. In locations where new concrete is doweled to existing work, i.e. pavement or cross pan repair, drill holes, 3/4-inch diameter, 12-inches o.c. in existing concrete, clear out holes using compressed air, fill holes with epoxy, and insert steel dowels. Coat exposed portion of dowels with grease.
- D. Place expansion material and reinforcement in required locations. Locate reinforcing splices, not indicated on drawings, at point of minimum stress. Splice according to ACI 318, Class B tension splice.
- E. Place any conduit and repair any cables or pipelines.
- F. Place forms to straight-line grade at specified elevations. Maintain or facilitate storm water drainage with driveway, sidewalk, curb and gutter, and cross-pan grading.
- G. Forms shall be placed around all concrete work. Pouring concrete directly against asphalt edge will not be allowed. Horizontal lines shall be smooth and straight. Curved forms shall be placed at uniform distance from radius point. Standard curb face shall be formed and not hand shaped.
- H. Remove all loose dirt, mud, debris, and other loose materials from inside forms.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304.
- B. Notify Engineer minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Place concrete continuously between predetermined expansion, control, and construction joints.
- F. All curb and gutter shall be formed and placed by machine when physically possible.

- G. Do not interrupt successive placement; do not permit cold joints to occur.
- H. Saw cut joints within 12 hours after placing, using 3/16 inch thick blade or hand tool; cut into 1/4 depth of slab thickness; straight and perpendicular to edges; match existing joint patterns per Engineer where applicable. Locate joints at changes in grade or line, corners, or other points of stress.
- I. Screed slabs on grade to drain; sidewalks shall not have a cross slope of more than 2 percent.

3.4 CONCRETE FINISHING

- A. Provide formed concrete surfaces to be left exposed with a broomed, uniformed finish free of visual cavities or defects. Finish edges with edging trowel.

3.5 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Apply curing compound to unformed surfaces after finishing, not to exceed 300 SF per gallon.
- D. Remove forms only after concrete has attained sufficient strength to support all dead and live loads.
- E. Contractor shall provide barricading or personnel as necessary to protect freshly finished concrete from vandalism or other damage.

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed in accordance with ACI 301.
- B. Provide free access to Work and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- D. When tests indicate Work does not meet specified requirements, remove Work and replace.
- E. Concrete Testing:
 - 1. Contractor is required to hire an independent, licensed engineer experienced in concrete analysis and evaluation to perform required tests in accordance with ACI. Copies of test results showing exact location of sample collection and test

sites must be furnished to Engineer. Engineer shall be informed prior to testing and he may designate areas of testing.

2. Engineer may request additional cylinder compressions, slump, aggregate sieve designation, thickness, and deleterious substance tests to be performed by a qualified designee.
3. Tests of concrete may be performed at random to ensure conformance with specified requirements.

F. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.7 PATCHING AND REPAIR

- A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
- C. Patch imperfections as directed by Engineer using specified grout and epoxy.
- D. For repair of internal sections of pavement or cross pans, entire panels must be removed joint to joint by carefully saw-cutting and hammering out discarded concrete so as not to chip, crack, or otherwise damage adjacent concrete. Removal of no more than one half of or less than one third of concrete pavement panel will be allowed as long as transverse saw-cuts are continued completely to both outside edges of the pavement. If the saw-cut for the partial panel removal is longitudinal to the pavement than upon completion of curing operations but prior to opening of pavement to traffic, the pavement shall be cored with a 6-inch diameter core at the terminus of the longitudinal saw-cut to include the entire "T" joint intersection. The core shall then be removed and the remaining hole filled and repaired with non-shrink grout.
- E. Pavement panels broken into three or more pieces shall be removed and replaced.
- F. Pavement panels containing random and wandering cracks shall be removed and replaced.
- G. Pavement panels containing a single longitudinal or transverse crack not having vertical separation and is no closer than 1 foot to but generally parallel, for the width or length of the panel, to any tooled or sawed joint, shall be routed or "vee'd" out with appropriate tools and sealed in the same manner as the pavement.
- H. Concrete pavement shall be cut back a minimum of 1 foot from the trench wall. Contractor shall repair any damage due to settlement of the pavement subgrade due to operations in the trench. Voids under pavement shall be repaired by pavement removal and replacement or by drilling and injecting an approved non-shrink hydraulic cement grout into the empty spaces.

- I. Concrete pavement shall be resealed in accordance with Section 02750 after repair. Old sealant must be removed by methods approved by Engineer prior to resealing.

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Engineer will determine repair or replacement of defective concrete.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.9 PEDESTRIAN ACCESS RAMPS

- A. Pedestrian Access Ramps (Curb Ramps) shall be constructed in accordance with 2011 PROWAG and other standards incorporated by reference.
- B. Detectable Warning and Well
 1. Detectable warnings shall be located and constructed in accordance with section R305, 2011 PROWAG.
 2. Weep holes shall be cast or drilled into the well for proper drainage of the structure. Weep holes shall be $\frac{3}{4}$ " (0.75 inch) diameter and fully penetrate the concrete floor of the well. Weep holes shall be spaced evenly across the lowest edge of the well with one weep hole placed in the lowest corner. The number of weep holes shall be equal to the width of the sidewalk (i.e. 4 foot wide sidewalk will have 4 weep holes).
 3. Spread sand evenly in the well area defined and screed the sand to an appropriate embedment depth as directed by Engineer.
 4. Screeded sand should not be disturbed. Place sufficient sand to stay ahead of the laid pavers.
 5. Pavers shall be placed in a running bond pattern. Domes shall be aligned to create a square grid in the predominant direction of travel. Pavers shall be installed such that the base of the truncated dome is approximately 1/8 inch above the adjoining surface, allowing for settlement with a smooth transition between the sidewalk and detectable warning.
 6. A vibrating plate compactor shall be used to embed the pavers into the sand. The size and type of compactor shall be in accordance with the paver manufacturer's recommendations, or as directed by the Engineer. Replace any pavers damaged during the compaction operations.

7. Joint spacing between paver units shall be in accordance with the manufacturer's recommendations, or as approved by the Engineer. Joints shall be filled completely with joint sand. Excess sand shall be removed by sweeping.
8. Bedding sand may be used for joint sand, requiring more effort in compaction and sweeping to fill the joints. Joint sand shall never be used for bedding sand.

3.10 SITE WORK

- A. Backfill suitable topsoil around all new concrete adjacent to existing earth or sodded areas to conform to new elevations. Topsoil shall conform to 2017 CDOT Standard Specifications for Road and Bridge Construction, Section 207.02. Generally, install lightly compacted topsoil to within 1 inch of top of concrete, grade and rake out clumps to leave smooth.
- B. Backfill with approved aggregate material and asphalt patch.
- C. Remove all roots, wood chips, excess concrete, trash or other debris, or excess materials generated from work from the site, leaving site clean and basically complete.

3.11 SCHEDULE

- A. Sidewalk:
 1. Concrete 4 inches thick minimum, over base course.
 2. Concrete 6 inches thick minimum, over base course: through driveways and alleys and sidewalk adjacent to mountable curb and gutter.
 3. Minimum width:
 - a. 4 feet for repair of existing facilities of lengths equal to or less than the width of a single parcel of land;
 - b. 5 feet for new construction and repairs of existing facilities longer than the width of a single parcel of land;
 - c. 6 feet for high use and commercial areas.
 - d. Areas with sidewalk widths less than 5 feet shall have 60 inch X 60 inch passing spaces spaced at a maximum of 200 feet installed at the time of repair or construction.
- B. PCC Pavement:
 1. Concrete 6 inches thick minimum, over base course: a professional licensed engineer shall design final installed thickness.

C. Cross pan:

1. Concrete 8 inches thick minimum, over base course.
2. Minimum width: 8 feet

END OF SECTION

SECTION 10440

STREET SIGNS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Design.
2. Appurtenances.
3. Placement.

1.2 REFERENCES

- A. Model Traffic Code for Colorado 2010
- B. Manual on Uniform Traffic Control Devices 2009 (MUTCD)
- C. Standard Highway Signs and Markings 2004 and 2012 Supplement
- D. US Department of Transportation, Federal Highway Administration (FHWA)

1.3 SUBMITTALS

- A. Product Data: Submit product information and design.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Design and install Street Name Signs in accordance with all applicable Local, State, and Federal Standards.

1.5 QUALIFICATIONS

- A. Manufacturer/Installer: Company specializing in performing work of this section with documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Signs - General:

1. Blank: Aluminum Blank, 12gauge (.0808") minimum thickness

2. Sheeting: Retroreflective (FHWA-RD-03-081) High Intensity Prismatic ASTM D4956-04 Sheeting Type III or better,
3. Color: Background and legend per MUTCD.
4. Size: Determined by Engineer.

B. Street Name Signs (“D3” MUTCD):

1. Blank: Aluminum Blank, 12gauge (.0808”) minimum thickness
2. Sheeting: Retroreflective (FHWA-RD-03-081) High Intensity Prismatic ASTM D4956-04 Sheeting Type III or better,
3. Color: Green background , white legend, white border
4. Size: Varies. Refer to 2009 MUTCD, Section 2D.43
5. Design & Lettering: Refer to 2009 MUTCD, Sections 2A.13 and 2D.43

C. Appurtenances:

1. Upright Post: 12 gauge galvanized steel, square 2 inch x 2 inch, 3/8 inch diameter holes on 1 inch centers all sides
2. Anchor Post: 12 gauge galvanized steel, square 2 1/4 inch x 2 1/4 inch x 3 foot minimum, 3/8 inch diameter holes on 1 inch centers all sides
3. Post Cap: Square, 5 1/4 inch length, 90° crosspiece flat blade 1 foot long, aluminum
4. Bolts, Nuts, and Washers: Galvanizedsteel

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify placement with City Engineer.
- B. Verify locations of underground utilities.

3.2 INSTALLING SIGN

- A. Post Installation- drive anchor post 2 1/2 feet minimum into ground. Bolt up right post to anchor post, 2 bolts minimum.
- B. Location and Mounting- MUTCD Part 2.

3.3 STREET NAME SCHEDULES

- A. Lettering Size: 6 inch - Local Roads & Collectors Roads, 8 inch - Arterial Roads.

B. Placement per Intersection:

1. Local Roads- 1 sign assembly per intersection.
2. Collector & Arterial Roads- 2 sign assemblies located on opposite corners diagonally across intersection.

END OF SECTION

APPENDIX

PART 1 City of Cañon City Standard Details (W & S)

- W-1 Fire Hydrant
- W-2 Blow-Off Assembly
- W-3 Trench Backfill
- W-4 Thrust Block
- W-5a Meter Pit: $\frac{3}{4}$ " & 1"
- W-5b Meter Pit: 1 $\frac{1}{2}$ " & 2"
- W-5c Meter Vault
- W-6 Sewer Crossing Detail
- W-7 Air and Vacuum Valve Vault
- W-8 Backflow Prevention Schematic

- S-1 Curb and Gutter
- S-2 Sidewalk
- S-3 Sidewalk Drain Pan (Chase)
- S-4 Typical Tree Radius Sidewalk Notch
- S-5 Mountable Curb and Gutter with Sidewalk
- S-6a Typical Sidewalk Ramp "A"
- S-6b Typical Sidewalk Ramp "B"
- S-6c Typical Sidewalk Ramp "C"
- S-6d Sidewalk Ramp Detectable Warning
- S-7 Cross Pan Detail
- S-8a Private Driveway in Right-of-Way
- S-8b Sidewalk Alley/Driveway Connection
- S-9 Driveway Apron (Public Alley Ways)
- S-10 H.M.A. Pavement Road Cross Section
- S-11 P.C.C. Pavement Road Cross Section
- S-12 P.C.C. Pavement Joint Details
- S-13 P.C.C. Pavement Repair
- S-14a Standard Irrigation/Drainage Culvert
- S-14b Standard Irrigation/Drainage Culvert (less than 12" cover)
- S-15 Utilities Placement & Street Dimensions
- S-16 Mailbox Location
- S-17 Drain Line Clean Out Box
- S-18 ROW Landscaping – No Curb & Gutter

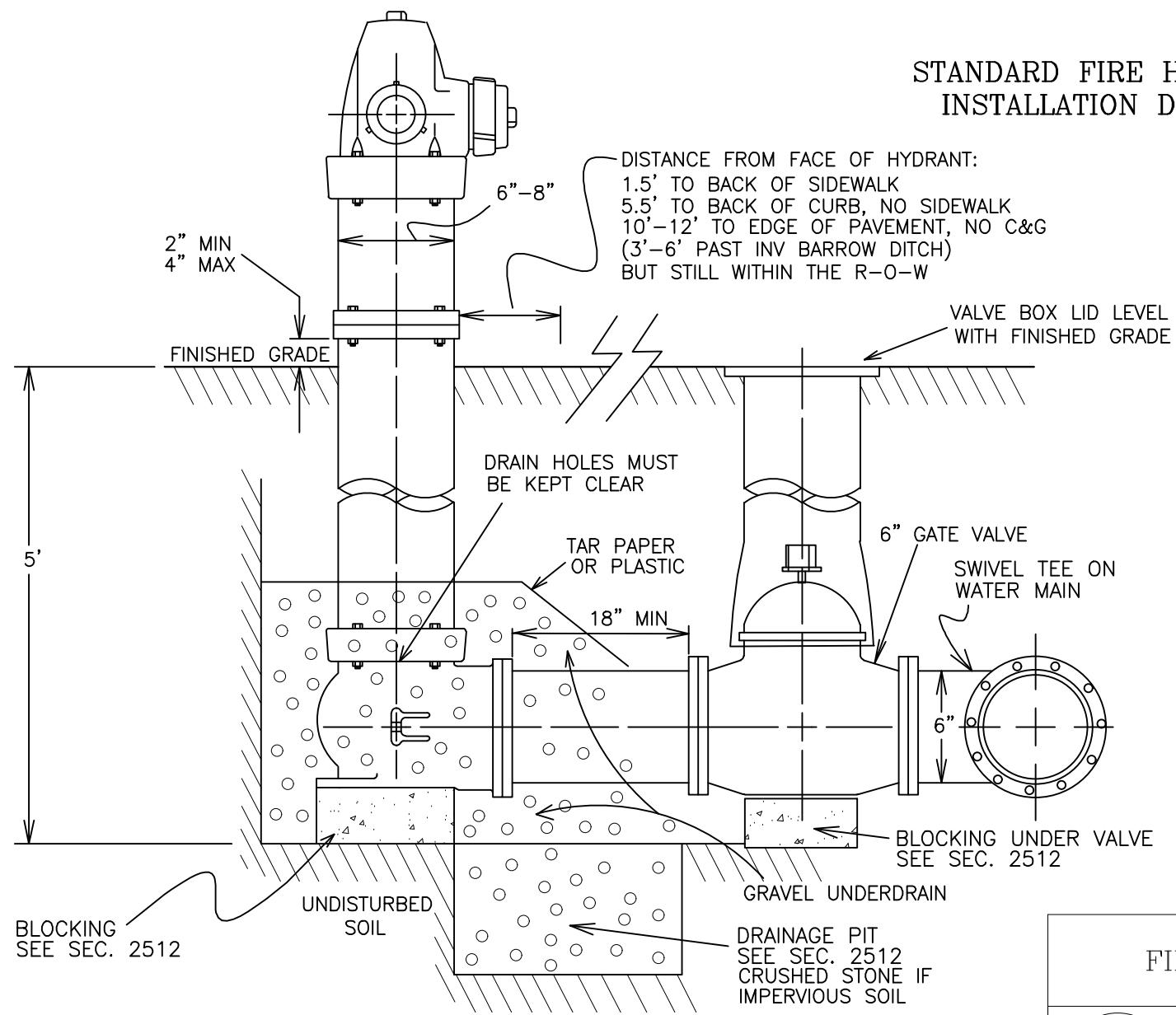
PART 2 Excerpts from City of Cañon City Municipal Code

- Chapter 5.12 Building Contractors
- Chapter 8.70 Stormwater Illicit Discharges and Permit Requirements
- Chapter 12.12 Work and Encroachment on City Property
- Chapter 13.10 Stormwater Utility

PART 3 Reference City of Canon City Stormwater Regulations

- City of Canon City GESC Manual
- City of Canon City IDDE Manual

STANDARD FIRE HYDRANT INSTALLATION DETAIL



FIRE HYDRANT

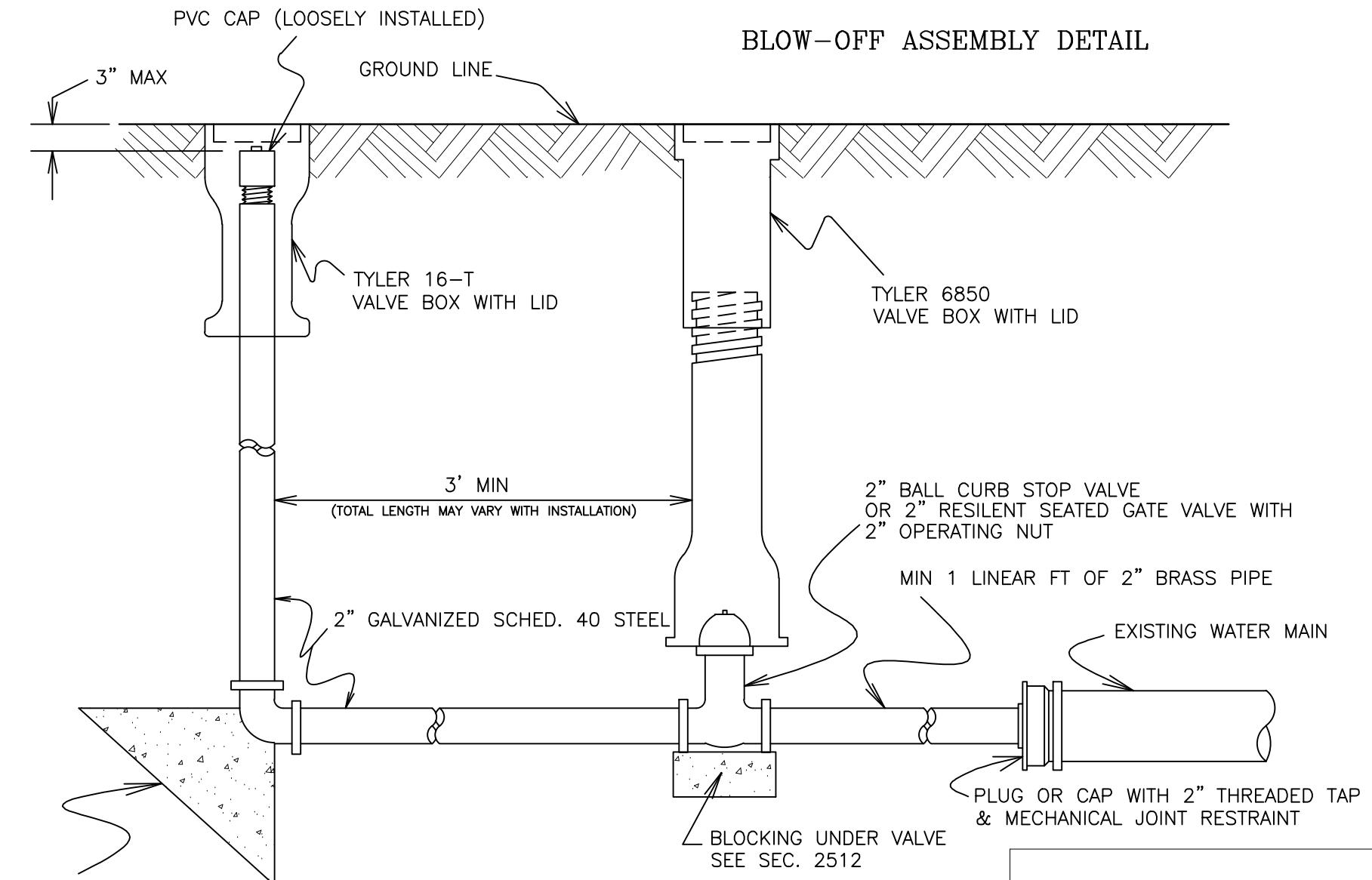


CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: MARCH 2004

W-1

BLOW-OFF ASSEMBLY DETAIL



BLOW-OFF ASSEMBLY



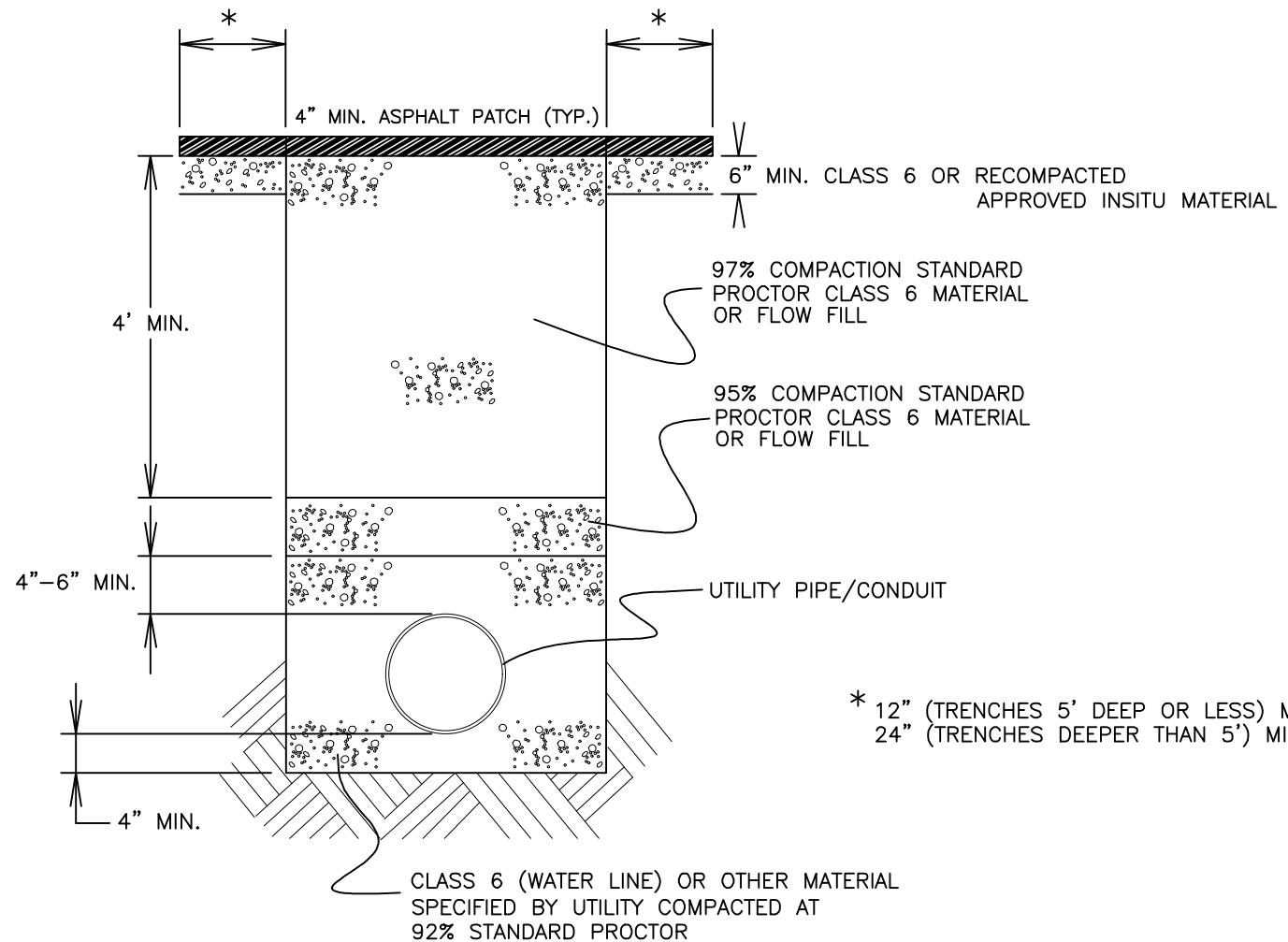
CITY OF CANON CITY
INCORPORATED 1872
COLORADO

STANDARD DETAIL
REVISED: MARCH 2004

W-2

W-2

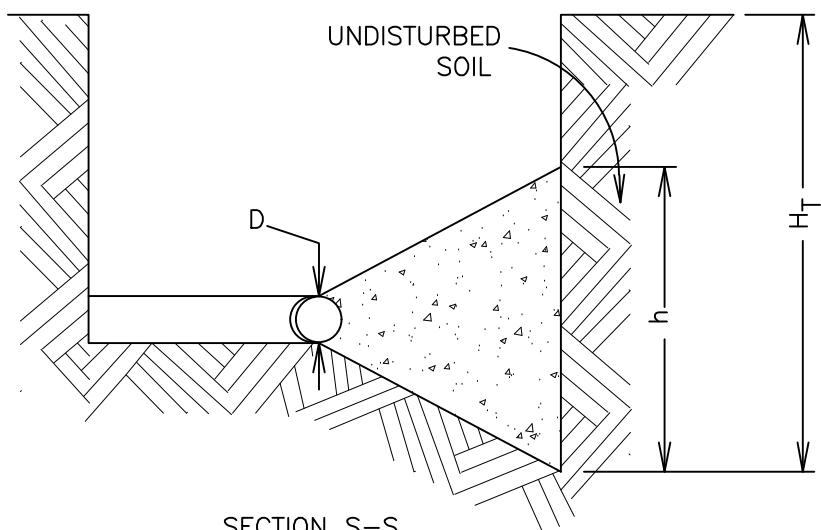
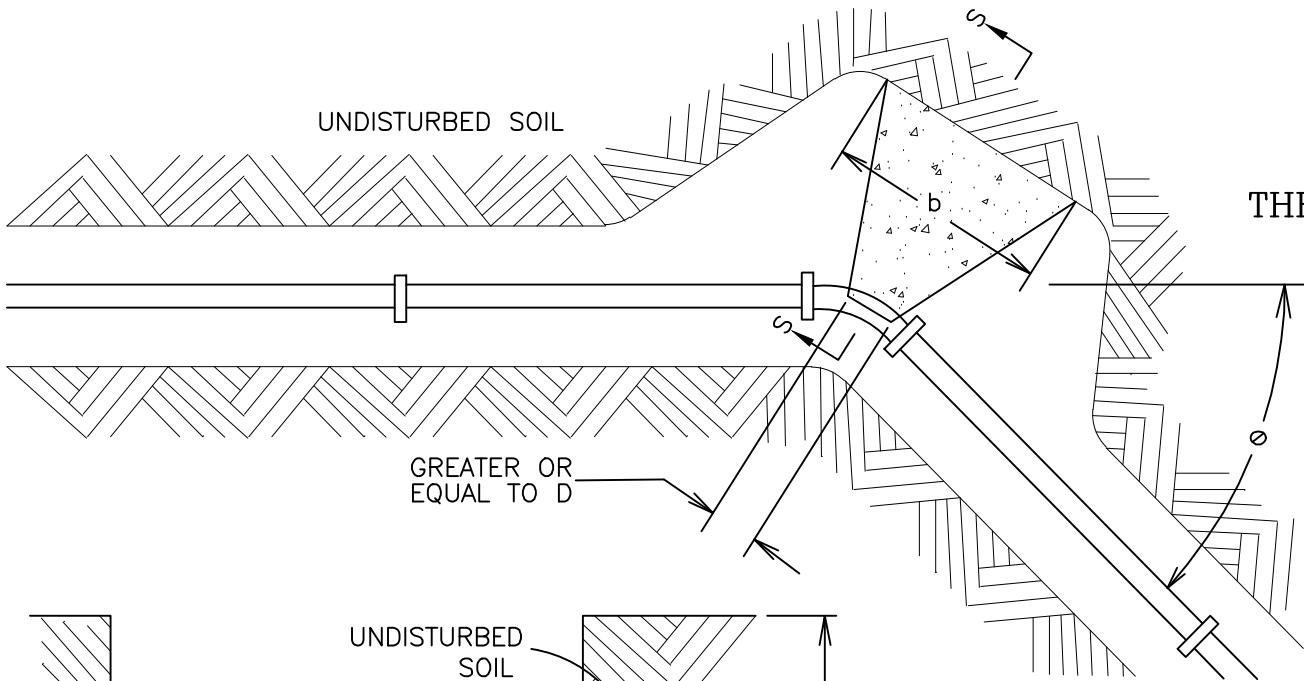
UTILITY TRENCH DETAIL



NOTE: EXCEPTION FOR LARGE NEW SUBDIVISION, SEE SECTION 02324-2.1C

TRENCH BACKFILL

<p>CITY OF CANON CITY INCORPORATED 1872 COLORADO</p>	CITY OF CANON CITY ENGINEERING DEPARTMENT	
	STANDARD DETAIL	W-3
	REVISED: AUGUST 2008	



SECTION S-S

NOTE: D = OUTSIDE DIAMETER OF PIPE

AREA, $Ab = h \times b$
WITH $h \leq 1/2 HT$
& $h \geq D$ WHICHEVER IS GREATER
ALSO $h \leq b < 2h$

DIA.	Ab (FT ²) FOR $\angle \theta$	221/2°	45°	90°
4"	0.5	1.0	1.5	
6"	1.0	2.0	3.5	
8"	2.0	3.0	6.0	
10"	2.5	5.0	9.5	
12"	4.0	7.0	13.5	
16"	6.5	13.0	24.0	
20"	10.0	20.5	37.5	
24"	15.0	29.0	54.0	
30"	23.0	45.5	84.0	
36"	33.5	65.5	121.0	

THRUST BLOCK



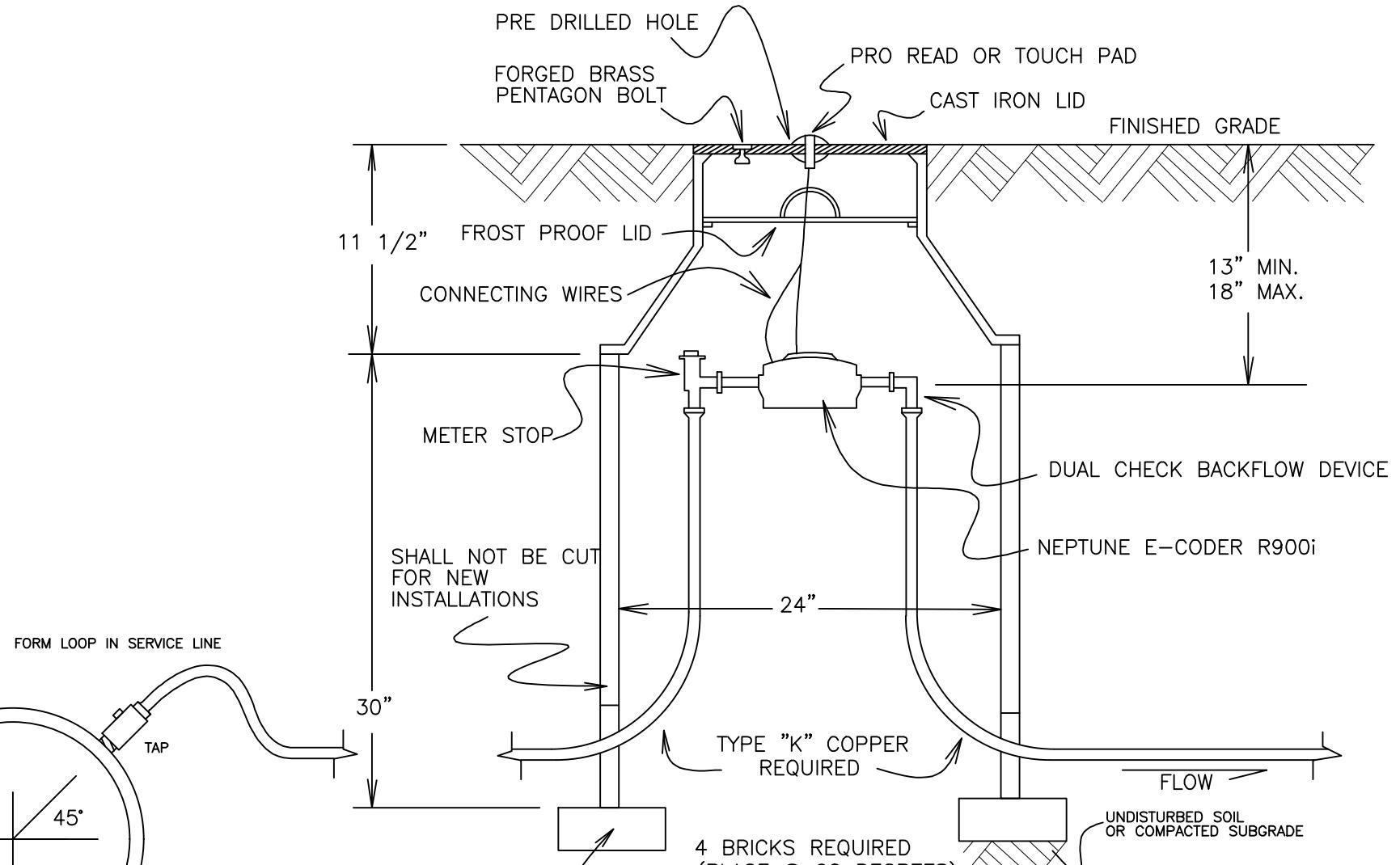
CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: OCTOBER 2003

W-4

W-4

3/4" & 1" METER PIT INSTALLATION DETAIL



NOTES: 1) NO TAPS, SPRINKLER OR OTHERWISE, WILL BE ALLOWED INSIDE THE METER PIT
 2) ANY UNIONS USED INSIDE THE METER PIT SHALL HAVE FLARED ENDS
 3) IF OVER-EXCAVATED, SOIL UNDER PIT IS TO BE COMPAKTED TO 97% STANDARD PROCTOR

METER PIT
 3/4" & 1"

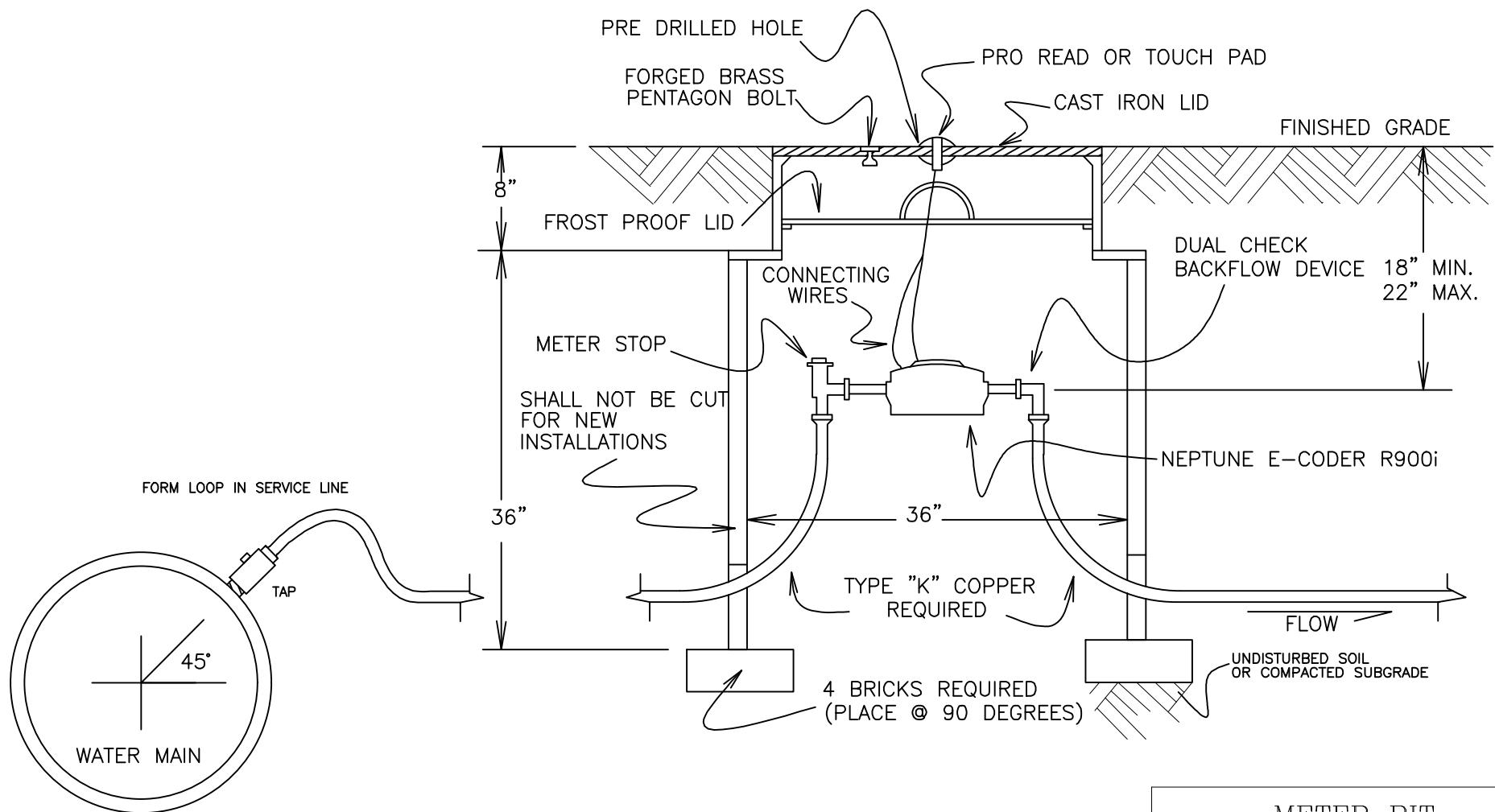


CITY OF CANON CITY
 ENGINEERING DEPARTMENT

STANDARD DETAIL
 REVISED: AUGUST 2017

W-5a

1-1/2" & 2" METER PIT INSTALLATION DETAIL



NOTES:

- 1) NO TAPS, SPRINKLER OR OTHERWISE, WILL BE ALLOWED INSIDE THE METER PIT
- 2) ANY UNIONS USED INSIDE THE METER PIT SHALL HAVE FLARED ENDS
- 3) IF OVER-EXCAVATED, SOIL UNDER PIT IS TO BE COMPAKTED TO 97% STANDARD PROCTOR

METER PIT
1-1/2" & 2"

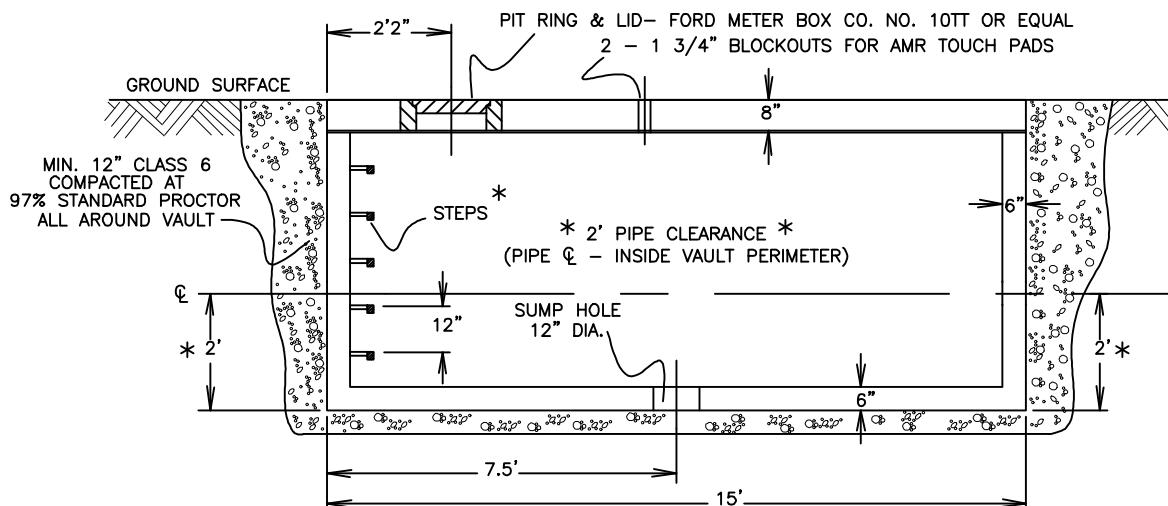


CITY OF CANON CITY
ENGINEERING DEPARTMENT

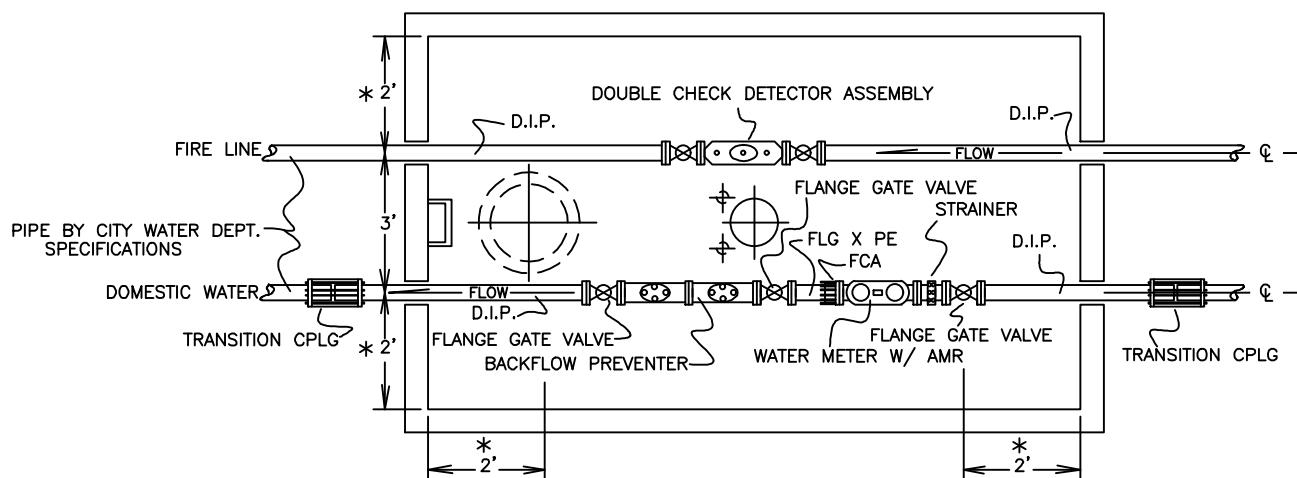
STANDARD DETAIL
REVISED: AUGUST 2017

W-5b

METER VAULT INSTALLATION DETAIL



SIDE CROSS SECTION



PLAN VIEW

*NOTE: STEPS SHALL BE ALUMINUM OR GREY IRON AND CAST IN PLACE WHEN CONCRETE IS CAST AND BE 9 1/4" X 12 1/2". AS AN ALTERNATE, STEPS MAY BE POLYPROPYLENE (M.A. INDUSTRIES PS2-PFS OR EQUAL) AND CAN BE PRESS FIT INTO PREFORMED HOLES. THE STEPS SHALL BE NO MORE THAN 24 INCHES FROM THE TOP OF THE ACCESS, AND NO MORE THAN 18 INCHES FROM THE BENCH OF THE ACCESS.

PIPE SIZE WILL VARY AS NECESSARY AND BE SUBJECT
TO APPROVAL BY THE PUBLIC WORKS DEPARTMENT.

VAULT SHALL HAVE A 2-FT MINIMUM CLEARANCE FROM INSIDE PERIMETER AND FLOOR OF METER VAULT TO PIPE AND VALVE C.

DESIGN OF VAULT (INCLUDING REINFORCING STEEL AND CONCRETE) SHALL BE RATED FOR HS-20 LOADING. MODIFICATIONS AS TO SIZE OF VAULT CAN BE APPROVED BY CITY ENGINEER.

METER VAULT



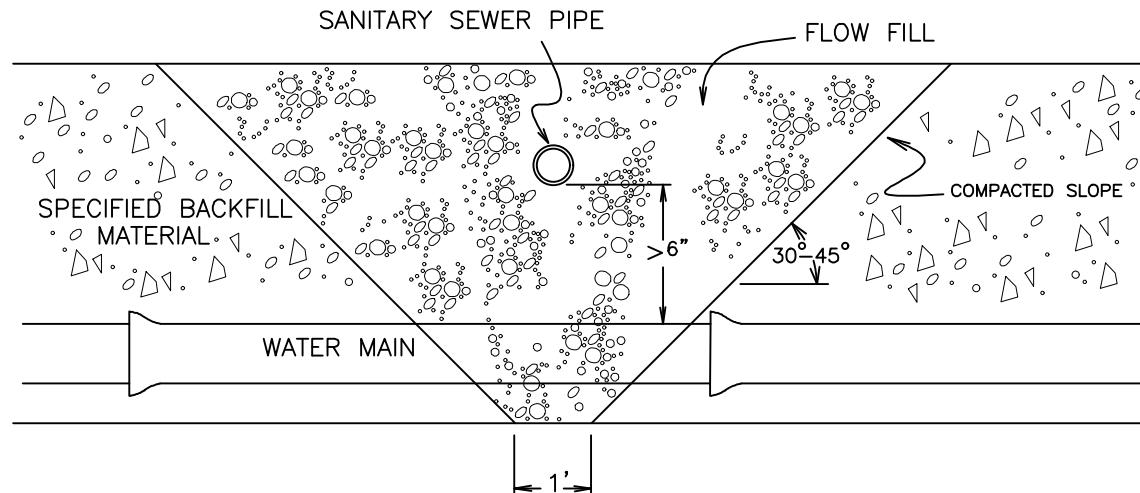
CITY OF CAÑON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL

REVISED: FEB 2017

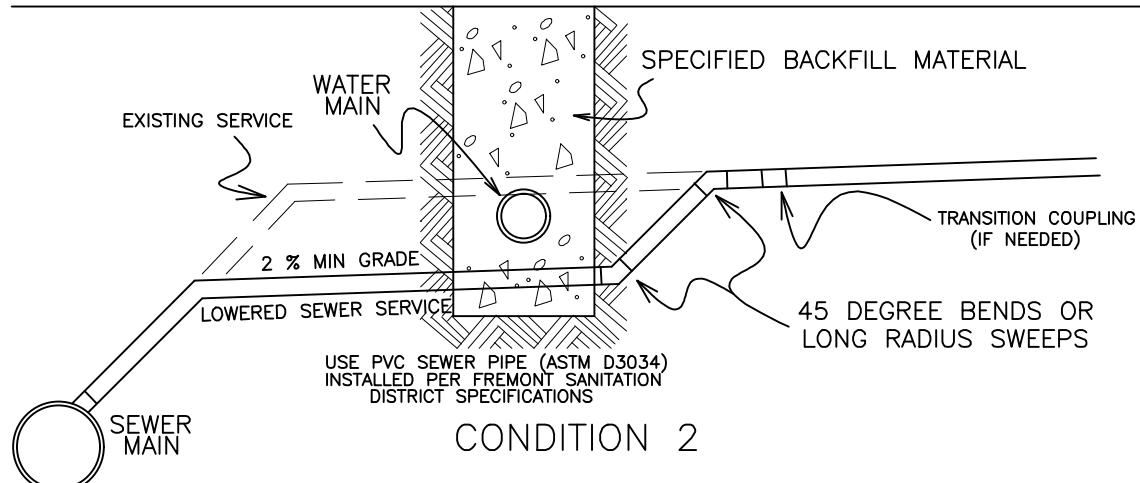
W-5c

WATER AND SANITARY SEWER SERVICE CROSSING DETAIL



CONDITION 1:
WATER LINE PASSES UNDER SEWER LINE WITH GREATER THAN 6" OF CLEARANCE. FILL TRENCH, 2' ON EACH SIDE OF SEWER, WITH FLOWABLE FILL.

CONDITION 2:
WATER LINE PASSES UNDER OR OVER SEWER LINE WITHIN 6". SEWER LINE MUST BE LOWERED 6" OR GREATER BELOW THE BOTTOM OF WATER LINE IF POSSIBLE.



NOTE:
NECESSARY PRECAUTIONS SHALL BE TAKEN WHILE COMPACTING BACKFILL AROUND WATER LINE WHERE IT PASSES OVER A SEWER LINE TO PRESERVE GRADE OF SUCH LINE.

SEWER CROSSING DETAIL

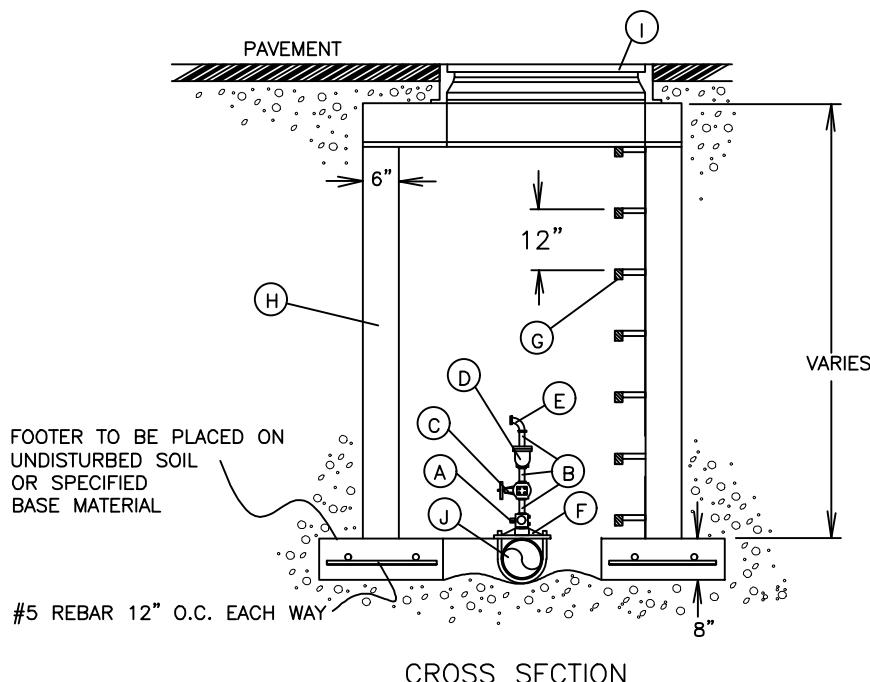
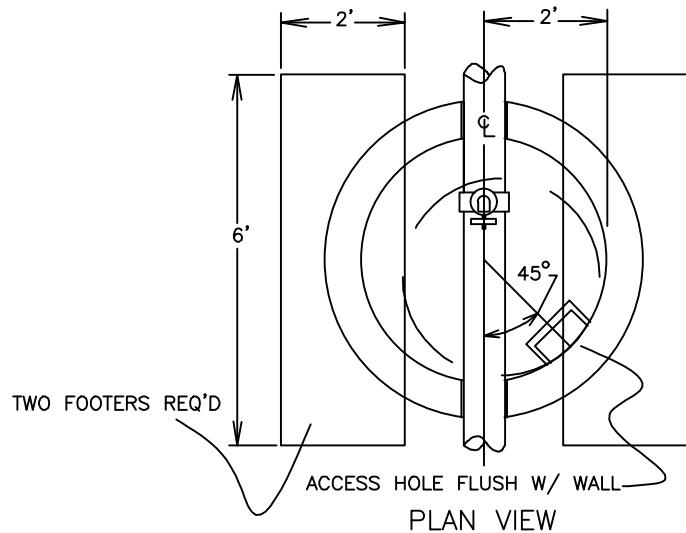


CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: OCTOBER 2003

W-6

AIR & VACUUM VALVE VAULT INSTALLATION DETAIL



LEGEND

- A. 1" CORPORATION BALL VALVE TAPERED THREADS INLET W/ 1" FEMALE IRON PIPE OUTLET (MUELLER OR FORD)
- B. 1" X 3" THREADED BRASS NIPPLE
- C. 1" THREADED BALL VALVE WITH STANDARD OPERATING NUT
- D. 1" THREADED INLET APCO OR CRISPIN AIR AND VACUUM VALVE
- E. 1" X 90 DEGREE BRASS THREADED ELBOW
- F. SERVICE SADDLE REQ'D FOR C-900 AND C-905 PVC PIPE
- G. STEPS SHALL BE AS REQ'D PER STANDARD DETAIL W-5C
- H. 4' INSIDE DIAMETER REINFORCED PRECAST CONCRETE VAULT. DESIGN OF VAULT SHALL BE RATED FOR HS-20 TRAFFIC LOADING.
- I. HEAVY DUTY SINGLE 38" NOMINAL MANHOLE RING AND COVER. ADD RISERS AS NECESSARY SO LID IS LEVEL WITH PAVEMENT OR 1" ABOVE GROUND SURFACE.
- J. PIPE SIZE WILL VARY. AIR VALVE ASSEMBLY LARGER THAN 1" SIZE OR FOR MAINS LARGER THAN 16" SHALL BE SPECIALLY DESIGNED AND MEET WATER DEPARTMENT REQUIREMENTS.

GENERAL NOTES

1. ALL CONCRETE WORK SHALL COMPLY TO ACI 318 SPECIFICATIONS
2. A MANHOLE VENT PIPE IS OPTIONAL— ONLY TO BE INSTALLED IF REQ'D BY WATER DEPT.
3. VAULT SHALL BE SURROUNDED BY A MIN. OF 12" CLASS 6 MATERIAL COMPAKTED AT 97% STANDARD PROCTOR.

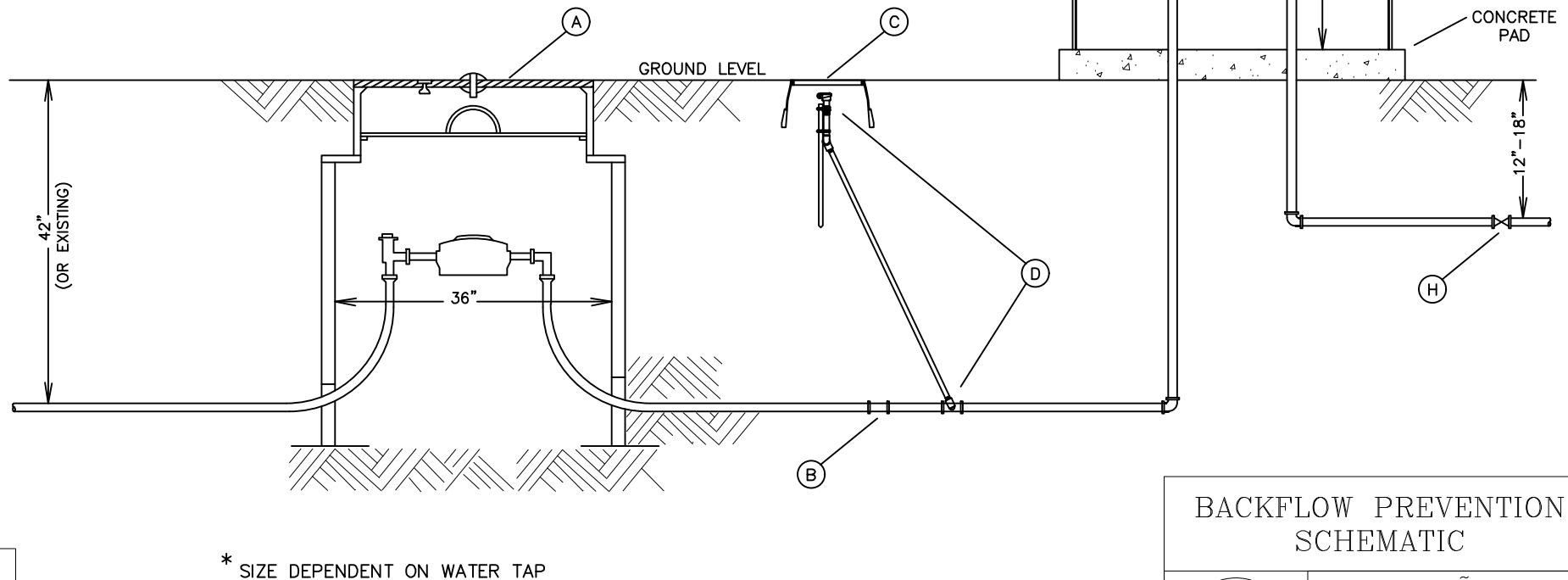
AIR AND VACUUM VALVE VAULT

	CITY OF CANON CITY ENGINEERING DEPARTMENT	
	STANDARD DETAIL	W-7
	REVISED: MARCH 2004	

LEGEND

- A.* CITY WATER METER & PIT PER SPECIFICATIONS, 3/4" - 2"
- B. OPTIONAL TEE - FOUNTAIN OR RESTROOM 3/4" OR 1" OUTLET
- C. 12" IRRIGATION VALVE BOX W/ LOCKING LID
(SECURE HOUSING FOR QUICK COUPLER BLOWOFF VALVE (QCV))
- D. QUICK COUPLER BLOWOFF ASSEMBLY
TEE - ELBOW - PIPE - ELBOW - QCV
(TEES PREVENT BREAKING PIPE W/ QCV KEY ENGAGEMENT)
- E. CAGE OR HOT BOX - LOCKED
- F.* REDUCED PRESSURE BACKFLOW DEVICE ASSEMBLY
- G. SHUT OFF VALVES ON ASSEMBLY
- H. ZONE VALVE - IRRIGATION

BACKFLOW PREVENTION SCHEMATIC FOR CITY PARKS & CEMETARY USE ONLY



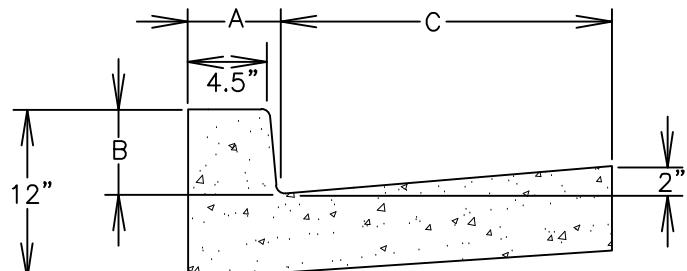
BACKFLOW PREVENTION
SCHEMATIC



CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: JANUARY 2017

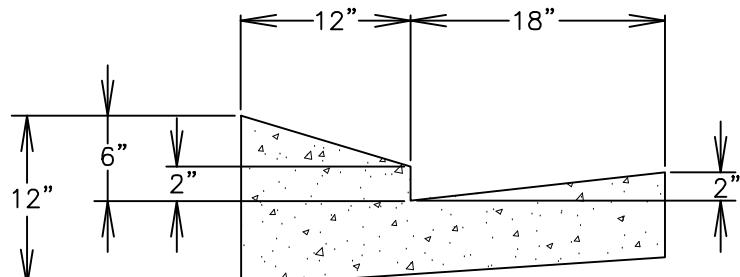
W-8



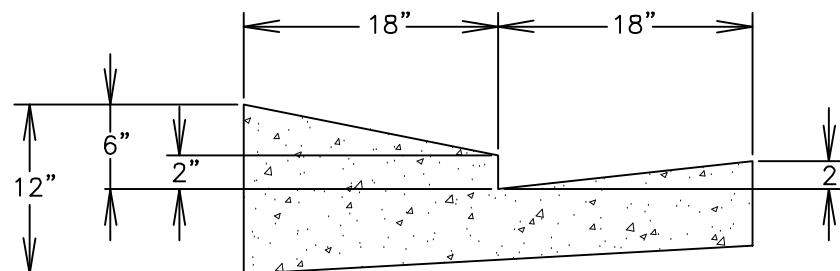
SECTION 1
CURB AND GUTTER

SECTION 1			
CURB & GUTTER	A	B	C
SECTION 1A	6"	6"	24"
SECTION 1B	6"	8.5"	28"
SECTION 1C	6"	9"	30"
CURB CUT	6"	2"	24"

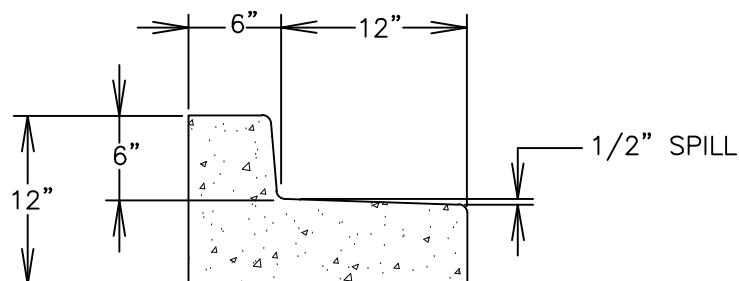
SECTION 1B & 1C TO BE USED ONLY TO REPAIR EXISTING.



SECTION 2
MOUNTABLE CURB AND GUTTER

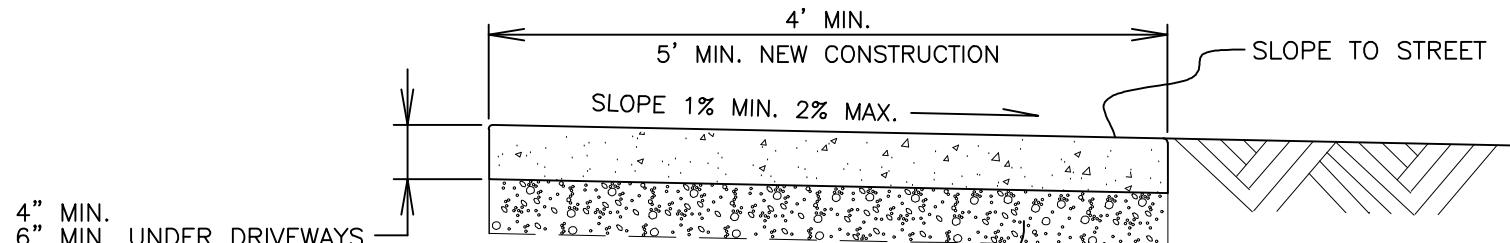


SECTION 3
MOUNTABLE CURB AND GUTTER



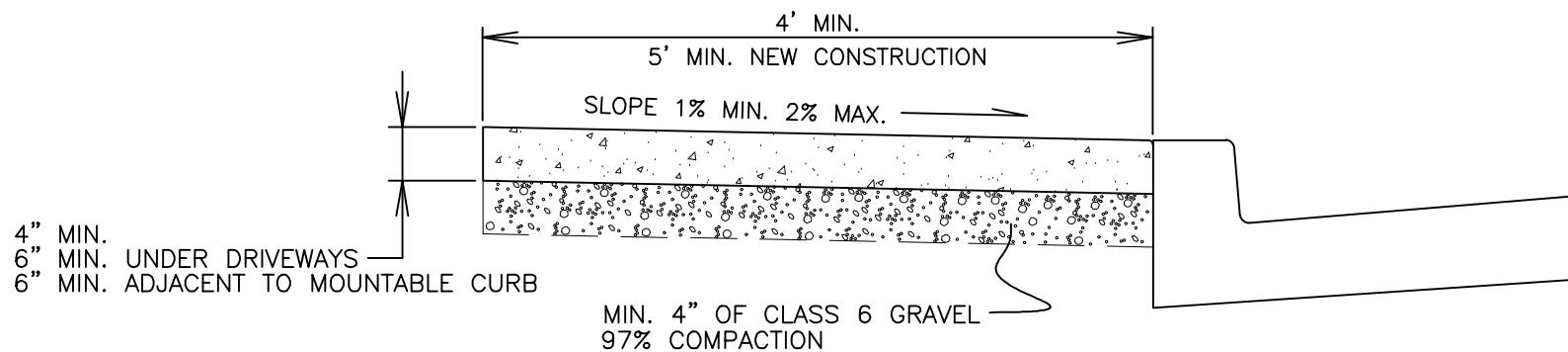
SECTION 4
6" MEDIAN CURB AND GUTTER

CURB AND GUTTER	
	CITY OF CANON CITY ENGINEERING DEPARTMENT
STANDARD DETAIL	S-1
REVISED: AUGUST 2008	



MIN. 4" OF CLASS 6 GRAVEL
97% COMPACTION

SIDEWALK



SIDEWALK

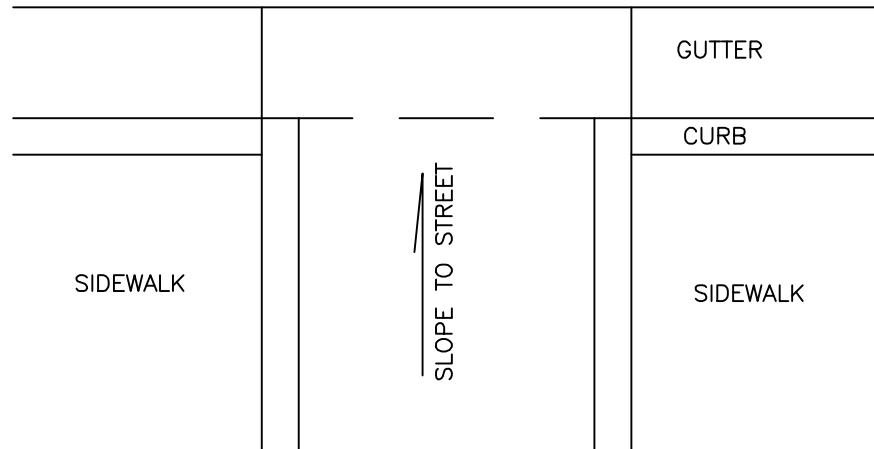


CITY OF CANON CITY
ENGINEERING DEPARTMENT

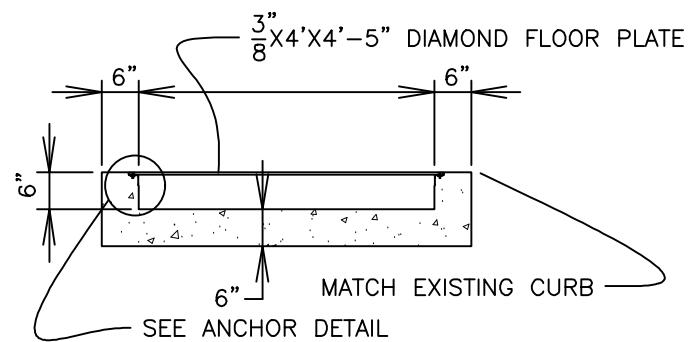
STANDARD DETAIL
REVISED: APRIL 2005

S-2

S-1
2



PLAN
N.T.S



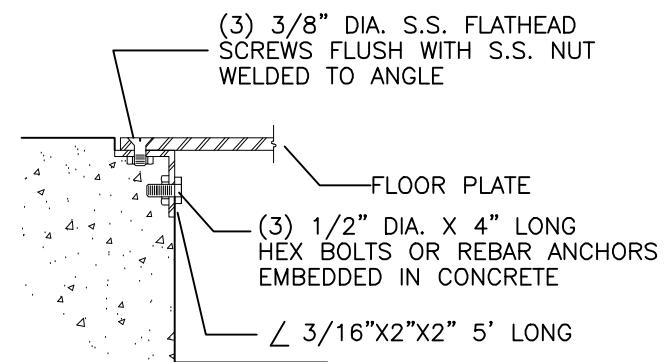
SECTION
N.T.S

NOTE: WIDTH OF PAN CAN VARY DEPENDING ON SIZE OF ROOF DRAIN.

WIDER DRAINS MAY REQUIRE THICKER PLATE STEEL OR ADDITIONAL SUPPORT.

R & R OF CURB & GUTTER REQUIRED, REMOVAL OF CURB HEAD IN EXISTING NOT PERMITTED.

S
—
3



ANCHOR DETAIL
N.T.S

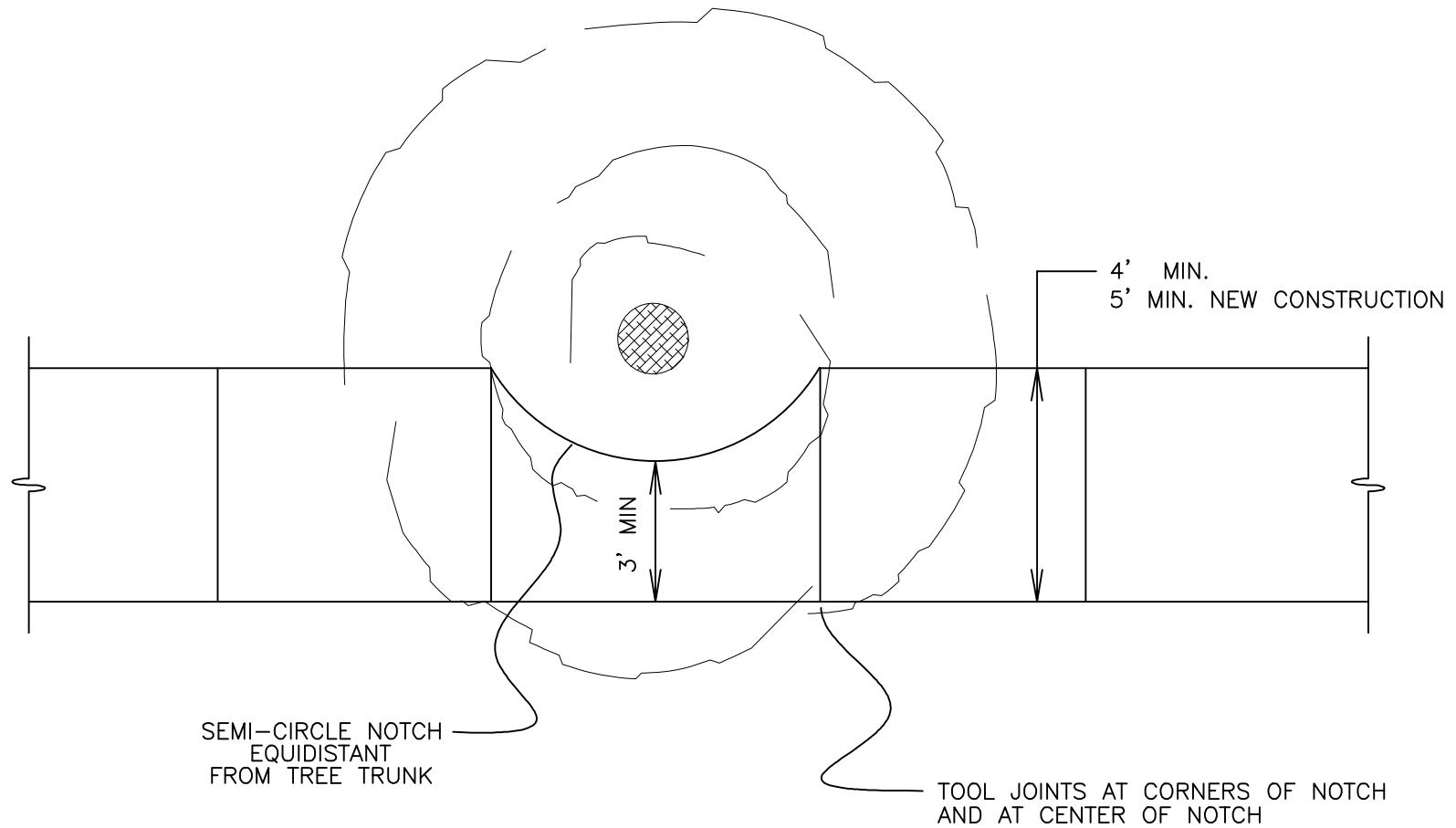
SIDEWALK DRAIN PAN
(CHASE)



CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: AUGUST 2008

S-3



TYPICAL TREE RADIUS
SIDEWALK NOTCH

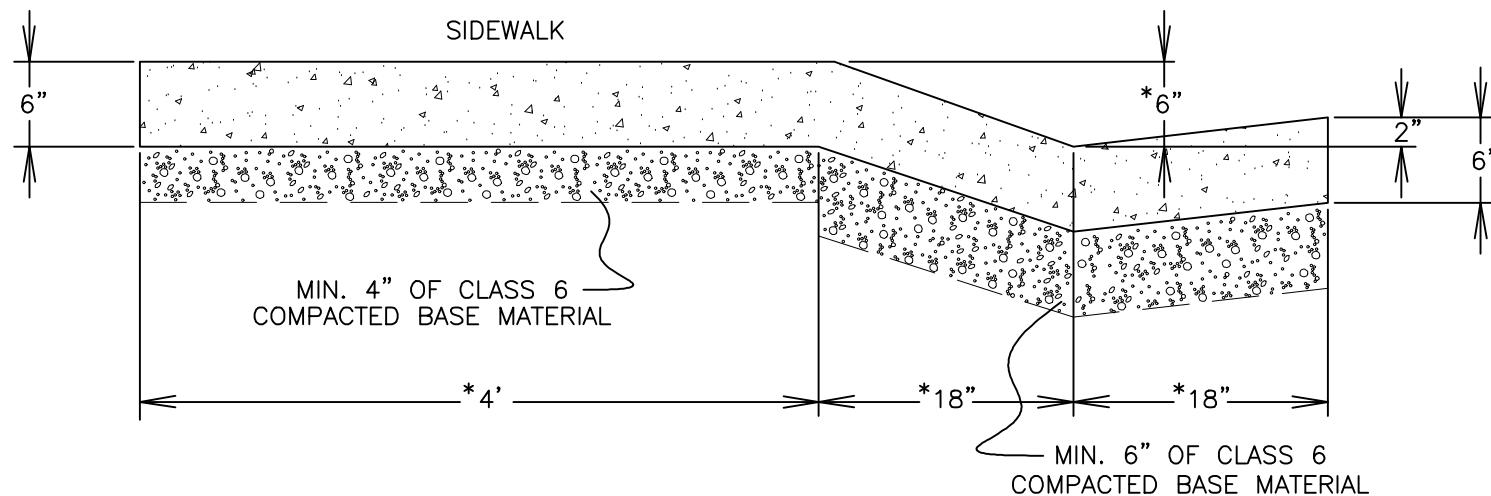


CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: APRIL 2005

S-4

* NOTE: MATCH EXISTING DIMENSIONS



*FOR USE IN RESTORING EXISTING FACILITIES ONLY, NOT FOR NEW CONSTRUCITON.

MOUNTABLE CURB AND
GUTTER WITH SIDEWALK



CITY OF CANON CITY
ENGINEERING DEPARTMENT

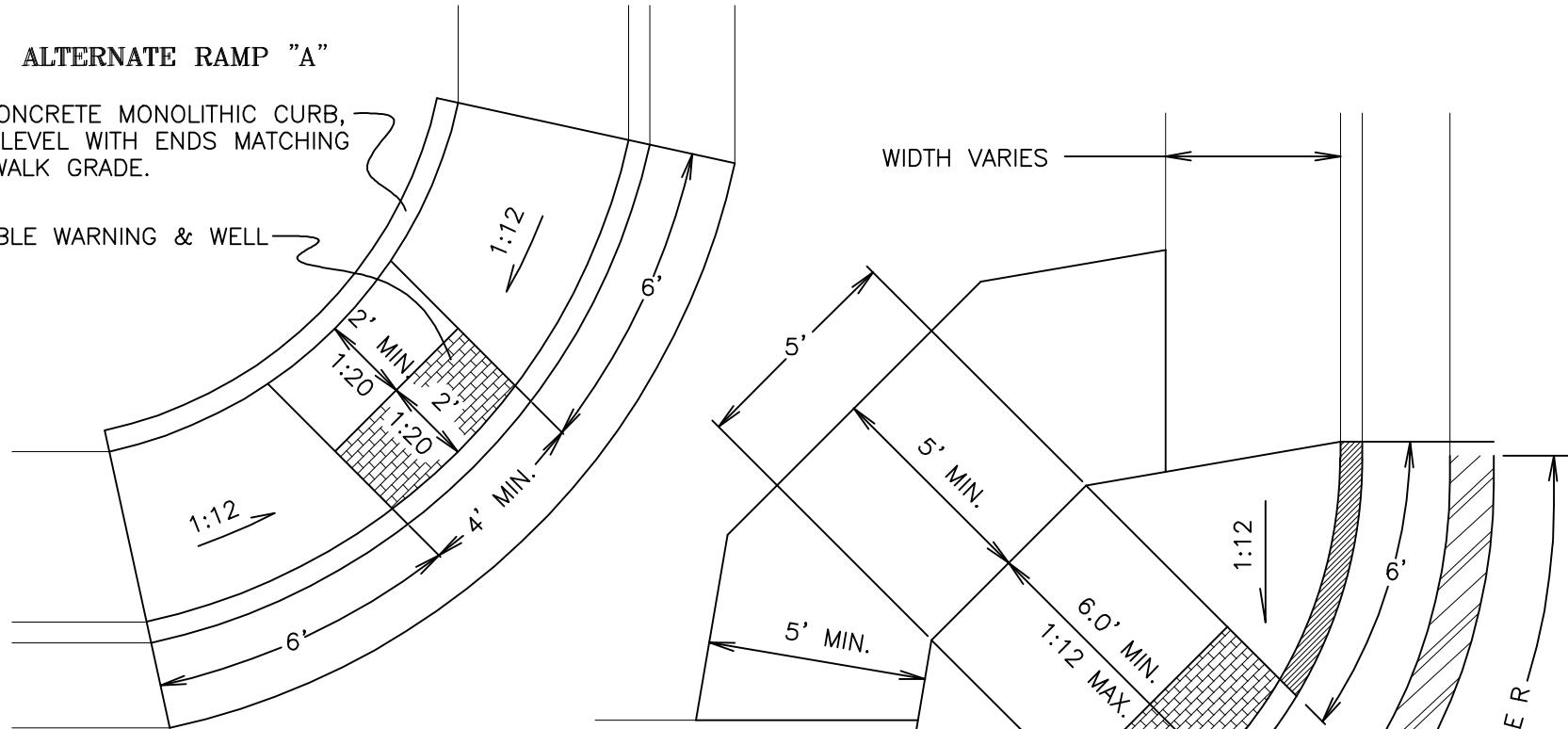
STANDARD DETAIL
REVISED: OCTOBER 2003

S-5

ALTERNATE RAMP "A"

6" CONCRETE MONOLITHIC CURB,
TOP LEVEL WITH ENDS MATCHING
SIDEWALK GRADE.

DETECTABLE WARNING & WELL



SAW CUT CURB & GUTTER
(EACH SIDE)

MIN. 1' WIDE 2.5" THICK
ASPHALT PATCH

FOR USE IN EXISTING RETROFIT ONLY FOR EXTENUATING CIRCUMSTANCES
AS DETERMINED BY CITY ENGINEER, NOT FOR NEW CONSTRUCTION

TYP. SIDEWALK RAMP "A"



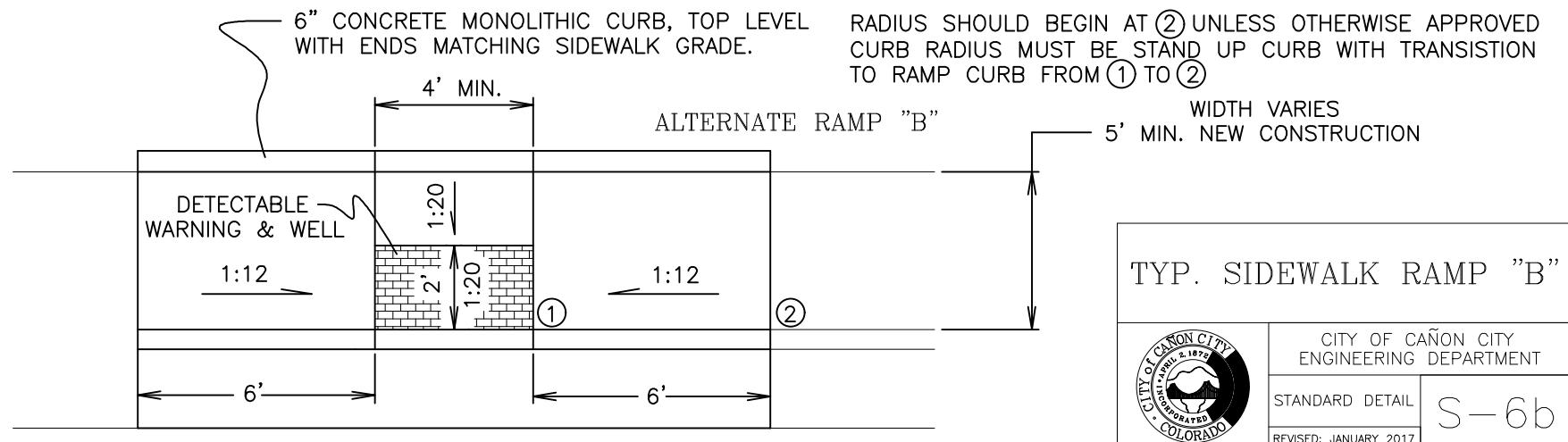
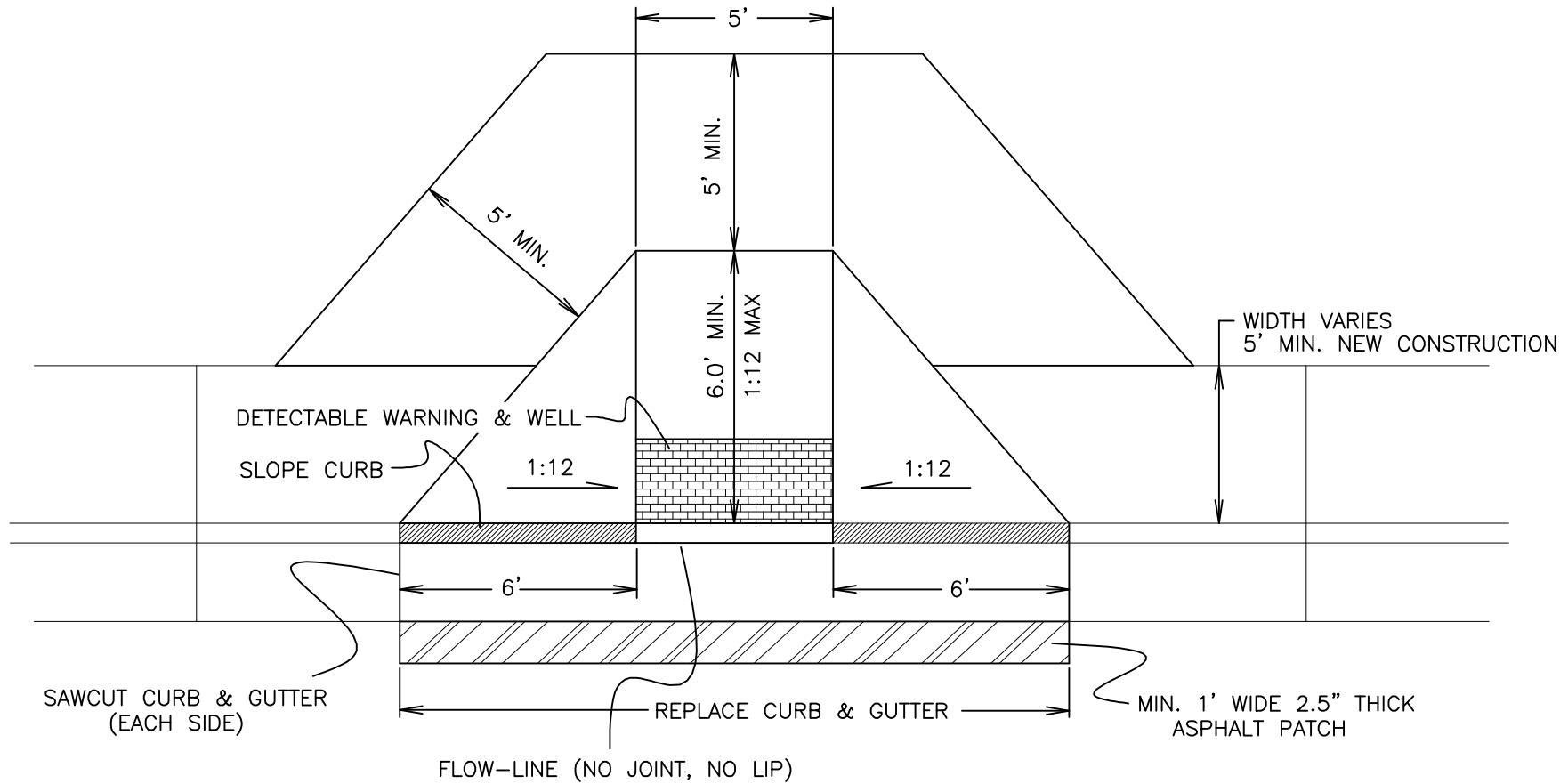
CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL

S-6a

REVISED: AUGUST 2017

S
I
O
Q



INSTALL 6" CONCRETE MONOLITHIC CURB
WHEN GRADE DIFFERENCE EXCEEDS 4 INCHES.
TOP OF CURB SHALL BE LEVEL WITH ENDS
MATCHING SIDEWALK GRADE.

REMOVE & REPLACE SIDEWALK IN
EITHER DIRECTION TO MAINTAIN A
MAX. SLOPE OF 1:12

MATCH WIDTH OF SIDEWALK
(BUT NOT LESS THAN 4',
5' MIN. NEW CONSTRUCTION)

INSTALL 6" CONCRETE MONOLITHIC CURB
WHERE WING CAN NOT BE CONSTRUCTED.
TOP OF CURB SHALL BE STRAIGHT GRADE
FROM TOP OF RAMP TO TOP OF CURB.

MONOLITHIC CURB IF REQUIRED FOR CLEARANCE
TOP OF CURB LEVEL TO MATCH SIDEWALK GRADE

MIN. 1' WIDE 2.5" THICK
ASPHALT PATCH

REPLACE
CURB & GUTTER

SAWCUT CURB & GUTTER (EACH SIDE)

4'X4' MIN. LEVEL LANDING
5'X5' NEW CONSTRUCTION

DETECTABLE WARNING & WELL

FLOW-LINE
(NO JOINT, NO LIP)

FLARE 1:4
1:10 OR FLATTER IF PART OF
PEDESTRIAN CIRCULATION PATH

SLOPE CURB

6.0' MIN.
1:12 MAX

2' - 5' MAX
1:20

ALTERNATE RAMP "C"

TYP. SIDEWALK RAMP "C"



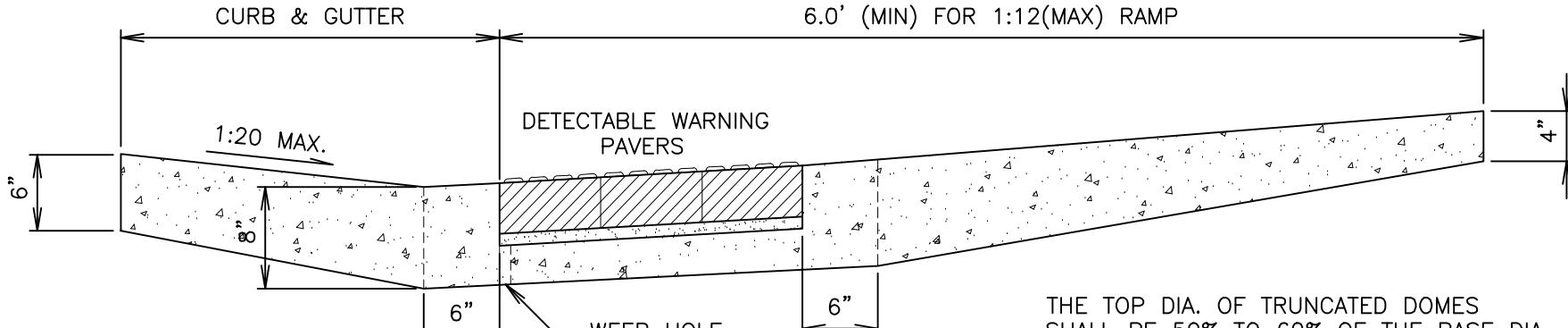
CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL

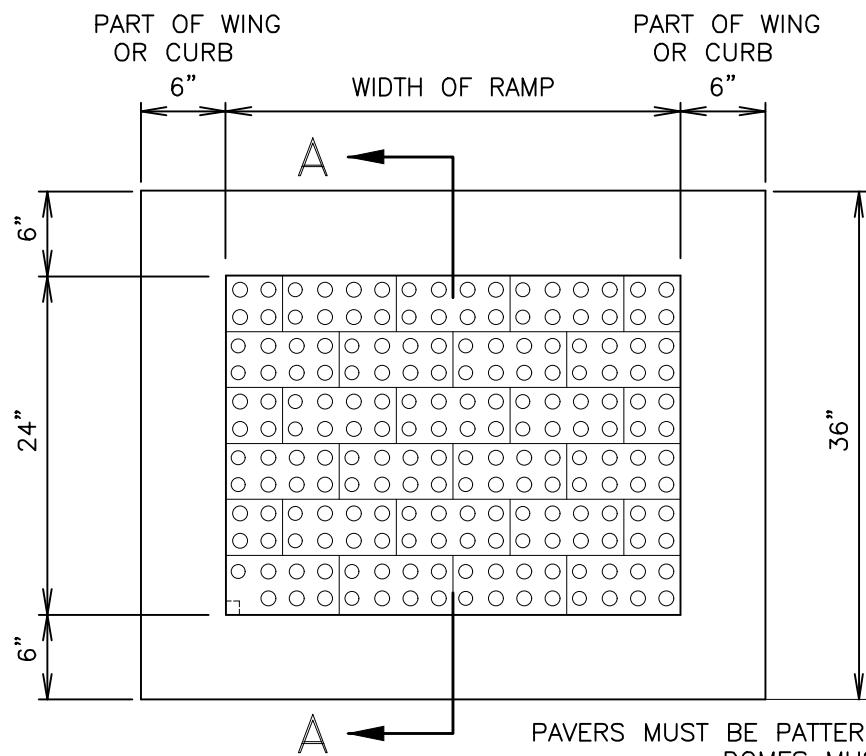
REVISED: JANUARY 2017

S-6c

S
I
G
C

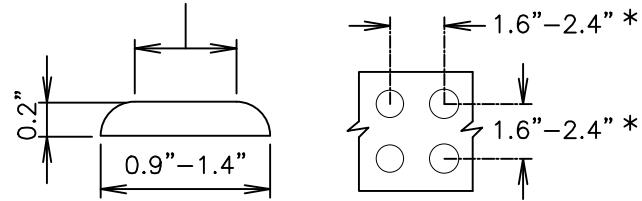


SIDE CROSS SECTION VIEW OF
DETECTABLE WARNING, WELL, CURB,
AND GUTTER

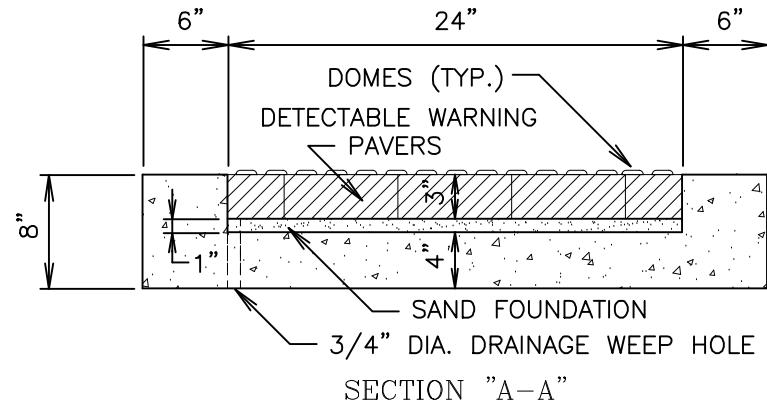


PLAN VIEW OF
DETECTABLE WARNING AND WELL

THE TOP DIA. OF TRUNCATED DOMES
SHALL BE 50% TO 60% OF THE BASE DIA.



* SHALL BE EQUAL IN BOTH DIRECTIONS
DOOME AND DETECTABLE WARNING DETAILS



SIDEWALK RAMP
DETECTABLE WARNING

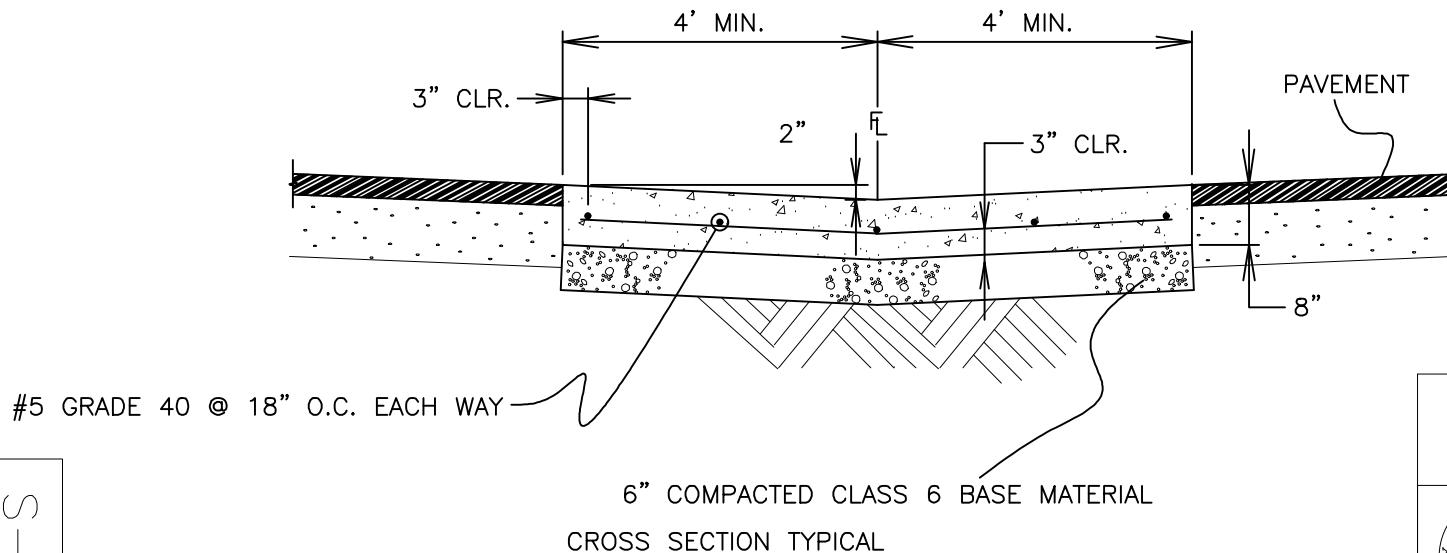
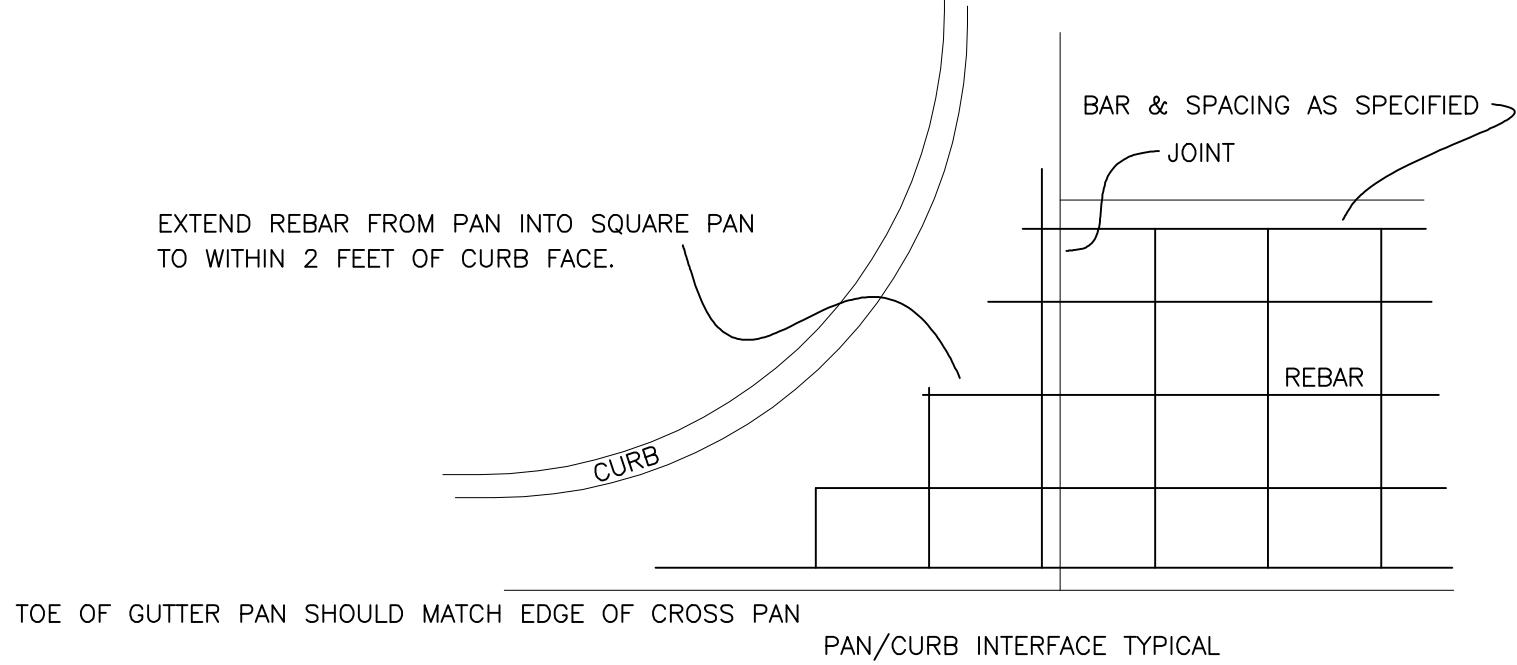


CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL

REVISED: JANUARY 2017

S-6d



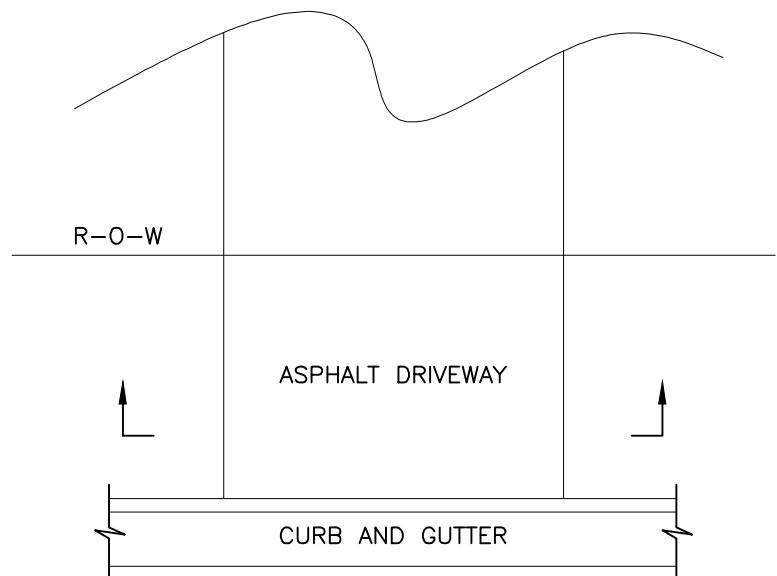
CROSS PAN DETAIL



CITY OF CANON CITY
ENGINEERING DEPARTMENT

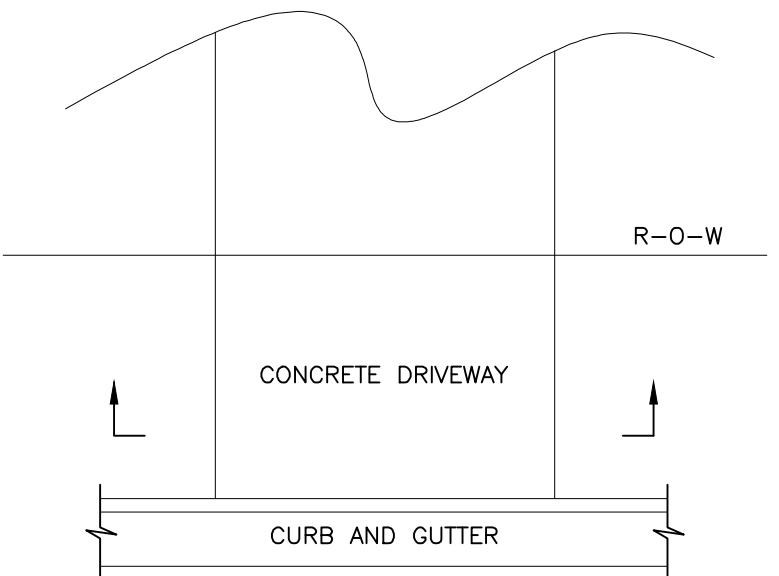
STANDARD DETAIL
REVISED: AUGUST 2008

S-7



8" MIN. CLASS 6 BASE MATERIAL
97% COMPACTION, MAX. DENSITY STANDARD PROCTOR

CROSS SECTION



6" MIN. CLASS 6 BASE MATERIAL →
97% COMPACTION, MAX. DENSITY STANDARD PROCTOR

CROSS SECTION

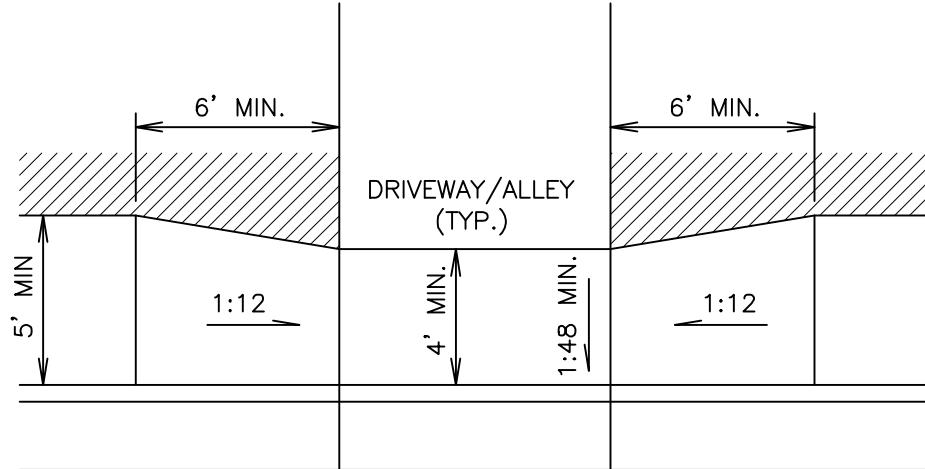


PRIVATE DRIVEWAY
IN RIGHT-OF-WAY

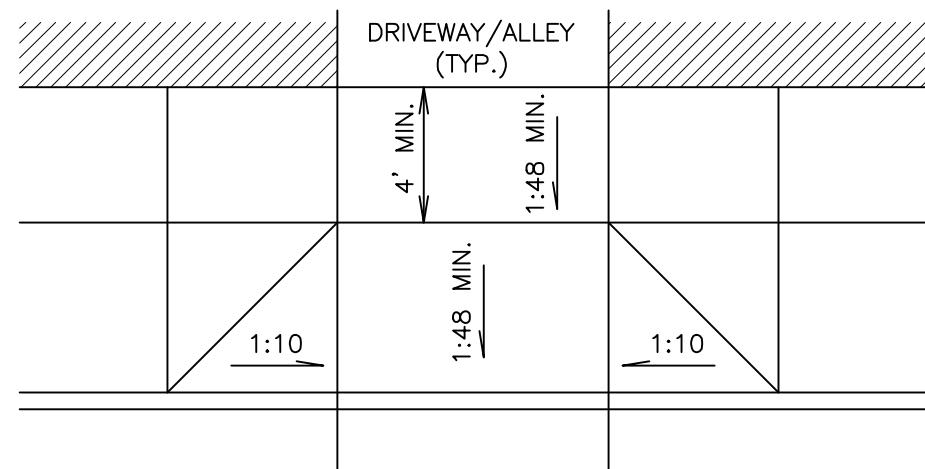
CITY OF CAÑON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL

S-8 a



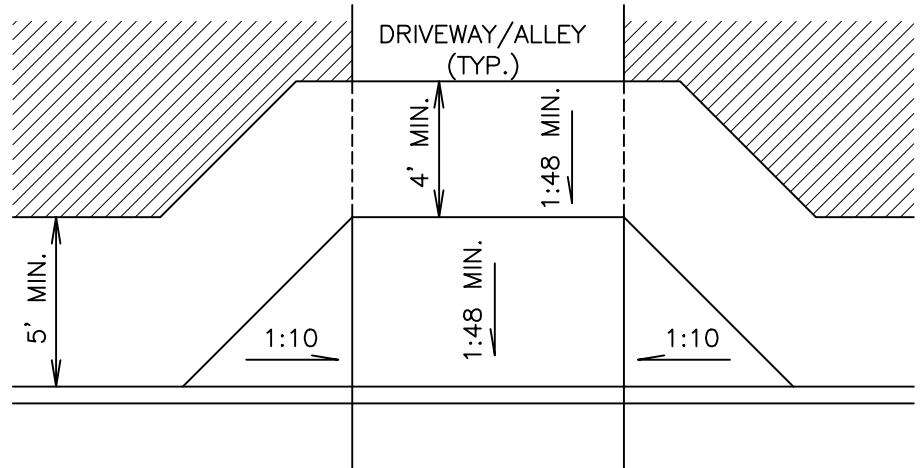
RAMP SIDEWALK



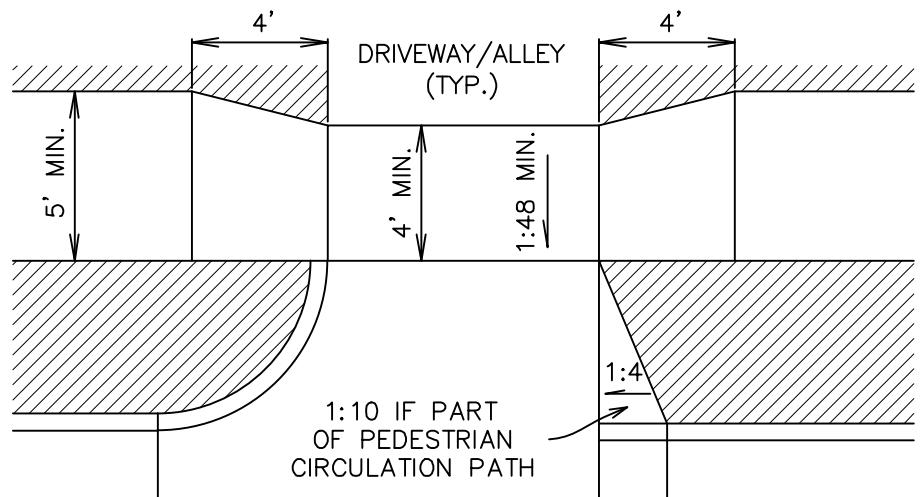
WIDE SIDEWALK

NOTE: COMMERCIAL DRIVEWAYS AND DOWNTOWN ALLEYS SHALL HAVE DETECTABLE WARNINGS ON EACH SIDE.

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APRON OFFSET SIDEWALK



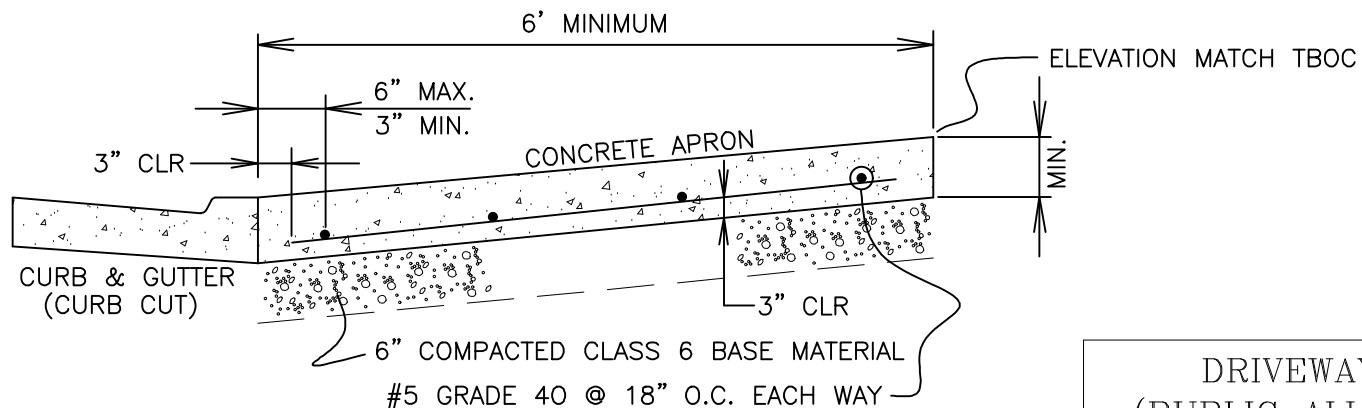
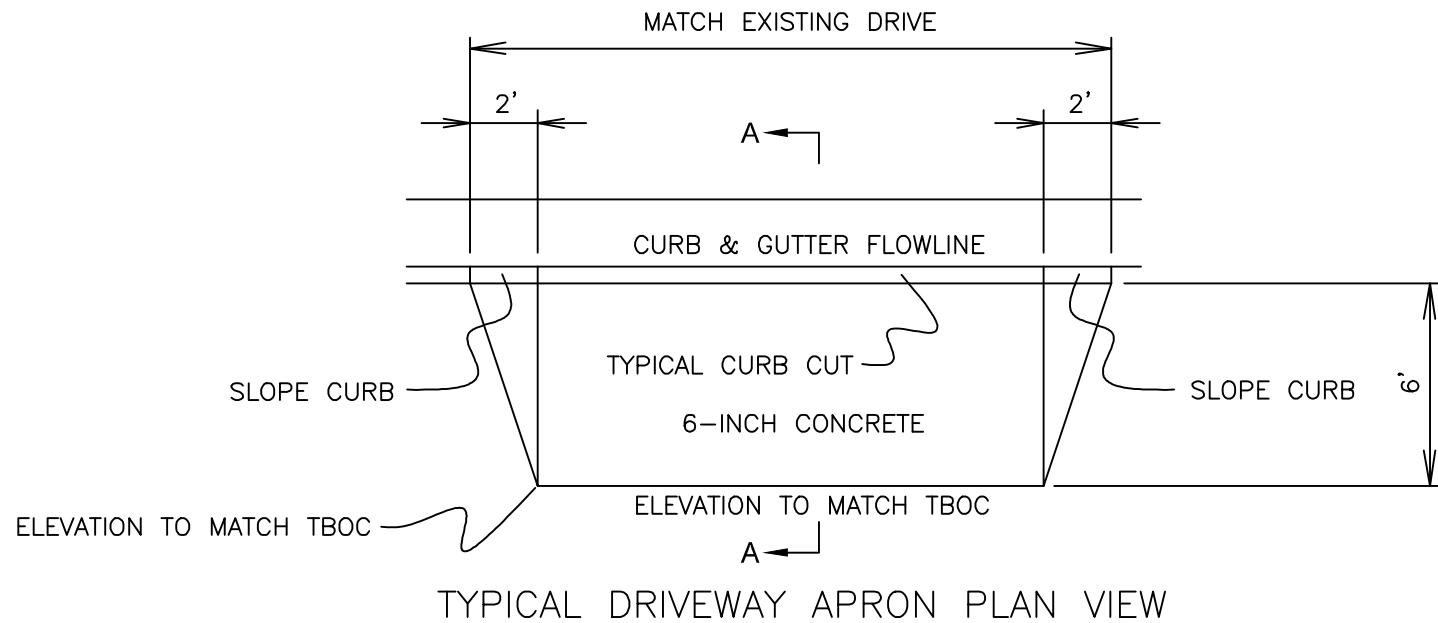
SETBACK SIDEWALK - WING OR CURB

SIDEWALK ALLEY/DRIVEWAY CONNECTION



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ENGINEERING DEPARTMENT
STANDARD DETAIL
REVISED: AUGUST 2017

S-8b



SECTION A-A DRIVEWAY APRON

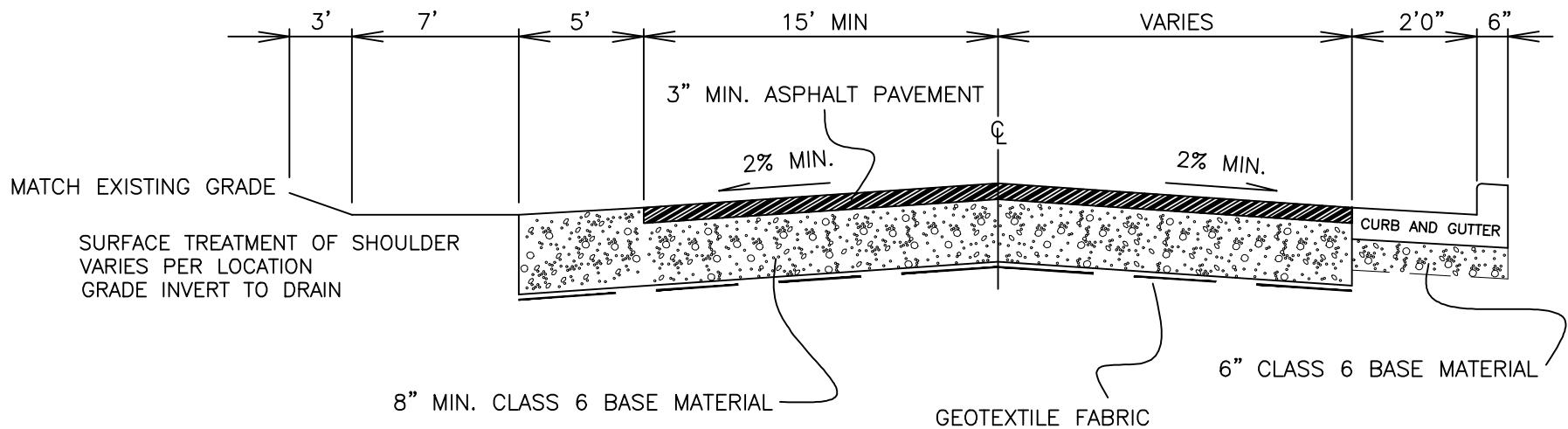
DRIVEWAY APRON
(PUBLIC ALLEY WAYS)



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ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: APRIL 2005

S-9



*LOCAL ROAD MINIMUM

*SECTION TO BE DESIGNED/CONFIRMED BY GEOTECHNICAL ENGINEER AND APPROVED BY CITY.

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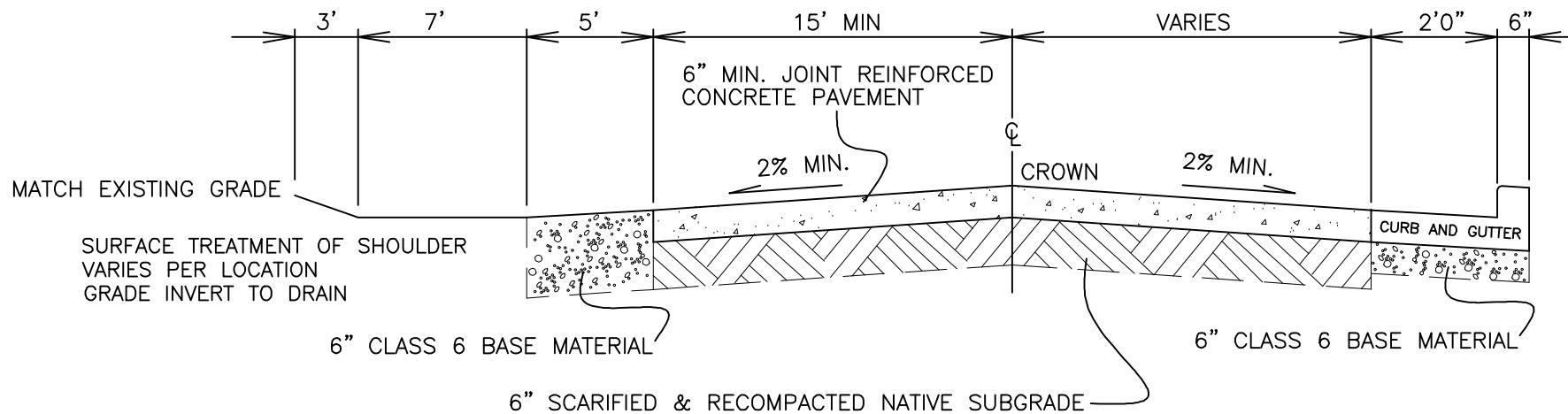
H.M.A. PAVEMENT
ROAD CROSS SECTION



CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: AUGUST 2008

S-10



*LOCAL ROAD MINIMUM

*SECTION TO BE DESIGNED/CONFIRMED BY GEOTECHNICAL ENGINEER AND APPROVED BY CITY.

P.C.C. PAVEMENT
ROAD CROSS SECTION

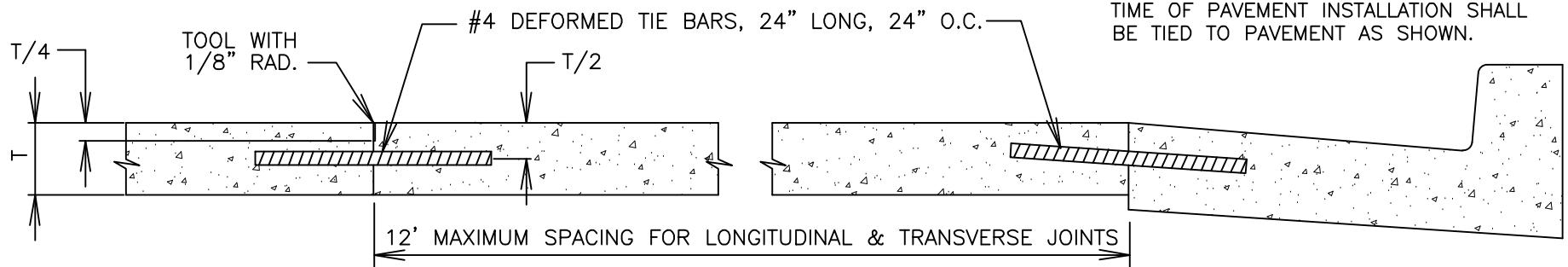


CITY OF CANON CITY
ENGINEERING DEPARTMENT

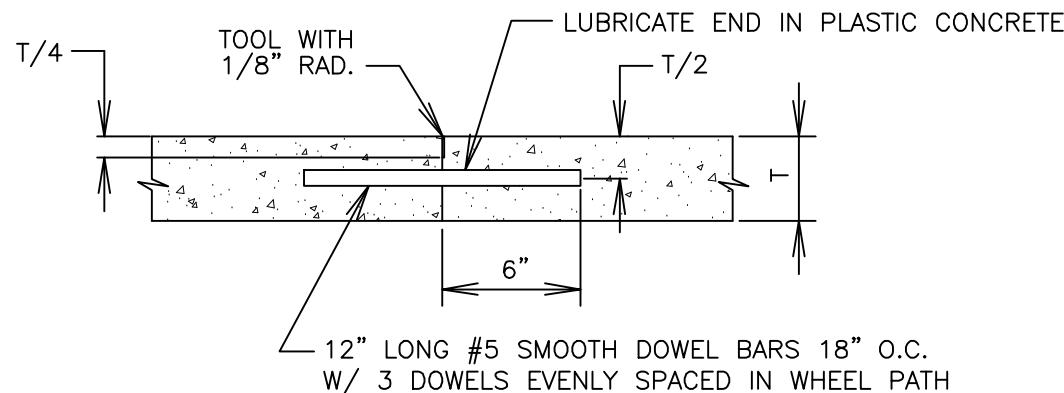
STANDARD DETAIL
REVISED: AUGUST 2008

S-11

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TYPE A-1
PRE-MOLDED OR SAWED LONGITUDINAL AND C&G JOINT

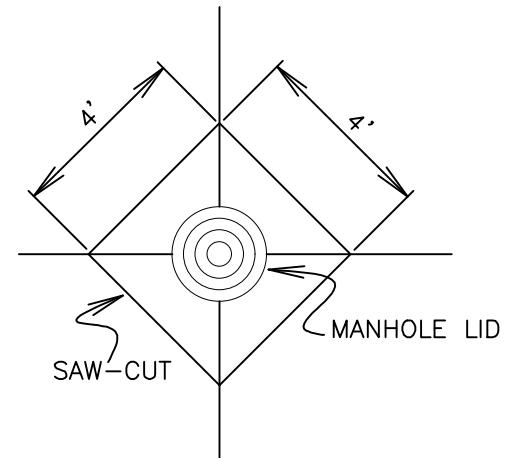


TYPE D
TRANSVERSE CONSTRUCTION JOINT

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*LOCAL ROAD MINIMUM

*SECTION TO BE DESIGNED/CONFIRMED BY GEOTECHNICAL ENGINEER AND APPROVED BY CITY.



MANHOLE SAW-CUT DETAIL

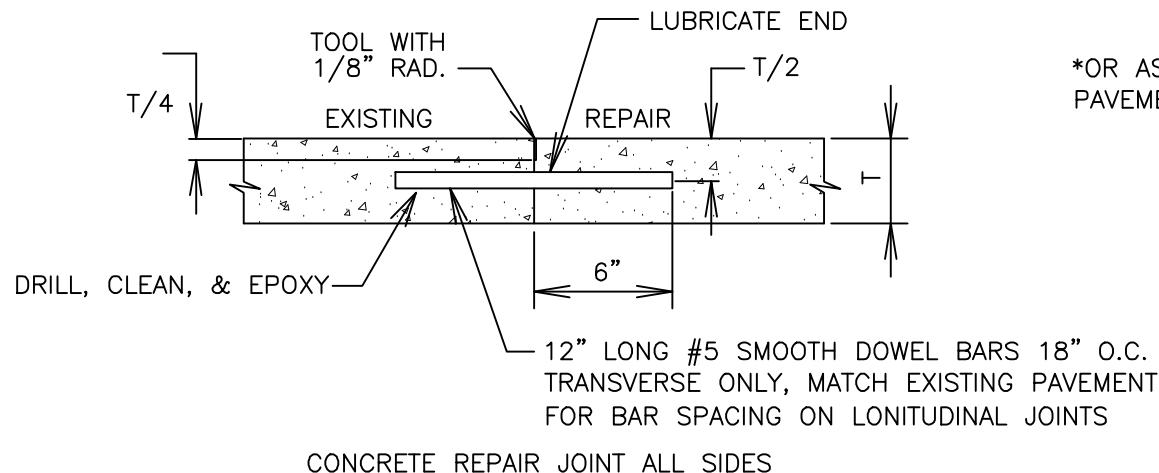
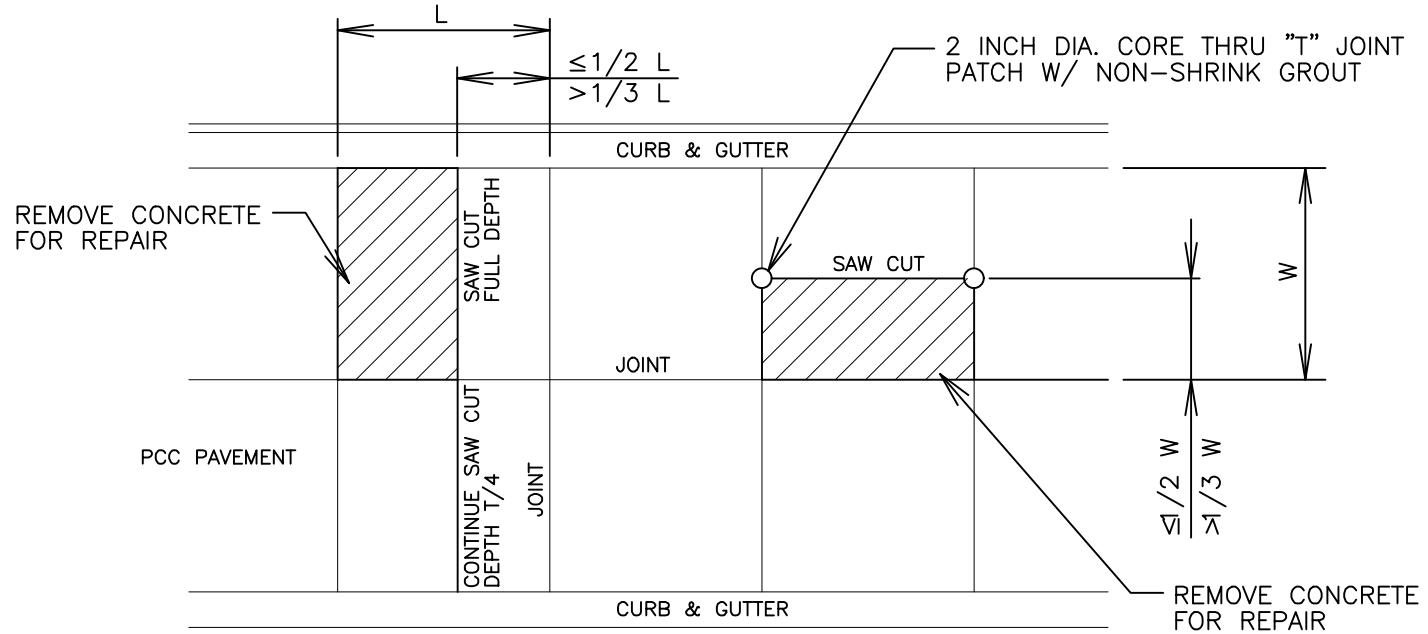
P.C.C. PAVEMENT
JOINT DETAILS



CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: AUGUST 2008

S-12



*OR AS DIRECTED BY ENGINEER BASED ON PAVEMENT DESIGN AND CONDITION.

P.C.C. PAVEMENT REPAIR

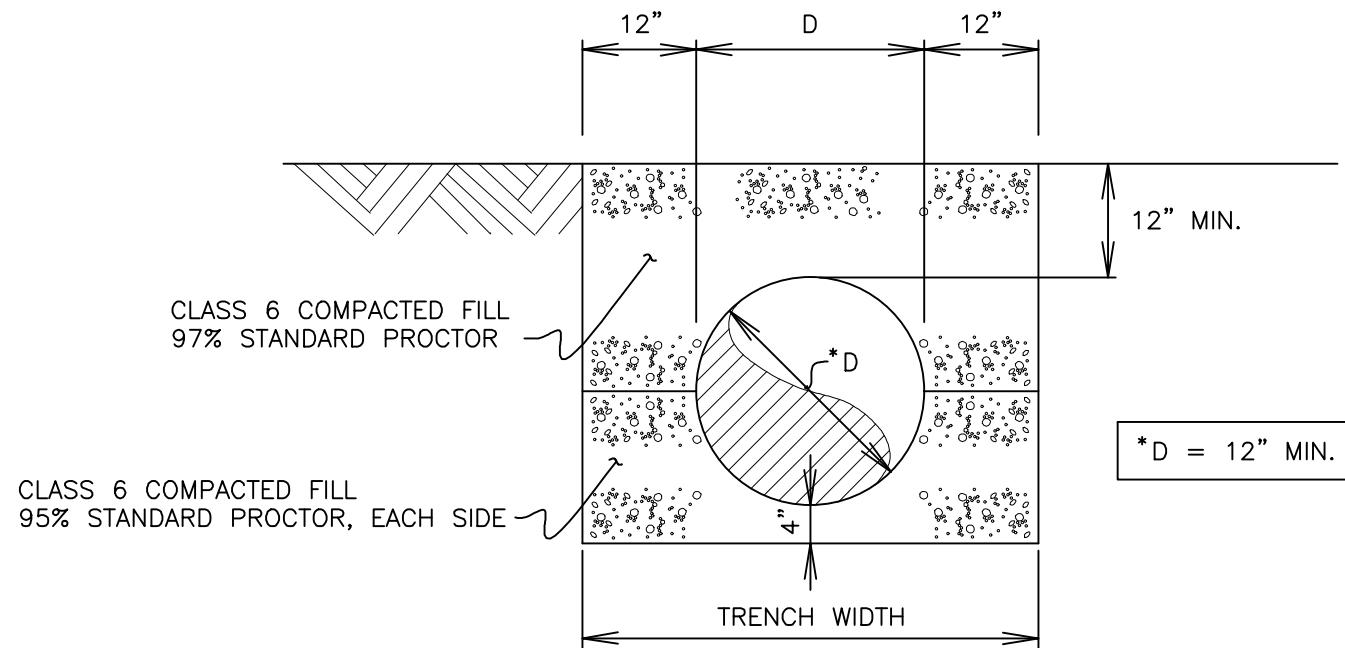


CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: AUGUST 2008

S-13

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STANDARD IRRIGATION
DRAINAGE CULVERT

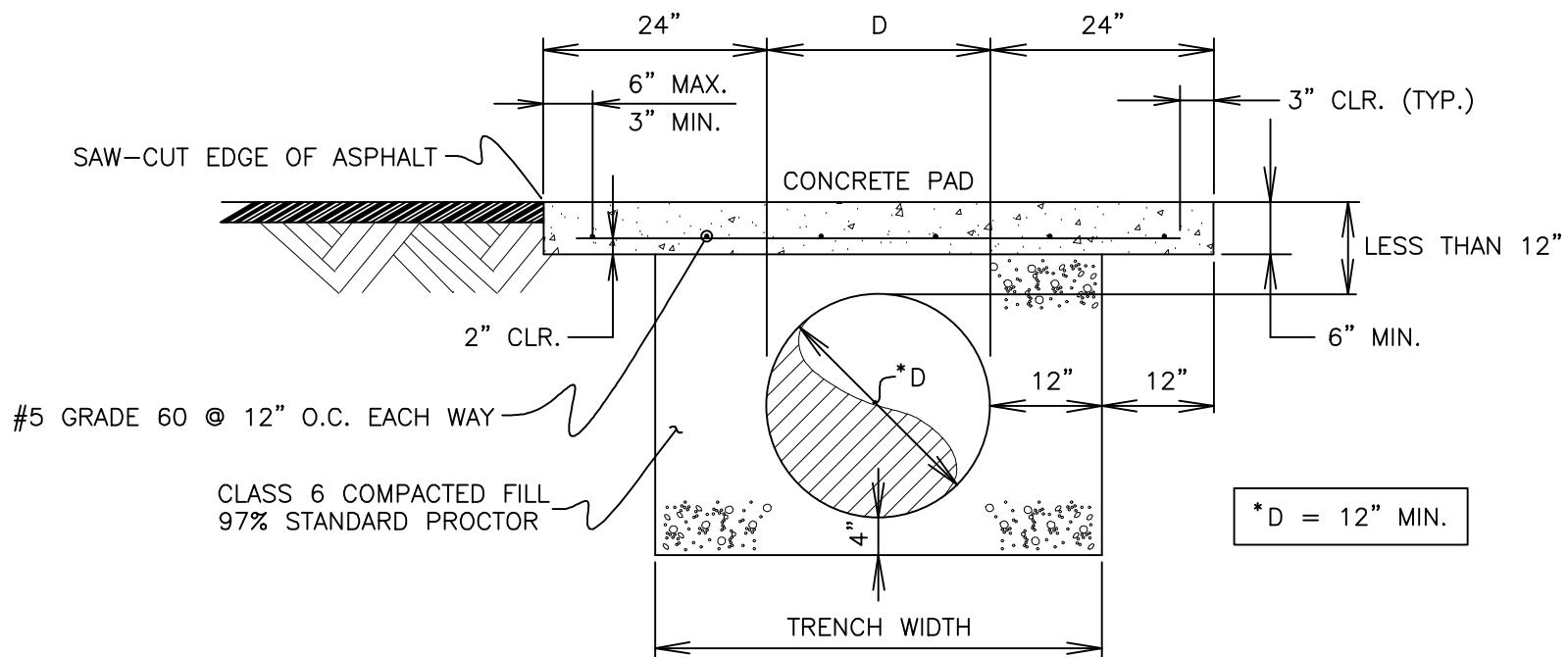


CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: MARCH 2004

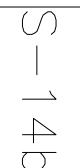
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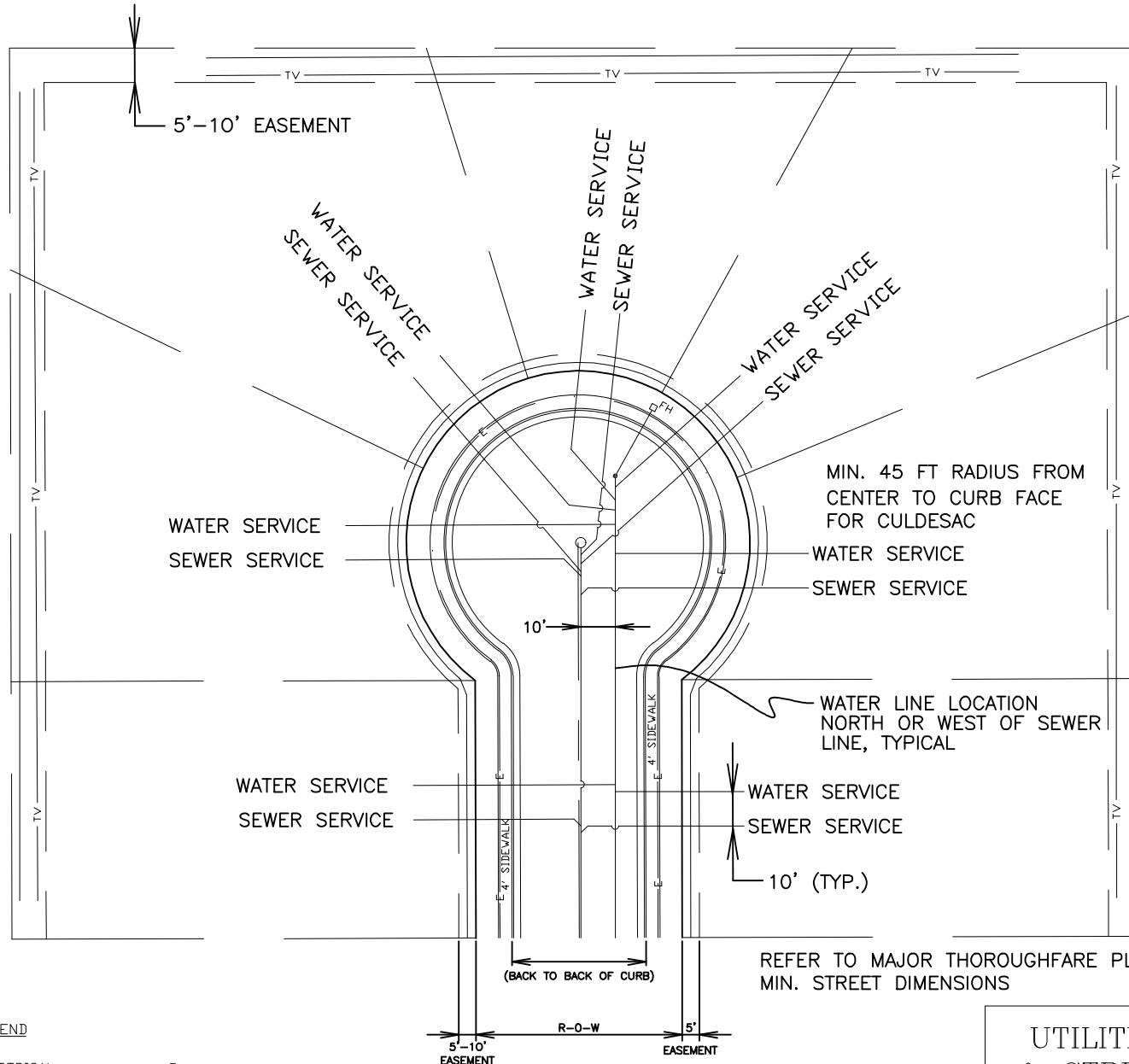


NOTES:

- 1.) 1" MIN. SPACE BETWEEN PIPE AND CONCRETE PAD
- 2.) FOR FAMILY RESIDENCE: IF 12 GA. C.M.P. IS USED, THE FULL 12" CLASS 6 COVER OR 6" CONCRETE CAP IS NOT REQUIRED.



STANDARD IRRIGATION DRAINAGE CULVERT (LESS THAN 12" COVER)	
	CITY OF CANON CITY ENGINEERING DEPARTMENT
STANDARD DETAIL	S-14b
REVISED: MARCH 2004	



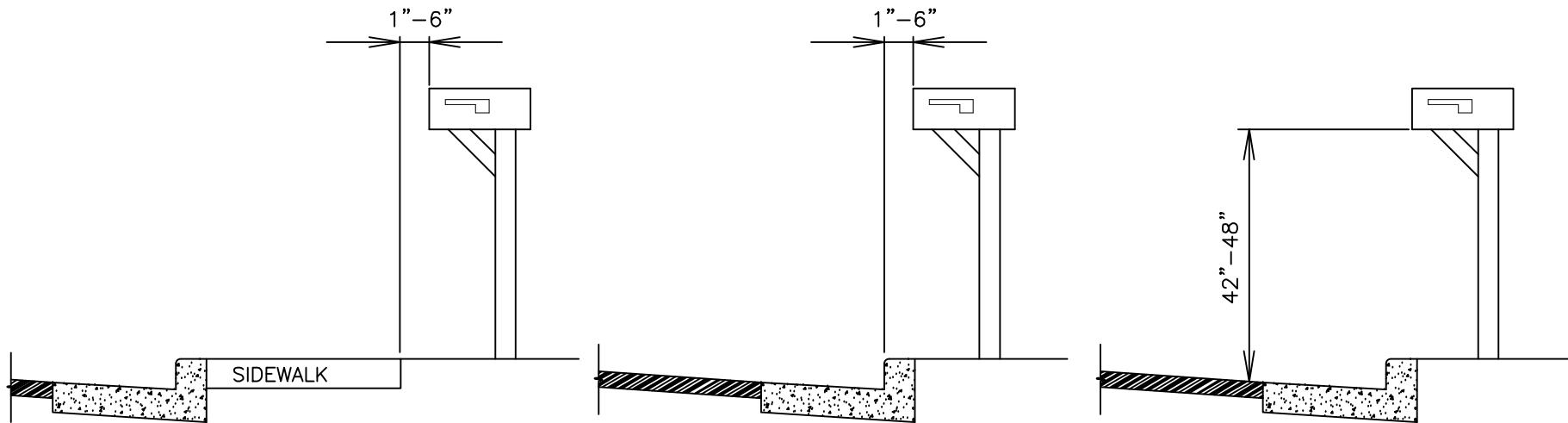
UTILITIES PLACEMENT & STREET DIMENSIONS



CITY OF CANON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: AUGUST 2008

S-15



FRONT OF MAILBOX MUST BE
1-6 INCHES BACK FROM EDGE
OF SIDEWALK

FRONT OF MAILBOX MUST BE
1-6 INCHES BACK FROM EDGE
OF CURB OR SHOULDER OF ROADWAY

BOTTOM OF MAILBOX MUST BE
42-48 INCHES FROM ROADWAY
SURFACE

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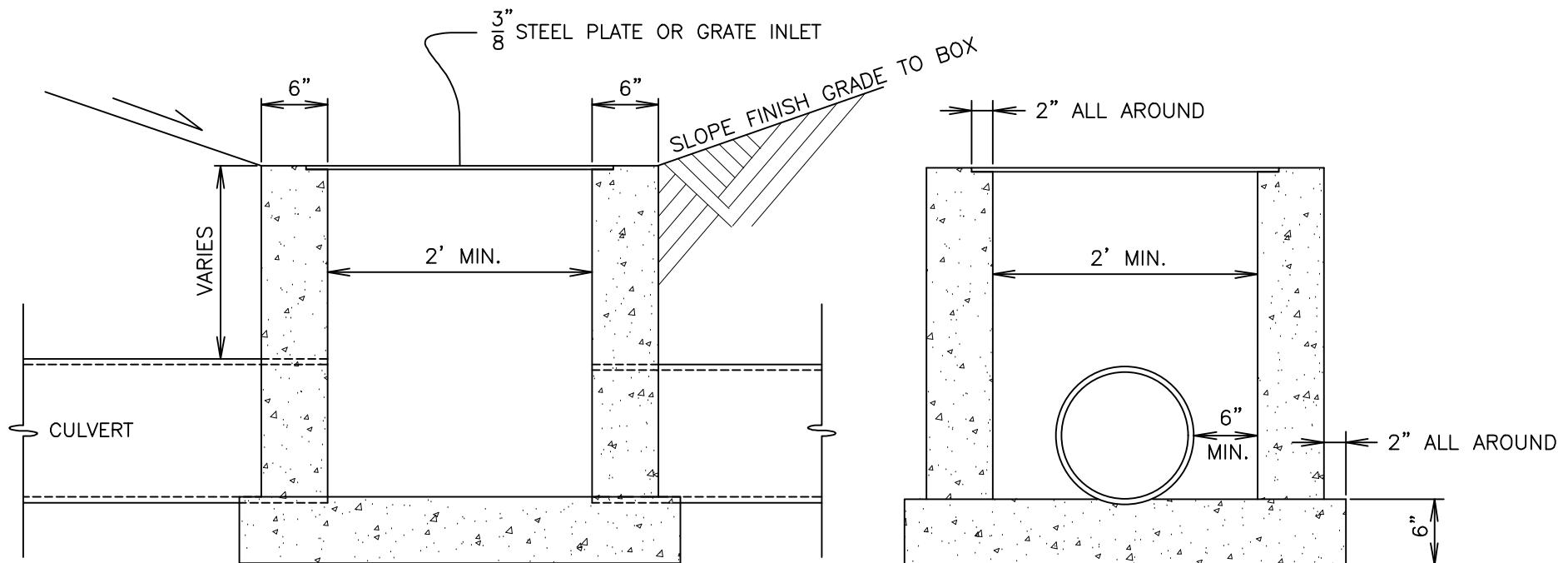
MAILBOX LOCATION



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ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: AUGUST 2008

S-16



CLEANOUT SHALL BE PLACED A MIN.
OF EVERY 50 FEET.

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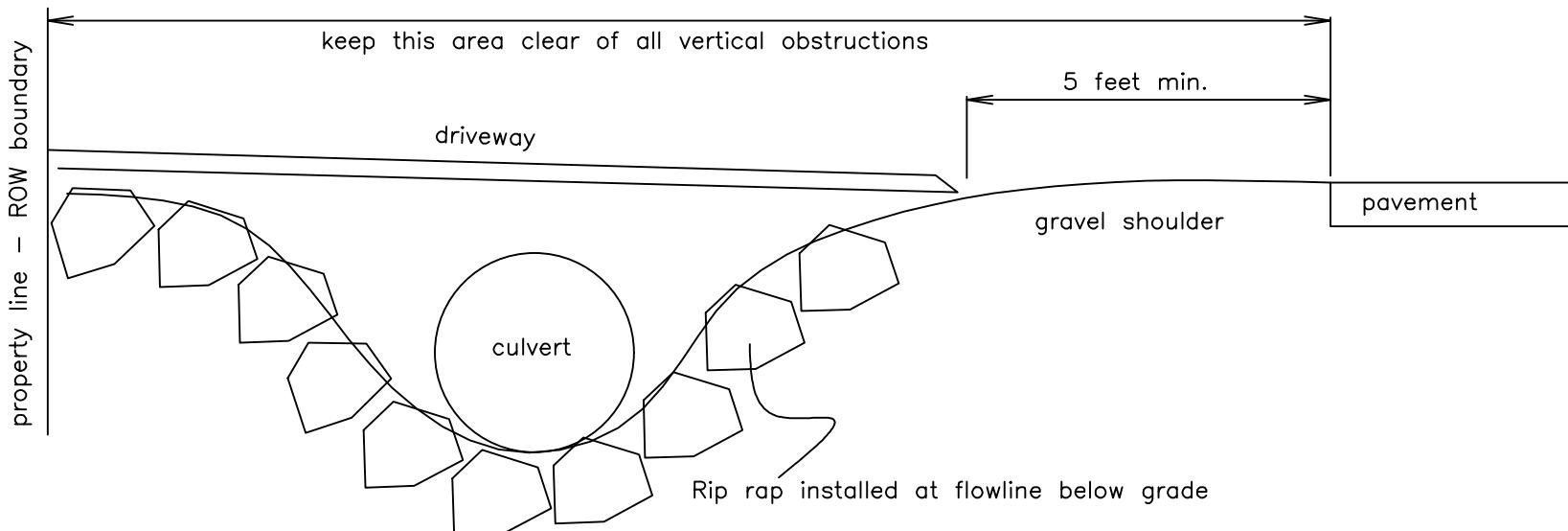
DRAIN LINE
CLEANOUT BOX



CITY OF CANON CITY
ENGINEERING DEPARTMENT

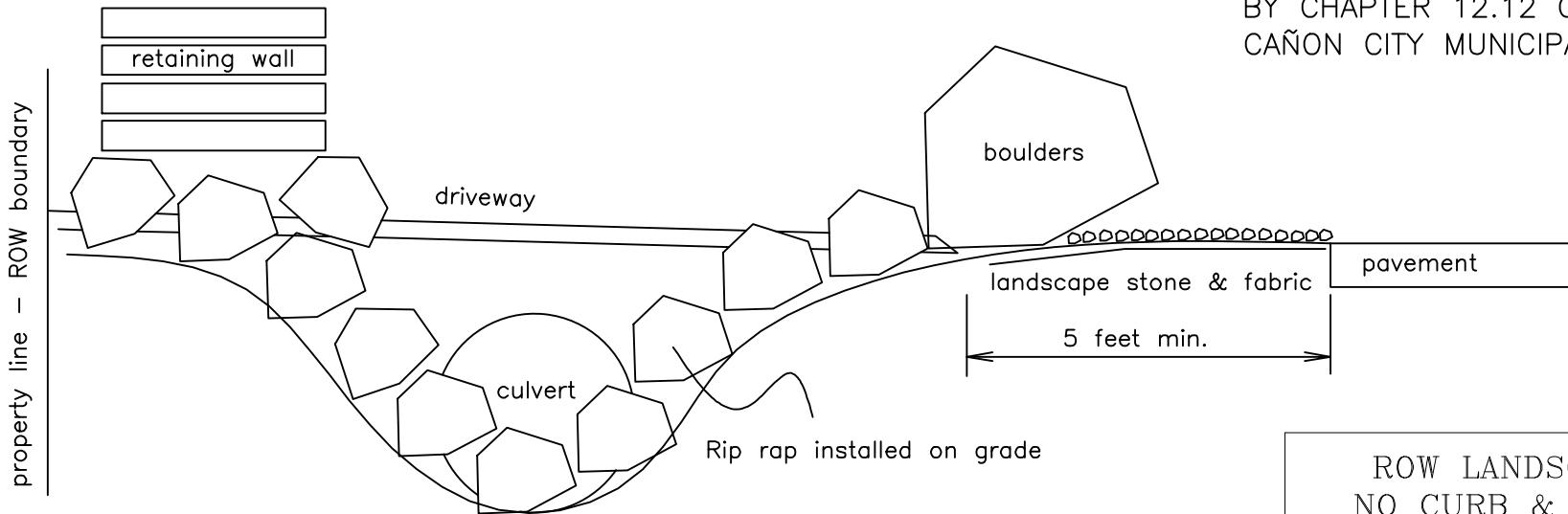
STANDARD DETAIL
REVISED: AUGUST 2008

S-17



LANDSCAPING IN ROW - CORRECT
CROSS SECTION - N.T.S.

NOTE: ENCROACHMENTS IN
RIGHT-OF-WAY IS GOVERNED
BY CHAPTER 12.12 OF THE
CAÑON CITY MUNICIPAL CODE



LANDSCAPING IN ROW - INCORRECT
CROSS SECTION - N.T.S.

ROW LANDSCAPING
NO CURB & GUTTER



CITY OF CAÑON CITY
ENGINEERING DEPARTMENT

STANDARD DETAIL
REVISED: AUGUST 2017

S-18