

**CITY OF GREELEY  
INVITATION FOR BID**

**35<sup>th</sup> Avenue Widening and Utility Project – Phase 1**

**BID #FD20-11-158**

**DUE DECEMBER 8, 2020 BEFORE 2:00 P.M.**



Serving Our  
Community  
It's A Tradition

*The Office of the Purchasing Manager is a service division  
established to build effective partnerships through efficient and responsive  
procurement processes to obtain high quality  
goods and services for the best value.*

**SECTION 00110**  
**BID #FD20-11-158**

**INVITATION FOR BID**

The City of Greeley, Colorado is requesting **sealed** bids for 35<sup>th</sup> Avenue Widening and Utility Project – Phase 1 due **December 8, 2020 before 2:00pm** via electronic submission which at that time all bids will be publicly opened and read aloud via a Zoom meeting. No late or faxed bids will be accepted. It is the responsibility of the vendor to ensure the solicitation documents are submitted to the correct email address as noted in the Solicitation Documents. Solicitations delivered to other City of Greeley email addresses may be deemed as late and not accepted.

Instructions for electronic submittal.

Email your Bid Response to [purchasing@greeleygov.com](mailto:purchasing@greeleygov.com). [purchasing@greeleygov.com](mailto:purchasing@greeleygov.com) Submit your Bid response to this email only – please do not email to multiple people. Only email's sent to will be considered as responsive to the invitation to bid. Emails sent to other City emails may be considered as non-responsive and may not be reviewed.

Bids shall be submitted in a single Microsoft Word or PDF file under 20MB

The Bid number and Project name **must be noted** in the subject line, otherwise the Bid may be considered as non-responsive to the Bid.

Electronic submittals will be held, un-opened, until the time and date noted in the Bid documents or posted addenda.

The City of Greeley disseminates all bids through the Rocky Mountain E-Purchasing System site. Go to <http://www.RockyMountainBidSystem.com>, then "Bid Opportunities" and then select "The City of Greeley". Bids submitted to the City of Greeley must include Sections 00120, 00130, 00140 and 00160. Addenda must be acknowledged in Section 00120 of the bidding documents. Bidders failing to acknowledge any and all addenda may be considered non-responsive.

An optional pre-bid meeting will be held on **November 19, 2020 at 11:30am** via a Zoom Meeting. All prospective bidders are encouraged to attend.

Invitation to a scheduled Zoom meeting.

Join Zoom Meeting

<https://greeleygov.zoom.us/j/86538086275>

Meeting ID: 865 3808 6275

Passcode: 460804

Dial by your location

+1 669 900 6833 US (San Jose)

+1 253 215 8782 US (Tacoma)

+1 346 248 7799 US (Houston)

Each bid shall be accompanied, by a bidder's bond executed by a surety company authorized to do business in Colorado, made payable to the City of Greeley, Colorado or by a certified check drawn on a bank which is insured by the Federal Deposit Insurance corporation made payable to the City of Greeley, Colorado, in an amount not less than five percent (5%) of the proposal sum as security that the successful bidder will enter into a contract to construct this project in accordance with the plans and specifications, and give bonds in the sum as hereafter provided. Checks accompanying bids not accepted will be returned.

The successful responsive and responsible bidder will be required to furnish a satisfactory performance bond and payment bond in the amount of the contract sum.

No bid shall be withdrawn after the opening of the bids without the consent of the City of Greeley, Colorado, for a

4-7-2020

period of sixty (60) days after the scheduled time of the receiving the bids.

All proposals will be confidential until a contract is awarded and fully executed. At that time, all proposals and documents pertaining to the proposals will be open for public inspection, except for the material that is proprietary or confidential. However, requests for confidentiality can be submitted to the Purchasing Contact provided that the submission is in accordance with the following procedures. This remains the *sole responsibility* of the offeror. The Purchasing Contact will make no attempt to cure any information that is found to be at a variance with this procedure. The offeror may not be given an opportunity to cure any variances after proposal opening.

**Neither a proposal in its entirety, nor proposal price information will be considered confidential/proprietary.** Questions regarding the application of this procedure must be directed to the Purchasing Contact listed in this RFP.

*"Public Viewing Copy: The City is a governmental entity subject to the Colorado Open Records Act, C.R.S. §§ 24-72-200.1 et seq. ("CORA"). Any bids/proposals submitted hereunder are subject to public disclosure by the City pursuant to CORA and City ordinances. Vendors may submit one (1) additional complete bid/proposal clearly marked "FOR PUBLIC VIEWING." In this version of the bid/proposal, the Vendor may redact text and/or data that it deems confidential or proprietary pursuant to CORA. Such statement does not necessarily exempt such documentation from public disclosure if required by CORA, by order of a court of appropriate jurisdiction, or other applicable law. Generally, under CORA trade secrets, confidential commercial and financial data information is not required to be disclosed by the City. Bids/Proposals may not be marked "Confidential" or "Proprietary" in their entirety. **All provisions of any contract resulting from this request for proposal will be public information.**"*

The City of Greeley retains the right to reject any and all bids and to waive any informality as deemed in the best interest of the city.

Questions pertaining to the project may be directed to Doug Clapp via email: [doug.clapp@greeleygov.com](mailto:doug.clapp@greeleygov.com) or at 970-350-9792. Deadline to receive questions is **November 23, 2020 by 4:00pm.**

Doug Clapp  
Purchasing Manager

Greeley Website  
November 10, 2020

## Section 00120

### BID PROPOSAL

**PROJECT:**           **35<sup>th</sup> Avenue Widening & Utility Project – Phase 1**

The Undersigned, having become familiar with the local conditions affecting the cost of the work, plans, drawings, and specifications attached herewith, and with advertisement for bids, the form of bid and proposal, form of bond, all of which are issued and attached and on file in the office of the Project Manager, hereby bid and propose to furnish all the labor, materials, necessary tools, and equipment and all utility and transportation service necessary to perform and complete in a workmanlike manner all of the work required in connection with the construction of the items listed on the bidding schedule in accordance with the plans and specifications as prepared by the City of Greeley, Colorado, for the sums set forth in the Bidding Schedule.

The total bid shall be the basis for establishing the amount of the Performance and Payment Bond for this project. The total bid is based on the quantities shown in the bid proposal form and the dimensions shown on the plans.

The undersigned has carefully checked the Bidding Schedule quantities against the plans and specifications before preparing this proposal and accepts the said quantities as substantially correct, both as to classification and the amounts, and as correctly listing the complete work to be done in accordance with the plans and specifications.

The undersigned, agrees to complete and file a Performance and Payment Bond and further agrees to complete the contract within two hundred (200) Calendar Days from Notice to Proceed. Official notice to proceed will not be issued until adequate Performance and Payment Bonds and other required documents are on file with the City of Greeley.

NOTE: Bidders should not add any conditions or qualifying statements to this bid as otherwise the bid may be declared irregular as being non responsive to the Invitation for bids. The following numbered Addenda have been received and the bid, as submitted, reflects any changes resulting from those Addenda: \_\_\_\_\_

\_\_\_\_\_  
ATTEST

\_\_\_\_\_  
DATE

\_\_\_\_\_  
COMPANY NAME

\_\_\_\_\_  
BY

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
TITLE

**SECTION 00130**  
**BID SCHEDULE**  
**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
<b>BID SCHEDULE A</b>					
<b>Roadway Widening and Storm Sewer</b>					
1.	Clearing and Grubbing (Includes Sm/Med Boulders at Stoneybrook Entrance)	1	LS	\$ _____	\$ _____
2.	Removal of Irrigation Structure (Includes Slide Valve & Adjacent Hydrant) (CIP)	1	EA	\$ _____	\$ _____
3.	Removal of Manhole (Storm)	2	EA	\$ _____	\$ _____
4.	Removal of Abandoned Storm Structure	1	EA	\$ _____	\$ _____
5.	Removal of Fire Hydrant Assembly	1	EA	\$ _____	\$ _____
6.	Removal of Tree	32	EA	\$ _____	\$ _____
7.	Removal of Tree Stump	1	EA	\$ _____	\$ _____
8.	Removal of Inlet	5	EA	\$ _____	\$ _____
9.	Removal of Riprap	11	SY	\$ _____	\$ _____
10.	Removal of Storm Pipe (Pipe Size Varies)	530	LF	\$ _____	\$ _____
11.	Removal of Existing Culvert Wingwalls	12	LF	\$ _____	\$ _____
12.	Removal of Structures and Obstructions (66-inch Abandoned RCP & Plug Ends)	1	LS	\$ _____	\$ _____
13.	Removal of Utility Pole	0	EA	\$ _____	\$ _____
14.	Removal of Post (Wood/Steel)	5	EA	\$ _____	\$ _____
15.	Removal of Bollard	4	EA	\$ _____	\$ _____
16.	Removal of Delineator	1	EA	\$ _____	\$ _____
17.	Removal of Bench	1	EA	\$ _____	\$ _____
18.	Removal of Bus Stop Structure	1	EA	\$ _____	\$ _____
19.	Removal of Fence	2420	LF	\$ _____	\$ _____
20.	Removal of Gate (16-Ft Metal)	1	EA	\$ _____	\$ _____
21.	Removal of Slide Gate (30-Ft Chain Link)	2	EA	\$ _____	\$ _____
22.	Removal of Guardrail	48	LF	\$ _____	\$ _____
23.	Removal of Wall (Concrete & Brick)	90	LF	\$ _____	\$ _____
24.	Removal of Concrete	448	SY	\$ _____	\$ _____
25.	Removal of Gravel Walk	132	SY	\$ _____	\$ _____
26.	Removal of Curb & Gutter	1141	LF	\$ _____	\$ _____
27.	Removal of Asphalt Pavement	17763	SY	\$ _____	\$ _____
28.	Removal of Temporary Asphalt Drive	270	SY	\$ _____	\$ _____
29.	Asphalt Milling (2 Inch)	2627	SY	\$ _____	\$ _____
30.	Removal of Ground Sign	28	EA	\$ _____	\$ _____
31.	Removal of Business Sign	2	EA	\$ _____	\$ _____
32.	Removal of Pull Box	1	EA	\$ _____	\$ _____
33.	Removal of Traffic Signal Equipment	1	LS	\$ _____	\$ _____
34.	Unclassified Excavation (Complete In Place)	8015	CY	\$ _____	\$ _____
35.	Unsuitable Material (Complete In Place)	1100	CY	\$ _____	\$ _____
36.	Borrow (Complete In Place)	2193	CY	\$ _____	\$ _____
37.	Flowfill Ex Test Hole	49	EA	\$ _____	\$ _____

**SECTION 00130**  
**BID SCHEDULE**  
**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
38.	Structure Excavation	340	CY	\$ _____	\$ _____
39.	Structure Backfill (Class 1)	224	CY	\$ _____	\$ _____
40.	Topsoil Strip (4 Inch)	3528	CY	\$ _____	\$ _____
41.	Topsoil Replacement (4 Inch Backslope)	1163	CY	\$ _____	\$ _____
42.	Topsoil/Squeegee in Medians 50/50 (Pre-amended w/Compost ) (compacted quantity) 12" depth	286	CY	\$ _____	\$ _____
43.	Topsoil in tree lawns (Pre-amended w/Compost ) (compacted quantity) 4" depth	478	CY	\$ _____	\$ _____
44.	Sediment Control Log (SCL-1)	5659	LF	\$ _____	\$ _____
45.	Concrete Washout Structure (CWA)	2	EA	\$ _____	\$ _____
46.	Rock Sock (RS) & Inlet Protection (IP) & Culvert Inlet Protection (CIP-1)	569	LF	\$ _____	\$ _____
47.	Check Dam (CD-1)	0	EA	\$ _____	\$ _____
48.	Vehicle Tracking Pad (VTC)	2	EA	\$ _____	\$ _____
49.	Erosion Control Management	30	DAY	\$ _____	\$ _____
50.	Relocate Business Sign	1	EA	\$ _____	\$ _____
51.	Relocate Bus Stop Structure & Amenities	1	EA	\$ _____	\$ _____
52.	Relocate Existing Landscaping Blocks	1	EA	\$ _____	\$ _____
53.	Reset Sign Panel	1	EA	\$ _____	\$ _____
54.	Modify and Adjust Ex Storm MH to connect with Proposed Storm	1	EA	\$ _____	\$ _____
55.	Modify Existing Sanitary MH (Includes Cementitious Coating)	0	EA	\$ _____	\$ _____
56.	Adjust Water Valve	16	EA	\$ _____	\$ _____
57.	Adjust Water Meter Pit	1	EA	\$ _____	\$ _____
58.	Adjust Fire Hydrant Assembly	1	EA	\$ _____	\$ _____
59.	Adjust Traffic Vault	2	EA	\$ _____	\$ _____
60.	Adjust Manhole (Storm, Water, & Sanitary Sewer)	13	EA	\$ _____	\$ _____
61.	Dewatering (Roadway Widening Project)	1	LS	\$ _____	\$ _____
62.	Switchgrass plugs	0	EA	\$ _____	\$ _____
63.	Low Grow Native Seed Mix (Non-irrigated) (Includes Hydraulic Mulching)	38000	SF	\$ _____	\$ _____
64.	Buffalo Grass Seed (Includes Hydraulic Mulching)	0	SF	\$ _____	\$ _____
65.	Bluegrass Sod (Includes Fine Grading and Sod)	30000	SF	\$ _____	\$ _____
66.	Landscape Weed Barrier Fabric (In Cobble Mulch and under Boulders)	0	SF	\$ _____	\$ _____
67.	Wood (Organic) Mulch (4" Depth) (50% of Medians total size - 15000)	0	CY	\$ _____	\$ _____
68.	Cobble Mulch - 3" to 6" Diameter Tan River Rock (50% of Median - 15000 SF) (4 " Depth)	0	TON	\$ _____	\$ _____
69.	Sand/Pea Gravel/Aggregate Rock Mix ( 7300 SF) (4" Depth)	80	TON	\$ _____	\$ _____
70.	Landscape Boulders	0	EA	\$ _____	\$ _____
71.	Ornamental Tree (1.5" Caliper)	0	EA	\$ _____	\$ _____
72.	Deciduous Shade Tree (2" Caliper)	0	EA	\$ _____	\$ _____
73.	Coniferous Trees	0	EA	\$ _____	\$ _____

**SECTION 00130**  
**BID SCHEDULE**  
**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
74.	Perennials	0	EA	\$ _____	\$ _____
75.	Ornamental Grasses (1 gallon)	0	EA	\$ _____	\$ _____
76.	Shrubs (5 Gallon)	0	EA	\$ _____	\$ _____
77.	Soil Retention Blanket (Straw-Coconut)(Biodegradable Class 1)	901	SY	\$ _____	\$ _____
78.	Aggregate Base Course (6 Inch) (Concrete RAB and under C&G)	1055	TON	\$ _____	\$ _____
79.	Aggregate Base Course (12 Inch) (Asphalt Roadway and under C&G)	16983	TON	\$ _____	\$ _____
80.	Hot Mix Asphalt (Grade S)(75)(PG 58-28)(4 Inch)(Bottom Lift)	5278	TON	\$ _____	\$ _____
81.	Hot Mix Asphalt (Grade S)(75)(PG 64-22)(3 Inch)(Top Lift)	3961	TON	\$ _____	\$ _____
82.	Hot Mix Asphalt (Grade S)(75)(PG 64-22)(2 Inch)(Overlay)	305	TON	\$ _____	\$ _____
83.	Concrete Pavement (11 Inch)(RAB)	2518	SY	\$ _____	\$ _____
84.	Concrete Pavement (8 Inch) (Truck Apron & Driveways)	800	SY	\$ _____	\$ _____
85.	Concrete Pavement (8 Inch) (Colored Drive -- Nevarez Property)	0	SY	\$ _____	\$ _____
86.	Concrete Pavement (Fast Track)	50	SY	\$ _____	\$ _____
87.	Drilled Caisson (18 Inch)	10	LF	\$ _____	\$ _____
88.	Drilled Caisson (36 Inch)	95	LF	\$ _____	\$ _____
89.	Hydrovac Caisson Excavation (East HAWK)	15	LF	\$ _____	\$ _____
90.	Retaining Wall (Dry-Stack)(NE Corner of RAB)	188	SF	\$ _____	\$ _____
91.	Riprap (Type L) (Buried) (CIP)	8	CY	\$ _____	\$ _____
92.	Riprap (Type M) (CIP)	0	CY	\$ _____	\$ _____
93.	Pedestrian Railing	0	LF	\$ _____	\$ _____
94.	Concrete Sealer	82	SY	\$ _____	\$ _____
95.	Waterproofing (Asphalt)	218	SY	\$ _____	\$ _____
96.	Headwall (HW Storm)	0	SF	\$ _____	\$ _____
97.	Concrete Class D (Wall)	23	CY	\$ _____	\$ _____
98.	Concrete Class D (Box Culvert)	162	CY	\$ _____	\$ _____
99.	Reinforcing Steel	49470	LB	\$ _____	\$ _____
100.	12" ADS HP (Complete In Place)	47	LF	\$ _____	\$ _____
101.	15" RCP (Complete In Place)	43	LF	\$ _____	\$ _____
102.	18" RCP (Complete In Place)	720	LF	\$ _____	\$ _____
103.	24" RCP (Complete In Place)	217	LF	\$ _____	\$ _____
104.	30" RCP (Complete In Place)	217	LF	\$ _____	\$ _____
105.	36" RCP (Complete In Place)	130	LF	\$ _____	\$ _____
106.	12" ADS End Section (Complete In Place)	1	EA	\$ _____	\$ _____
107.	18" RC End Section w/ Cutoff Wall (Complete In Place)	1	EA	\$ _____	\$ _____
108.	24" RC End Section (Complete In Place)	1	EA	\$ _____	\$ _____
109.	30" RC End Section (Complete In Place)	0	EA	\$ _____	\$ _____
110.	36" RC End Section (Special) (Complete In Place)	1	EA	\$ _____	\$ _____
111.	Storm Crossing over Water or Sanitary Sewer Pipes (Pipe Cradle, Wrap, Flowfill)	4	EA	\$ _____	\$ _____

**SECTION 00130**  
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**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
112.	7x5 Foot Concrete Box Culvert (Precast)	0	LF	\$ _____	\$ _____
113.	12" ADS Inline Basin w/ Dome Grate	2	EA	\$ _____	\$ _____
114.	Modified Type C Area Inlet w/ Dry Well	0	EA	\$ _____	\$ _____
115.	5' Type R Inlet (5 Ft)	0	EA	\$ _____	\$ _____
116.	5' Type R Inlet (10 Ft)	2	EA	\$ _____	\$ _____
117.	5' Type R Inlet (15 Ft)	0	EA	\$ _____	\$ _____
118.	10' Type R Inlet (5 Ft)	1	EA	\$ _____	\$ _____
119.	10' Type R Inlet-Modified (5 Ft)	1	EA	\$ _____	\$ _____
120.	10' Type R Inlet (10 Ft)	2	EA	\$ _____	\$ _____
121.	10' Type R Inlet (15 Ft)	4	EA	\$ _____	\$ _____
122.	Median Area Inlet (with 36" Drain Basin and Neenah Grate)	2	EA	\$ _____	\$ _____
123.	Storm Drain Manhole Box Base	4	EA	\$ _____	\$ _____
124.	4' Dia. Storm Drain Manhole & 15" Pipe Stub (Connect to Ex Irr Line) (CIP)	1	EA	\$ _____	\$ _____
125.	4' Dia. Storm Drain Manhole	2	EA	\$ _____	\$ _____
126.	5' Dia. Storm Drain Manhole	3	EA	\$ _____	\$ _____
127.	Ex Stilling Basin Wall Core Connection (24" and 36" pipes)	1	LS	\$ _____	\$ _____
128.	Water Quality Flex Filter Bag	2	EA	\$ _____	\$ _____
129.	Water Quality Structure-SAFL	3	EA	\$ _____	\$ _____
130.	Water Quality Structure-Snout 24F	3	EA	\$ _____	\$ _____
131.	Water Quality Bioswale	312	LF	\$ _____	\$ _____
132.	Bridge Rail Type 10M (Special)	80	LF	\$ _____	\$ _____
133.	Guardrail Type 3	50	LF	\$ _____	\$ _____
134.	Transition Type 3J	1	EA	\$ _____	\$ _____
135.	End Anchorage Type 3D	1	EA	\$ _____	\$ _____
136.	End Anchorage Type 3K	1	EA	\$ _____	\$ _____
137.	Concrete Sidewalk (5 Inch with Fiber Mesh)	4765	SY	\$ _____	\$ _____
138.	Concrete Sidewalk (6 Inch with Fiber Mesh)	1707	SY	\$ _____	\$ _____
139.	Concrete Sidewalk (5 Inch with Fiber Mesh) and 6" High Curb (Monolithic Pour)	280	SY	\$ _____	\$ _____
140.	Detectable Warning	632	SF	\$ _____	\$ _____
141.	6" Vertical Face Curb and Gutter (2' Gutter - Inflow) (Curb 1)	6202	LF	\$ _____	\$ _____
142.	6" Vertical Face Curb and Gutter (1' Gutter - Outflow/Inflow) (Curb 2 & Curb 5)	2714	LF	\$ _____	\$ _____
143.	6" Mountable Curb and Gutter (2' Gutter - Inflow) (Curb 3)	365	LF	\$ _____	\$ _____
144.	3" Mountable Curb and Gutter (1' Gutter - Outfall) (Curb 4)(11" Thick for Conc. RAB)	290	LF	\$ _____	\$ _____
145.	2' Gutter Pan	0	LF	\$ _____	\$ _____
146.	Splash Block	1109	LF	\$ _____	\$ _____
147.	2" PVC Conduit (Electrical Plans)	598	LF	\$ _____	\$ _____
148.	2 Inch Electrical Conduit (Traffic Signal Plans)	420	LF	\$ _____	\$ _____
149.	2 Inch Electrical Conduit (Bored) (Traffic Signal Plans)	275	LF	\$ _____	\$ _____



**SECTION 00130**  
**BID SCHEDULE**  
**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
150.	2 Inch Electrical Conduit (4 - 2" Conduit w/ Single Trench 4,075LF) (Fiber Optic)	11720	LF	\$ _____	\$ _____
151.	2 Inch Electrical Conduit (Sidewalk of Bridge Deck)	27	LF	\$ _____	\$ _____
152.	3 Inch Electrical Conduit (Traffic Signal Plans)	310	LF	\$ _____	\$ _____
153.	3 Inch Electrical Conduit (Bored) (Traffic Signal Plans)	375	LF	\$ _____	\$ _____
154.	4 Inch Electrical Conduit (Sidewalk of Bridge Deck)	242	LF	\$ _____	\$ _____
155.	6 Inch Electrical Conduit (Sidewalk of Bridge Deck)	27	LF	\$ _____	\$ _____
156.	Traffic Rated Pull Box 18"x24"x18" (Electrical Plans)	2	EA	\$ _____	\$ _____
157.	Pull Box (13"x24"x18")(Channel)(INSTALL ONLY)(Traffic Signal Plans)	6	EA	\$ _____	\$ _____
158.	Pull Box (24"x36"x24")(Channel)(INSTALL ONLY)(Traffic Signal Plans)	3	EA	\$ _____	\$ _____
159.	Pull Box (24"x36"x24")(Fiber Optic)	8	EA	\$ _____	\$ _____
160.	Heat Trace Cable (Fiber Optic)	2930	LF	\$ _____	\$ _____
161.	Wiring (Traffic Signal Plans)	3	EA	\$ _____	\$ _____
162.	Luminaire (LED)(INSTALL ONLY)(Traffic Signal Plans)	3	EA	\$ _____	\$ _____
163.	Electrical Service Equipment - Milbank Pedestal or Equal	1	EA	\$ _____	\$ _____
164.	Concrete Pad for Electrical Panel	1	EA	\$ _____	\$ _____
165.	Grounding Rod (Electrical)	2	EA	\$ _____	\$ _____
166.	Grounding Electrode Conductor #4AWG (Electrical)	65	LF	\$ _____	\$ _____
167.	Trenching (Electrical)	519	LF	\$ _____	\$ _____
168.	#10 AWG CU Conductors (Electrical)	1650	LF	\$ _____	\$ _____
169.	Pedestrian Signal Face (16)(Countdown)(INSTALL ONLY)	4	EA	\$ _____	\$ _____
170.	Traffic Signal Face (12-12-12)(INSTALL ONLY)	11	EA	\$ _____	\$ _____
171.	Traffic Signal Face (12-12-12-12)(INSTALL ONLY)	4	EA	\$ _____	\$ _____
172.	Traffic Signal Controller Cabinet (INSTALL ONLY)	2	EA	\$ _____	\$ _____
173.	Pedestrian Push Button (INSTALL ONLY)	4	EA	\$ _____	\$ _____
174.	Fire Preemption Unit and Timer (INSTALL ONLY)	1	EA	\$ _____	\$ _____
175.	Intersection Detection System (Camera) (INSTALL ONLY)	2	EA	\$ _____	\$ _____
176.	Flashing Beacon (Special)(INSTALL ONLY)	4	EA	\$ _____	\$ _____
177.	Traffic Signal - Light Pole Steel (1-30 Foot Mast Arm) (INSTALL ONLY)	2	EA	\$ _____	\$ _____
178.	Traffic Signal - Light Pole Steel (1-35 Foot Mast Arm) (INSTALL ONLY)	1	EA	\$ _____	\$ _____
179.	Traffic Signal - Light Pole Steel (1-40 Foot Mast Arm) (INSTALL ONLY)	1	EA	\$ _____	\$ _____
180.	Traffic Signal - Light Pole Steel (1-55 Foot Mast Arm) (INSTALL ONLY)	1	EA	\$ _____	\$ _____
181.	Traffic Signal Pedestal Pole Aluminum (INSTALL ONLY)	2	EA	\$ _____	\$ _____
182.	Sign Panel (Class I)(Roadway)	312	SF	\$ _____	\$ _____
183.	Sign Panel (Class I)(Traffic Signal Plan)	85	SF	\$ _____	\$ _____
184.	Sign Post	48	EA	\$ _____	\$ _____
185.	Bus Stop Amenities (Shelter, Bike Rack, Trash Bin)	1	EA	\$ _____	\$ _____
186.	Irrigation (Medians and Tree Lawns)	0	SF	\$ _____	\$ _____

**SECTION 00130**  
**BID SCHEDULE**  
**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
187.	Irrigation (Bluegrass Sod private irrigation repairs)	23960	SF	\$ _____	\$ _____
188.	Irrigation Controller System (Controller, Two Wire, Grounding)	0	EA	\$ _____	\$ _____
189.	Repair Existing Bestway Irrigation System and Reseed	1	LS	\$ _____	\$ _____
190.	Pavement Marking Paint	52	GAL	\$ _____	\$ _____
191.	Preformed Thermoplastic Pavement Marking (Word-Symbol)	1148	SF	\$ _____	\$ _____
192.	Preformed Thermoplastic Pavement Marking (Xwalk-Stop Line)	1441	SF	\$ _____	\$ _____
193.	Construction Traffic Control Devices	200	DAY	\$ _____	\$ _____
194.	Flagging	2500	HR	\$ _____	\$ _____
195.	Traffic Control Inspection	57	DAY	\$ _____	\$ _____
196.	Traffic Control Management	143	DAY	\$ _____	\$ _____
197.	Portable Message Sign Panel	4	EA	\$ _____	\$ _____
198.	Temporary Asphalt Pavement	525	SY	\$ _____	\$ _____
199.	Temporary Signal at 4th Street	1	LS	\$ _____	\$ _____
200.	F/A Maintenance & Plant Warranty	0	F.A.	\$ _____	\$ _____
201.	Mobilization - Roadway Widening and Storm Sewer	1	LS	\$ _____	\$ _____

**SECTION 00130**  
**BID SCHEDULE**  
**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
<b>TOTAL SCHEDULE A</b>					\$ _____
<b>BID SCHEDULE B</b>					
<b>Water, Non-Potable, and Sanitary Sewer</b>					
1.	Mobilization - Water, Non-Potable, and Sanitary Sewer	1	LS	\$ _____	\$ _____
2.	Dewatering	1	LS	\$ _____	\$ _____
3.	Install Fire Hydrants	2	EA	\$ _____	\$ _____
4.	2" Water Line Air Vac	1	EA	\$ _____	\$ _____
5.	20" Water Line	430	LF	\$ _____	\$ _____
6.	20" MJ Bends and Tees	7	EA	\$ _____	\$ _____
7.	20" Gate Valves	1	EA	\$ _____	\$ _____
8.	12" Water Line	80	LF	\$ _____	\$ _____
9.	12" MJ Bends and Tees	1	EA	\$ _____	\$ _____
10.	12" Gate Valves	1	EA	\$ _____	\$ _____
11.	16" Water Line Connection	1	LS	\$ _____	\$ _____
12.	2" Non-Potable Line Air Vac	2	EA	\$ _____	\$ _____
13.	24" Non-Potable Line	1400	LF	\$ _____	\$ _____
14.	24" MJ Bends and Tees	8	EA	\$ _____	\$ _____
15.	Dissipation Structure Riprap and Riprap Bedding	1	LS	\$ _____	\$ _____
16.	Dissipation Structure	1	LS	\$ _____	\$ _____
17.	Embankment Fill, Tree Root Removal, Grading	1	LS	\$ _____	\$ _____
18.	24" Sanitary Sewer Line	1300	LF	\$ _____	\$ _____
19.	18" Sanitary Sewer Line	140	LF	\$ _____	\$ _____
20.	5 ft dia Manhole	5	EA	\$ _____	\$ _____
21.	6 ft dia Manhole	1	EA	\$ _____	\$ _____
22.	7 ft dia Doghouse Manhole	1	EA	\$ _____	\$ _____
23.	Crush Existing Sanitary Sewer Line	1475	LF	\$ _____	\$ _____
24.	Remove Existing Sanitary Sewer Manholes	5	EA	\$ _____	\$ _____
25.	16" Water Line Encasement	1	LS	\$ _____	\$ _____
26.	Repair of Existing Potholes	43	EA	\$ _____	\$ _____
27.	Clearing and Grubbing	1	LS	\$ _____	\$ _____
28.	Sediment Control Log (SLC-1)	1	LF	\$ _____	\$ _____
29.	Concrete Washout Structure (CWA)	1	EA	\$ _____	\$ _____
30.	Rock Sock (RS) & Inlet Protection (IP) & Culvert Inlet Protection (CIP-1)	1	LF	\$ _____	\$ _____
31.	Check Dam (CD-1)	1	EA	\$ _____	\$ _____
32.	Vehicle Tracking Pad (VTC)	1	EA	\$ _____	\$ _____
33.	Erosion Control Management	1	LS	\$ _____	\$ _____
<b>TOTAL SCHEDULE B</b>					\$ _____

**SECTION 00130**  
**BID SCHEDULE**  
**35TH AVENUE WIDENING AND UTILITY IMPROVEMENTS - PHASE 1**  
**December-20**

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	AMOUNT
<b>Non-Potable Bid Alternate 214+00 to 225+12.19</b>					
1.	Clearing and Grubbing	1	LS	\$ _____	\$ _____
2.	Dewatering	1	LS	\$ _____	\$ _____
3.	Sediment Control Log (SLC-1)	1	LF	\$ _____	\$ _____
4.	Concrete Washout Structure (CWA) Rock Sock (RS) & Inlet Protection (IP) & Culvert Inlet	1	EA	\$ _____	\$ _____
5.	Protection (CIP-1)	1	LF	\$ _____	\$ _____
6.	Check Dam (CD-1)	1	EA	\$ _____	\$ _____
7.	Vehicle Tracking Pad (VTC)	1	EA	\$ _____	\$ _____
8.	Erosion Control Management	1	LS	\$ _____	\$ _____
9.	2" Non-Potable Line Air Vac	2	EA	\$ _____	\$ _____
10.	24" Non-Potable Line	1113	LF	\$ _____	\$ _____
11.	24" MJ Bends and Tees	5	EA	\$ _____	\$ _____
12.	Vac Truck Connection	1	EA	\$ _____	\$ _____
				<b>ALTERNATE TOTAL</b>	\$ _____

**TOTAL SCHEDULE A**      \$ \_\_\_\_\_  
**TOTAL SCHEDULE B**      \$ \_\_\_\_\_  
**TOTAL BASE BID (SCHEDULE A + SCHEDULE B)**      \$ \_\_\_\_\_  
**ALTERNATE TOTAL**      \$ \_\_\_\_\_  
**TOTAL BID WITH ALTERNATE**      \$ \_\_\_\_\_

Total Base Bid Written Out:

Total Bid With Alternate Written Out:

Vendor Name:

Authorized Signature:

Print Name:

Phone Number:

Fax Number:

Email Address:

Date:

Email Address:

Date:

## **COOPERATIVE PURCHASING STATEMENT**

The City of Greeley encourages and participates in cooperative purchasing endeavors undertaken by or on behalf of other governmental jurisdictions. To the extent, other governmental jurisdictions are legally able to participate in cooperative purchasing endeavors; the City of Greeley supports such cooperative activities. Further, it is a specific requirement of this proposal or Request for Proposal that pricing offered herein to the City of Greeley may be offered by the vendor to any other governmental jurisdiction purchasing the same products. The vendor(s) must deal directly with any governmental agency concerning the placement of purchase orders, contractual disputes, invoicing, and payment. The City of Greeley shall not be liable for any costs or damages incurred by any other entity.

## SECTION 00140

### BID BOND

KNOW ALL MEN BY THESE PRESENT, that we, the undersigned \_\_\_\_\_ as Principal, and \_\_\_\_\_ as Surety, are hereby held and firmly bound unto the City of Greeley, Colorado, as Owner, in the penal sum of \_\_\_\_\_ for the Payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors, and assigns.

THE CONDITION of this obligation is such that whereas the Principal has submitted to the City of Greeley, Colorado, the accompanying bid and hereby made a part hereof to enter into a Contract Agreement for the construction of City of Greeley Project,

#### **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

WHEREAS, the Owner, as condition for receiving said bid, requires that the Principal to deposit with the Owner as Bid Guaranty equal to five percent (5%) of the amount of said bid.

NOW, THEREFORE,

(a) If said bid shall be rejected; or in the alternate,

(b) If said bid shall be accepted and the Principal shall execute and deliver a Contract Agreement (properly completed in accordance with said bid) and shall furnish a Performance and Payment Bond upon the forms prescribed by the Owner for the faithful performance of said Agreement; and shall in all other respects perform the agreement created by the acceptance of said bid;

then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

PRINCIPAL

SURETY

Name: \_\_\_\_\_

Address: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_ Attorney \_\_\_\_\_

In-Fact:

(Seal)

(Seal)

NOTE: Surety Companies executing bonds must be authorized to transact business in the State of Colorado and be accepted to the Owner.

# SECTION 00160

## NOTICE OF PRE-BID CONFERENCE

### 35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1

A pre-bid conference will be held:

On November 19, 2020 at 11:30 a.m., via Zoom meeting. All bidders are highly encouraged to attend.

Join Zoom Meeting

<https://greeleygov.zoom.us/j/86538086275>

Meeting ID: 865 3808 6275

Passcode: 460804

Dial by your location

+1 669 900 6833 US (San Jose)

+1 253 215 8782 US (Tacoma)

+1 346 248 7799 US (Houston)

Representatives of the City of Greeley will be present to answer questions.

Each bidder shall submit the following declaration of attendance, along with the other bid documents.

\*\*\*\*\*

I have attended the pre-bid conference \_\_\_\_\_

I have not attended the pre-bid conference \_\_\_\_\_

\_\_\_\_\_  
Name of Contracting Organization

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Date



## SECTION 00210

### NOTICE OF AWARD

DATE:

TO:

Re: **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

Dear Contractor:

The City of Greeley, Colorado (hereinafter called "the Owner") has considered the bids submitted for referenced work in response to its Invitation for Bids. You are hereby notified that your bid has been accepted for items and prices stated in the Bid Schedule in the amount of \$\_\_\_\_\_. You are required to execute the Contract Agreement, provide the necessary insurance certificates, the Performance and Payment Bonds within ten (10) days from the date of this Notice. If you fail to execute said Contract Agreement and furnish the necessary insurance certificates and bonds within the time allotted from this date, the Owner will be entitled to consider your rights arising out of the Owner's acceptance of your bid as abandoned and to demand payment of bid guaranty as damages. The Owner will be entitled to such other rights as may be granted by law. You are required to return an acknowledged copy of this Notice of Award and enclosures to Purchasing.

CITY OF GREELEY, COLORADO

By: Joel Hemesath

Title: Director of Public Works

ACKNOWLEDGMENT: Receipt of the foregoing Notice of Award accompanied with a Performance and Payment Bond form and a signed copy of the Contract Document is hereby acknowledged this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

Bidder: \_\_\_\_\_

By: \_\_\_\_\_

## SECTION 00310

### CONTRACT

THIS AGREEMENT made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by and between the City of Greeley, Colorado, and under the laws of the state of Colorado, party of the first part, termed in the Contract Documents as the "Owner" and \_\_\_\_\_ party of the second part, termed in the Contract Documents as "Contractor."

WITNESSETH: In consideration of monetary compensation to be paid by the Owner to the Contractor at the time and in the manner hereinafter provided, the said Contractor has agreed, and does hereby agree, to furnish all labor, tools, equipment and material and to pay for all such items and to construct in every detail, to wit:

**PROJECT: 35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

at the price bid on the Proposal Form of \$ \_\_\_\_\_ all to the satisfaction and under the general supervision of the Project Manager for the City of Greeley, Colorado.

The Contract Documents consist of this Agreement, the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, the Specifications, all Addenda issued prior to and all Modifications issued after execution of this Agreement. These form the Contract, and all are as fully a part of the Contract as if attached to this Agreement or repeated herein.

The Project Manager named herein shall interpret and construe the Contract Documents, reconciling any apparent or alleged conflicts and inconsistencies therein; and all of the work and all details thereof shall be subject to the approval and determination of the Project Manager as to whether or not the work is in accordance with Contract Documents. Said City Project Manager shall be the final arbiter and shall determine any and all questions that may arise concerning the Contract Documents, the performance of the work, the workmanship, quality of materials and the acceptability of the completed project. The decision of the Project Manager on all questions shall be final, conclusive and binding.

AND FOR SAID CONSIDERATION IT IS FURTHER PARTICULARLY AGREED BETWEEN THE PARTIES TO THIS AGREEMENT.

1. That construction and installation of the above enumerated work for the Owner shall be completed and ready for use in accordance with the time of completion described in the Bid form of this Contract. That the above enumerated work shall begin within ten (10) days of the official "Notice to Proceed". (Contract shall become void if work is not started at specified time.)

2. That said work and materials for the project covered by the Contract Documents shall be completely installed and delivered to the Owner, within the time above stated, clear and free from any and all liens, claims, and demands of any kind.
3. The full compensation to be paid the Contractor by the Owner pursuant to the terms of this Contract shall be payable as provided in the Contract Documents.
4. This Contract consists of the following component parts, all of which are as fully a part of the Contract as herein set out verbatim, or if not attached, as if hereto attached:

Section 00110: Invitation for Bid  
Section 00120: Bid Proposal  
Section 00130: Bid Schedule  
Section 00140: Bid Bond  
Section 00160: Pre-bid meeting  
Section 00210: Notice of Award  
Section 00310: Contract  
Section 00320: Performance Bond  
Section 00330: Payment Bond  
Section 00340: Certificate of Insurance  
Section 00350: Lien Waiver Release  
Section 00360: Debarment/Suspension Certification Statement  
Section 00410: Notice to Proceed  
Section 00420: Project Manager Notification  
Section 00430: Certificate of Substantial Completion  
Section 00440: Final Completion  
Section 00510: General Conditions of the Contract  
Section 00520: Subcontractors List  
Section 00620: Special Provisions

Addenda Number \_\_\_\_\_ Inclusive

Any modifications, including change orders, duly delivered after execution of this Agreement.

**IN WITNESS WHEREOF**, the parties have caused this instrument to be executed as of the day and year first above written.

City of Greeley, Colorado

Contractor\_\_\_\_\_

Approved as to Substance

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
City Manager-Roy Otto

\_\_\_\_\_  
Printed Name

Reviewed as to Legal Form  
OFFICE OF THE CITY ATTORNEY

\_\_\_\_\_  
Title

By: \_\_\_\_\_  
City Attorney-Doug Marek

Certification of Contract  
Funds Availability

\_\_\_\_\_  
Interim Director of Finance-Robert Miller

## SECTION 00320

### PERFORMANCE BOND

Bond No. \_\_\_\_\_

KNOWN ALL MEN BY THESE PRESENTS: that

(Firm) \_\_\_\_\_

(Address) \_\_\_\_\_

(an Individual), (a Partnership), (a Corporation), hereinafter referred to as "the Principal", and

(Firm) \_\_\_\_\_

(Address) \_\_\_\_\_

hereinafter referred to as "the Surety", are held and firmly bound unto the CITY OF GREELEY, 1000 10th Street, Greeley, CO. 80631, a Municipal Corporation, hereinafter referred to as "the Owner" in the penal sum of \_\_\_\_\_ in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors and assigns, jointly and severally, firmly by these present.

THE CONDITIONS OF THIS OBLIGATION are such that whereas the Principal entered into a certain Contract Agreement with the Owner, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_, a copy of which is hereto attached and made a part hereof for the performance of City of Greeley Project,

### **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said Contract Agreement during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without Notice to the Surety and during the life of the guaranty period, and if he shall satisfy all claims and demands incurred under such Contract Agreement, and shall fully indemnify and save harmless the Owner from all cost and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, and then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract Agreement or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond; and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract Agreement or to the work or to the specifications.

IN WITNESS WHEREOF, this instrument is executed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

PROVIDED, FURTHER, that no final settlement between the Owner and Contractor shall abridge the right of any beneficiary hereunder, whose claims may be unsatisfied.

IN PRESENCE OF:

PRINCIPAL

_____	By: _____
_____	_____
_____	_____
(Corporate Seal)	(Address)

IN PRESENCE OF:

OTHER PARTNERS

_____	By: _____
_____	By: _____
	By: _____

IN PRESENCE OF:

SURETY

_____	By: _____
(Attorney-in-Fact)	
_____	_____
_____	_____
(SURETY SEAL)	(Address)

NOTE: Date of Bond must not be prior to date of Contract Agreement. If Contractor is Partnership, all partners should execute bond.

IMPORTANT: Surety Company must be authorized to transact business in the State of Colorado and be acceptable to the Owner.

## SECTION 00330

### PAYMENT BOND

Bond No. \_\_\_\_\_

KNOWN ALL MEN BY THESE PRESENT: that

(Firm) \_\_\_\_\_

(Address) \_\_\_\_\_

(an Individual), (a Partnership), (a Corporation), hereinafter referred to as "the Principal", and

(Firm) \_\_\_\_\_

(Address) \_\_\_\_\_

hereinafter referred to as "the Surety", are held and firmly bound unto the CITY OF GREELEY, 1000 10th Street, Greeley, Co. 80631, a Municipal Corporation, hereinafter referred to as "the Owner", in the penal sum of

\_\_\_\_\_ in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION are such that whereas the Principal entered into a certain Contract Agreement with the Owner, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_, a copy of which is hereto attached and made a part hereof for the performance of

### **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

NOW, THEREFORE, if the Principal shall make payment to all persons, firms, subcontractors and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such Contract Agreement, and any equipment and tools, consumed, rented or used in connection with the construction of such work and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract Agreement or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond; and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract Agreement or to the work or to the specifications.

IN WITNESS WHEREOF, this instrument is executed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

PROVIDED, FURTHER, that no final settlement between the Owner and Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN PRESENCE OF:

PRINCIPAL

\_\_\_\_\_ By: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (Corporate Seal) \_\_\_\_\_ (Address)

IN PRESENCE OF:

OTHER PARTNERS

\_\_\_\_\_ By: \_\_\_\_\_

\_\_\_\_\_ By: \_\_\_\_\_

By: \_\_\_\_\_

IN PRESENCE OF:

SURETY

\_\_\_\_\_ By: \_\_\_\_\_

(Attorney-in-Fact)

\_\_\_\_\_

\_\_\_\_\_ (SURETY SEAL) \_\_\_\_\_ (Address)

NOTE: Date of bond must not be prior to date of Contract Agreement. If Contractor is Partnership, all partners should execute Bond.

IMPORTANT: Surety Company must be authorized to transact business in the State of Colorado and be acceptable to the Owner.



## SECTION 00350

### LIEN WAIVER RELEASE

TO: City of Greeley, Colorado (hereinafter referred to as "the OWNER".)

FROM: (hereinafter referred to as "the CONTRACTOR")

PROJECT: **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

1. The CONTRACTOR does hereby release all Mechanic's Liens Rights, Miller Act Claim (40 USCA 270), Stop Notice, Equitable Liens and Labor and Material Bond Rights resulting from labor and/or materials, subcontract work, equipment or other work, rents, services or supplies heretofore furnished in and for the construction, design, improvement, alteration, additions to or repair of the above described project.
2. This release is given for and in consideration of the sum of \$            and other good and valuable consideration. If no dollar consideration is herein recited, it is acknowledged that other adequate consideration has been received by the CONTRACTOR for this release.
3. In further consideration of the payment made or to be made as above set forth, and to induce the OWNER to make said payment, the CONTRACTOR agrees to defend and hold harmless the OWNER, employees, agents and assigns from any claim or claims hereinafter made by the CONTRACTOR and/or its material suppliers, subcontractors or employees, servants, agents or assigns of such persons against the project. The CONTRACTOR agrees to indemnify or reimburse all persons so relying upon this release for any and all sums, including attorney's fees and costs, which may be incurred as the result of any such claims.
4. It is acknowledged that the designation of the above project constitutes an adequate description of the property and improvements for which the CONTRACTOR has received consideration for this release.
5. It is further warranted and represented that all such claims against the CONTRACTOR or the CONTRACTOR's subcontractors and/or material suppliers have been paid or that arrangements, satisfactory to the OWNER and CONTRACTOR, have been made for such payments.
6. It is acknowledged that this release is for the benefit of and may be relied upon by the OWNER, the CONTRACTOR, and construction lender and the principal and surety on any labor and material bond for the project.

7. In addition to the foregoing, this instrument shall constitute a \*\*\* (full, final and complete) \*\*\* (partial) release of all rights, claims and demands of the CONTRACTOR against the OWNER arising out of or pertaining to the above referenced project. If partial, all rights and claims on the project are released up to and including the \_\_\_\_\_ day of Month, 20\_\_.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

CONTRACTOR

By: \_\_\_\_\_

Title: \_\_\_\_\_

STATE OF \_\_\_\_\_ )  
 )ss.  
COUNTY OF \_\_\_\_\_ )

The foregoing instrument was acknowledged before me this \_\_\_\_\_ day of \_\_\_\_\_,  
20\_\_ by \_\_\_\_\_.

My Commission expires:

\_\_\_\_\_  
Notary Public

\*\*\*Strike when not applicable

## SECTION 00360

### 35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1

#### Debarment/Suspension Certification Statement

The proposer certifies that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in this transaction by any Federal, State, County, Municipal or any other department or agency thereof. The proposer certifies that it will provide immediate written notice to the City if at any time the proposer learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstance.

DUNS # (Optional) \_\_\_\_\_

Name of Organization\_\_\_\_\_

Address\_\_\_\_\_

Authorized Signature\_\_\_\_\_

Title\_\_\_\_\_

Date\_\_\_\_\_

## SECTION 00410

### NOTICE TO PROCEED

Month , 20

TO: NAME

PROJECT: **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

To Whom It May Concern:

You are hereby notified to commence work on the above-referenced project in accordance with the Contract Agreement dated Month , 20 .

You are to complete this project by Month , 20

CITY OF GREELEY, COLORADO

By: \_\_\_\_\_

Title: \_\_\_\_\_

\_\_\_\_\_  
Signature

## SECTION 00420

### PROJECT MANAGER NOTIFICATION

\_\_\_\_\_, 20\_\_\_\_

TO:

PROJECT: **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

The Owner hereby designates \_\_\_\_\_ as its Project Manager and authorizes this individual, under the authority of the Director of Public Works to make all necessary and proper decisions with reference to the project. Contract interpretations, change orders and other requests for clarification or instruction shall be directed to the Project Manager. The Director of Public Works shall be authorized to bind the Owner with respect to any decision made in accordance with the contract document.

CITY OF GREELEY, COLORADO

By: \_\_\_\_\_

Title: \_\_\_\_\_

## **SECTION 00430**

### **CERTIFICATE OF SUBSTANTIAL COMPLETION**

**TO: CONTRACTOR**

**PROJECT: 35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

Project or designated portion shall include: Describe Scope.

The work performed under this contract has been reviewed and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby established as Month , 20 .

The date of commencement of applicable warranties required by the Contract Documents is stipulated in Section 00440 - Certificate of Final Acceptance.

#### **DEFINITION OF DATE OF SUBSTANTIAL COMPLETION**

The Date of Substantial Completion of the Work or designated portion thereof is the date certified by the Project Manager when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can occupy or utilize the Work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents.

A list of items to be completed or corrected, prepared by the Contractor and verified and amended by the Project Manager is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. The date of commencement of warranties for items on the attached list is as stipulated in Section 00440 – Certificate of Final Acceptance.

The Owner shall operate and maintain the Work or portion of the Work described above from the Date of Substantial Completion and be responsible for all costs associated with the completed work excluding cost related to warrantee work.

Certificate of Substantial Completion

Page 2

The Contractor will complete or correct the Work on the list of items attached hereto within  
days from the above Date of Substantial Completion.

---

Contractor

---

Owner

(Note--Owner's and Contractor's legal and insurance counsel should review and determine insurance requirements and coverage; Contractor shall secure consent of surety company, if any.)

## SECTION 00440

### CERTIFICATE OF FINAL ACCEPTANCE

TO: **CONTRACTOR**

PROJECT NAME: **35TH AVENUE WIDENING & UTILITY PROJECT – PHASE 1**

The work performed under this contract has been reviewed and found to meet the definition of final acceptance. This Certificate of Final Acceptance applies to the whole of the work.

The Date of Final Acceptance of the Project designated above is hereby established as: Month \_\_\_\_\_, 20\_\_\_\_ at 2:00 pm. This date is also the date of commencement of applicable warranties associated with the Project described above and as required by the Contract Documents.

#### DEFINITION OF DATE OF FINAL ACCEPTANCE

The Date of Final Acceptance of the Work is the date certified by the City of Greeley's Project Manager when the work is 100% complete, in accordance with the Contract Documents, as amended by change order(s), or as amended below:

Amendment to the Certificate of Final Completion (if any): Describe Amendments.

The Contractor and/or the City Of Greeley shall define any claims or requests for additional compensation above (or as attachments to this document).

Final Acceptance shall not be achieved until the Contractor provides the City Of Greeley with all contract specified Contractor and Sub-contractor close out documents including final lien waivers, releases, insurances, manuals, training, test results, warranties, and other documents required by the Contract Documents, as amended.

Upon issuance of the Certificate of Final Acceptance the Contractor may submit an application for payment requesting final payment for the entire Work. Liquidated damages (if any) will be assessed at this time.

Contractor's acceptance of the final payment shall constitute a waiver by the Contractor of all claims arising out of or relating to the Work; except as noted under 'Amendment to the Certificate of Final Acceptance' above.

Agreed:

_____ Contractor's Representative	_____ DATE	_____ Project Manager (COG)	_____ DATE
--------------------------------------	---------------	--------------------------------	---------------

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**SECTION 00510**  
**CITY OF GREELEY**  
**GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION**  
**(REVISED MAY 2020)**

**ARTICLE 1**  
**DEFINITIONS**

- 1.1 **Bidder:** An architect, engineer, individual, firm, partnership, corporation or combination thereof, submitting a Bid for the Work.
- 1.2 **Change Notice:** A document issued to the Contractor specifying a proposed change to the Contract Documents. Unless otherwise expressly stated on the face of the Change Notice, a Change Notice is a proposal which may result in a Change Order.
- 1.3 **Change Order:** A document issued to the Contractor modifying the Contract.
- 1.4 **Construction Contract:** The Contract Documents, including the Contract for construction (hereinafter “the contract”) executed by the Contractor and the Owner covering the performance of the Work including the furnishing of labor, superintendence, materials, tools and equipment as indicated in the Contract Documents.
- 1.5 **Contract Documents:** Documents applicable to and specific to the construction of an individual Project, including the Contract and all other documents executed by the Contractor and Owner covering the performance of the work including but not limited to Specifications, Insurance Requirements, Contract Drawings, Conditions of the Contract (General and Supplementary), Owner Contractor Agreement, all Addenda, all change orders issued after execution of the Contract, Performance and Payment Bonds, and any other special provisions.
- 1.6 **Contract Drawings(Project Drawings):** Contract drawings, The plans, to include but not limited to plans, profiles, typical cross sections, general cross-sections, elevations, schedules, schematics, notes and details which show locations, character, dimensions, and details of the Work.
- 1.7 **Contractor:** The individual, firm, partnership, or corporation, or combination thereof, private, municipal, or public, including joint ventures, which, as an independent contractor, has entered into a contract with the Owner, who is referred to throughout the Contract Documents by singular number and masculine gender.
- 1.8 **Days:** Unless otherwise designated, days mean calendar days.

- 1.9 **Extra Work:** Work not provided for in the Contract as awarded but found to be essential to the satisfactory completion of the Contract, within its intended scope. Reimbursement for extra work is governed by Article 28, CHANGES, or Article 31, CONTRACTOR PROPOSALS.
- 1.10 **Field Order:** A written order issued to a contractor by the Owner, or Project Manager, effecting a minor change or clarification with instructions to perform work not included in the contract. The work will eventually become a Change Order. A field Order is an expedient process used in an emergency or need situation that in many cases does not involve an adjustment to the contract sum or an extension of the contract sum or an extension of the contract time.
- 1.11 **Final Acceptance:** The formal written acceptance by the Owner of the completed Work.
- 1.12 **Force Account:** A method of payment, other than lump sum or unit price, for Work ordered by Change Order or by written notice from the Owner. Reimbursement for force account work is governed by Article 36, FORCE ACCOUNT WORK.
- 1.13 **Furnishing:** Manufacturing, fabricating and delivering to the site of the Work materials, plant, power, tools, patterns, supplies, appliances, vehicles and conveyances necessary or required for the completion of the Work.
- 1.14 **General Conditions (GC):** A section of the Contract Documents which specifies, in general, the contractual conditions.
- 1.15 **General Terms:** Directed, required, permitted, ordered, designated, selected, prescribed or words of like import shall be understood to mean the direction, requirement, permission, order, designation, selection or prescription of the Project Manager. Approved, satisfactory, equal, necessary or words of like import shall be understood to mean approved by, acceptable to, satisfactory to, equal, necessary in the opinion of the Project Manager.
- 1.16 **Indicated:** A term meaning as shown on the Contract Drawings, or as specified and detailed in the Contract Documents.
- 1.17 **Installation, Install, or Installing:** Completely assembling, erecting and connecting material, parts, components, appliances, supplies and related equipment specified or required for the completion of the Work.
- 1.18 **Limit of Work:** Boundary within which the Work, excepting utility and drainage work in Public Right Of Way and Easements, is to be performed.
- 1.19 **Notice to Proceed:** Written notice from the Owner to the Contractor to proceed with the Work.
- 1.20 **Notice of Termination:** Written notice from the Owner to the Contractor to stop work under the Contract on the date and to the extent specified in the Notice of Termination.

- 1.21 **Owner:** The City of Greeley.
- 1.22 **Permanent Drainage Easement:** Area required to construct and maintain permanent drainage facilities for retention, release, and passage of surface water.
- 1.23 **Permanent Utility Easement:** Area required to construct and maintain utility facilities.
- 1.24 **Project:** That specific portion of the Work indicated in the Contract Documents.
- 1.25 **Project Manager:** The Owner's designated representative. The Project Manager has the authority to delegate portions of his responsibilities to others.
- 1.26 **Provide:** In reference to work to be performed by the Contractor, provide means furnish and install completely in place.
- 1.27 **Punch List:** Work determined to be incomplete or unacceptable at time of inspection for substantial completion.
- 1.28 **Samples:** Physical examples which illustrate materials, equipment, fixtures and workmanship which establish standards by which the Work will be judged.
- 1.29 **Schedule:** Acceptable schedules are BAR or GANTT Chart or CPM schedule.
- 1.30 **Shop Drawings:** Documents furnished by the Contractor to illustrate specific portions of the Work. Shop Drawings include drawings, diagrams, illustrations, schedules, charts, brochures, tables and other data describing fabrication and installation of specific portions of the Work.
- 1.31 **Specifications:** A document applicable to construction contracts containing the Technical Provisions.
- 1.32 **Subcontractor:** Any person, firm or corporation, other than the employees of the Contractor, who contracts with the Contractor to furnish labor, material or labor and materials, under this Contract.
- 1.33 **Special Provisions:** Provisions especially applicable to this Contract which invoke, modify and supplement the General Conditions which are included in the Contract Documents.
- 1.34 **Substantial Completion:** The state in the progress of Work when the Work, or a designated portion thereof, is sufficiently complete in accordance with the Contract Documents, so that Owner may access, occupy, use, and enjoy the Project, or designated portion thereof, for its intended purpose. Substantial Completion shall not occur until a temporary or permanent Certificate of Occupancy is issued and only minor punch list items remain for such Work.

1.35 **Technical Provisions:** Those provisions which specify the materials and execution of construction for work entering into the project.

1.36 **Work:** The construction, labor, materials, equipment, and contractual requirements as indicated in the Contract Documents, including alterations, amendments, or extensions thereto made by authorized changes.

1.37 **Work Site:** The area enclosed by the Limit of Work indicated in the Project Drawings and boundaries of local streets and public easements in which the Contractor is to perform work under the Contract. It shall also include areas obtained by the Contractor for use in connection with the Contract, when contiguous to the Limit of Work.

## **ARTICLE 2 INTERPRETATION**

2.1 The documents comprising the Contract Documents are complementary and indicate the construction and completion of the Work. Anything mentioned in the Contract Specifications and not shown on the Contract Drawings, or shown on the Contract Drawings and not mentioned in the Contract Specifications, shall be of like effect as if shown or mentioned in both.

2.2 Where "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the specifications or drawings accompanying this Contract unless stated otherwise.

2.3 References to Articles or Sections include sub articles or subsections under the Article Reference (for example, a reference to Article 2 is also a reference to 2.1 through 2.9, and references to paragraphs similarly include references to subparagraphs).

2.4 Referenced Standards: Material and workmanship specified by the number, symbol, or title of a referenced standard shall comply with the latest edition or revision thereof and amendments and supplements thereto in effect on the date of the Invitation to Bid except where a particular issue is indicated.

2.5 Precedence of Contract Documents: Except as provided by Paragraph 2.1 of this Article, the Construction Contract governs over other Contract Documents, except that a Change Order governs over the Contract and previously issued Change Orders. The Contract Conditions govern over the General Conditions.

2.6 Explanations: Should it appear that the Work to be done or any of the matters relative thereto are not sufficiently detailed or explained in the Contract Documents, the Contractor shall apply to the Owner for such explanation provided as part of the Contract. Disputes over questions of fact which are not settled by agreement shall be decided by Owner. Such decision thereon will be final, subject to remedies under Article 35, DISPUTES.

2.7 Should there be any conflict, detailed instructions govern over general instructions, detail drawings have precedence over small scale drawings, and dimensions have precedence over scale.

2.8 Omissions and Misdescriptions: The Contractor shall carefully study and compare all drawings, specifications, Contract Documents and other instructions; shall verify all dimensions on the Contract Drawings before laying out the Work; shall notify the Project Manager of all errors, inconsistencies or omissions which he may discover; and obtain specific instructions in writing before proceeding with the Work. The Contractor shall not take advantage of apparent errors or omissions which may be found in the Contract Documents, but the Project Manager shall be entitled to make such corrections therein and interpretations thereof as he may deem necessary for the fulfillment of their intent. The Contractor shall be responsible for all errors in construction which could have been avoided by such examination and notification, subject to remedies under Article 35, Disputes.

### **ARTICLE 3 ENTITY OF CONTRACTOR**

3.1 If the Contractor hereunder is comprised of more than one legal entity, each such entity shall be jointly and severally liable hereunder.

### **ARTICLE 4 LIABILITY AND INDEMNIFICATION**

4.1 It is agreed that the Contractor assumes responsibility and liability for damages, loss or injury of any kind or nature whatever to persons or property caused by or resulting from or in connection with any act, action, neglect, omission, or failure to act when under a duty to act on the part of the Contractor or any of his officers, agents, employees, or subcontractors in his or their performance of the Work. The Contractor shall indemnify and hold harmless the Government, the State, the Owner and the Project Manager and their members, officers, agents, or employees from claims, losses, damages, charges, costs, or expenses, including attorney's fees, whether direct or indirect, to which they or any of them may be put or subjected to by reason of any such loss or injury.

### **ARTICLE 5 PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES, AND IMPROVEMENTS AND LAND SURVEY MONUMENTS**

5.1 A Contractor shall preserve and protect existing vegetation such as trees, shrubs, and grass on or adjacent to the work site which are not indicated to be removed and which do not unreasonably interfere with the construction work and he shall replace in kind any vegetation, shrubs and grass damaged by him at his own expense.

5.2 The Contractor shall protect from damage all utilities, structures, or improvements on or near the site of the Work and shall repair or restore any damage to such utilities, structures, or improvements resulting from failure to comply with the requirements of the Contract or the failure to exercise reasonable care in the performance of the Work. If the Contractor fails or refuses to repair

any such damage promptly, the Owner may have the necessary work performed and charge the cost thereof to the Contractor.

5.3 All land survey monuments shall be protected from any damage by any work and/or shall be replaced by a licensed land surveyor licensed in the state of Colorado at the contractor's expense before final acceptance is issued.

## **ARTICLE 6 CONTRACTUAL RELATIONSHIPS**

6.1 No contractual relationship will be recognized under the Contract other than the contractual relationship between the Owner and the Contractor.

## **ARTICLE 7 ASSIGNMENT**

7.1 The performance of the Work under the Contract shall not be assigned except upon written consent of the Owner. Consent will not be given to any proposed assignment which would relieve the Contractor or his surety of their responsibilities under the Contract. The Contractor shall not assign any monies due or to become due to him under the Contract without the previous written consent of the Owner.

## **ARTICLE 8 SUBCONTRACTORS**

8.1 Unless otherwise required by the Contract Documents or the Bidding Documents, the Contractor, as soon as practicable after the award of the Contract, not to exceed 3 days, shall furnish to the Owner and the Project Manager, in writing the names of the subcontractors, persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. The Project Manager will promptly reply to the Contractor in writing whether or not the Owner or the Project Manager, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Project Manager to reply promptly shall constitute notice of no reasonable objections.

## **ARTICLE 9 CONDITIONS AFFECTING THE WORK**

9.1 The Contractor shall be responsible for taking steps reasonably necessary to ascertain the nature and location of the Work, and the general and local conditions which can affect the Work or the cost thereof. Failure by the Contractor to do so will not relieve him from responsibility for successfully performing work without additional expense to the Owner. The Owner will not be responsible for any understanding or representations concerning conditions, unless such understanding or representations are expressly stated in the Contract.

## **ARTICLE 10**

### **GRATUITIES AND CONFLICTS OF INTEREST**

10.1 The Owner may, by written notice to the Contractor terminate the right of the Contractor to proceed under this Contract if it is found that gratuities (in the form of entertainment, gifts, or otherwise) were offered or given by the Contractor, or any agent or representative of the Contractor or any director, officer or employee of the Owner or its Project Manager with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performance of such contract. The Owner's determination shall be final subject only to judicial review.

10.2 In the event this Contract is terminated for any reason, the Owner shall be entitled to pursue the same remedies against the Contractor as it could pursue in the event of a breach of the Contract by the Contractor.

10.3 No member, officer or employee of the Owner or of a local public body during his tenure or for one year thereafter shall have any interest, direct or indirect, in this Contract or the proceeds thereof. "Local public body" means the State, any political subdivision of the State, or any agency of the State or any political subdivision thereof.

10.4 The rights and remedies of the Owner provided in this article are not exclusive and are in addition to any other rights and remedies provided by law or under the Contract.

## **ARTICLE 11**

### **WARRANTY OF WORK**

11.1 Except where longer periods of warranty are indicated for certain items, the Contractor warrants work under the Contract to be free from faulty materials and workmanship for a period of not less than two years from date of Final Acceptance, which two year period shall be covered by the Performance Bond and Payment Bond as specified in this Contract. The Contractor shall immediately remedy, repair, or replace, without cost to the Owner and to the entire satisfaction of the Owner, defects, damages, or imperfections due to faulty materials or workmanship appearing in said work within said period of not less than two years. Remedied work shall carry the same warranty as the original work starting with the date of acceptance of the replacement or repair. Payment to the Contractor will not relieve him of any obligation under this Contract.

11.2 The Contractor, at no additional expense to the Owner, shall also remedy damage to equipment, the site, or the building or the contents thereof which is the result of any failure or defect in the Work, and restore any work damaged in fulfilling the requirements of the Contract. Should the Contractor fail to remedy any such failure or defect within a reasonable time but no longer than ten (10) days after receipt of notice thereof, the Owner will have the right to replace, repair, or otherwise remedy such failure or defect at the Contractor's expense.

11.3 Subcontractors', manufacturers', and suppliers' warranties and guarantees, expressed or implied, respecting any part of the Work and any material used therein shall be deemed obtained and

shall be enforced by the Contractor for the Benefit of the Owner without the necessity of separate transfer or assignment thereof.

11.4 The rights and remedies of the Owner provided in this Article are in addition to and do not limit any rights and remedies afforded by the Contract or by law.

## **ARTICLE 12 MATERIAL**

12.1 Unless otherwise indicated in this Contract, equipment, material and products incorporated in the Work covered by this Contract shall be new and of the grade specified in the Contract for the purpose intended. Unless otherwise specifically indicated, reference to equipment, material, product or patented process by trade names, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition, and the Contractor may, at his option, use any equipment, material, article, or process which is equivalent to that named, subject to the requirements of Paragraph 12.2 of this Article.

12.2 Within the scope of his authority, the Project Manager shall be the sole judge of the quality and suitability of proposed alternative equipment, material, article or process. The burden of proving the quality and suitability of the alternative shall be upon the Contractor. Information required by the Project Manager in judging an alternative shall be submitted for approval by the Contractor at the Contractor's expense prior to installation.

12.3 Where use of an alternative material involves redesign of or changes to other parts of the Work, the cost and the time required to affect such redesign or change will be considered in evaluating the suitability of the alternative material. Redesign and changes in other parts of the Work shall be at the Contractor's expense.

12.4 No action relating to the approval of alternative materials will be taken by the Project Manager until the request for substitution is made in writing by the Contractor accompanied by complete data as to the quality and suitability of the materials proposed. Such request shall be made in ample time to permit approval without delaying the Work.

12.5 Disposal of material outside the Work Site: The Contractor shall make his own arrangements for legally disposing of waste and excess materials outside the Work Site and he shall pay costs therefore.

12.6 Property rights in materials: The Contractor shall have no property right in materials after they have been attached or affixed to the Work or the soil, or after payment has been made by the Owner to the Contractor for materials delivered to the site of the Work, or stored subject to or under the control of the Owner as provided in Article 24, PROGRESS PAYMENTS.

## **ARTICLE 13 WORKMANSHIP AND UNAUTHORIZED WORK**



13.1 Work under this Contract shall be performed in a skillful and workmanlike manner. The Project Manager may, in writing, require the Contractor to remove from the work any employee the Project Manager determines incompetent, careless or otherwise objectionable.

13.2 Unauthorized work: Work performed beyond the lines and grades shown on the Contract Drawings, approved Working and Shop Drawings and Extra work done without written authorization, will be considered as unauthorized work, and the Contractor will receive no compensation therefore. If required by the Owner, unauthorized work shall be remedied, removed, or replaced by the Contractor at the Contractor's expense. Upon failure of the Contractor to remedy, remove or replace unauthorized work, the Owner may take courses of action set out in Paragraph 15.3 of Article 15, INSPECTION.

## **ARTICLE 14 SUPERINTENDENCE BY CONTRACTOR**

14.1 The Contractor shall give his personal superintendence to the Work or have a competent foreman or superintendent, hereinafter designated his authorized representative, satisfactory to the Owner, on the Work Site at all times during progress, with authority to act for him. There shall be provided at all times, a reasonable method of communication directly to the Contractor if the Owner experiences any problems or difficulties with the Superintendent.

## **ARTICLE 15 INSPECTION/TESTING**

15.1 Work (which term includes but is not restricted to materials, workmanship and manufacture and fabrication of components) will be subject to inspection and test by the Project Manager at all reasonable times and at all places prior to acceptance. Such inspection and test is for the sole benefit of the Owner and shall not relieve the Contractor of the responsibility of providing quality control measures to assure that the Work strictly complies with the Contract Documents. No inspection or test by the Project Manager shall be construed as constituting or implying acceptance. Inspection or test shall not relieve the Contractor of responsibility for damage to or loss of the material prior to acceptance, nor in any way affect the continuing rights of the Owner after acceptance of the completed Work.

15.2 The Contractor shall, at his own expense, replace any material or correct any workmanship found not to conform to the contract requirements, unless the Owner consents in writing to accept such material or workmanship with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises at his own expense.

15.3 If the Contractor does not promptly replace rejected material or correct the rejected workmanship, the Owner (1) may, by separate contract or otherwise, replace such material or correct such workmanship and charge the cost thereof to the Contractor, or (2) may terminate the Contractor's right to proceed in accordance with Article 38, TERMINATION FOR DEFAULT-DAMAGES FOR DELAY--TIME EXTENSIONS.

15.4 The Contractor shall give the Project Manager ample notification of inspections and tests, and the Project Manager will perform, except as otherwise specifically provided, said inspections and tests in such manner as not to unnecessarily delay the work. The Owner will have the right to charge to the Contractor any additional cost of inspection or test or when reinspection or retest is necessitated by prior rejection.

15.5 Should it be considered necessary, before acceptance of the entire work, to make an examination of work already completed by removing or tearing out same, the Contractor shall on request promptly furnish all necessary facilities, labor and material therefore. If such work is found to be defective or nonconforming in any material respect, due to the fault of the Contractor or his subcontractors, he shall defray the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, an equitable adjustment will be made in the contract price to compensate the Contractor for the additional services involved in such examination and reconstruction. If completion for the work has been delayed thereby, he will, in addition, be granted an equitable extension of time.

15.6 The Project Manager shall have access to the work during its construction. Work done and materials provided will be subject to the Project Manager's on-site and off-site inspection and approval. When work is to be performed during hours other than during his normal schedule, the Contractor shall so advise the Project Manager not less than 24 hours in advance. The Contractor shall provide access to the work for authorized representatives of the Owner.

15.7 The Project Manager's inspection and approval of work or materials shall not relieve the Contractor of any of his obligations to fulfill the requirements of the Contract Documents. Work and materials not meeting the requirements of the Contract shall not be incorporated in the Work. Unsuitable or substandard work or materials may be rejected by the Project Manager, notwithstanding that such work or materials may have been previously inspected by the Project Manager, or that payment therefore has been included in a progress payment.

## **ARTICLE 16**

### **PERMITS AND COMPLIANCE WITH LAWS**

16.1 The Contractor shall without additional expense to the Owner be responsible for obtaining necessary licenses and permits and for complying with applicable Federal, State, County and Municipal laws, codes and regulations in connection with the commencement of the work. The Contractor is required to supply the Project Manager with complete and final copies of license and permits including final inspection documentation. The Contractor shall be required to obtain permits at his own expense. The Contractor shall protect, indemnify and hold harmless the Owner and the Project Manager and their members, officers, agents and employees against claims and liabilities arising from or based on the violation of requirements of law or permits whether by the Contractor, his employees, agents or subcontractors.

**ARTICLE 17**  
**RIGHTS IN LAND IMPROVEMENT**

17.1 The Contractor shall make no arrangements with any person to permit occupancy or use of any land, structure or building within the work site for any purpose whatsoever, either with or without compensation, in conflict with any agreement between the Owner and any owner, former owner or tenant of such land, structure or building. The Contractor shall not occupy Owner property outside the work site without obtaining prior written approval from the Owner.

**ARTICLE 18**  
**DAMAGE TO THE WORK AND RESPONSIBILITY FOR MATERIALS**

18.1 The Contractor shall be responsible for materials delivered and work performed until completion and final acceptance of the entire construction thereof.

18.2 The Contractor shall bear the risk of injury, loss or damage to any and all parts of the work for whatever cause, whether arising from the execution or from the non-execution of work. The Contractor shall rebuild, repair or restore work and materials which have been damaged or destroyed from any cause before completion and acceptance of the work and shall bear the expense thereof. The Contractor shall provide security and drainage and erect temporary structures as necessary to protect the work and materials from damage.

18.3 The Contractor shall be responsible for materials not delivered to the site for which any progress payment has been made to the same extent as if the materials were so delivered.

**ARTICLE 19**  
**EMERGENCIES**

19.1 In an emergency affecting the safety of life, the work, or adjacent property, the Contractor shall notify the Project Manager as early as possible that an emergency exists. In the meantime, without special instruction from the Project Manager as to the manner of dealing with the emergency, the Contractor shall act at his own discretion to prevent such threatened loss or injury. As emergency work proceeds, the Project Manager may issue instruction, which the Contractor shall follow. The amount of compensation to which Contractor is entitled on account of emergency work will be determined in accordance with Article 28, CHANGES.

**ARTICLE 20**  
**NOTICE TO PROCEED**

20.1 The Owner will issue a Notice to Proceed to the Contractor within 15 days after the Contractor has executed the Contract and has delivered the specified bonds and Certificates of Insurance as required by the Owner. Except as specifically authorized in writing by the Owner, the Contractor is not authorized to perform work under the Contract until the effective date of the Notice to Proceed. Within 10 days after the effective date of such Notice to Proceed, the Contractor shall

commence work and shall diligently prosecute the Work to completion within the time limits specified. These time periods may be modified by mutual written agreement of both the Owner and Contractor.

## **ARTICLE 21**

### **PROGRESS SCHEDULE AND REQUIREMENTS FOR MAINTAINING PROGRESS**

21.1 The Contractor shall, at the pre-construction meeting, prepare and submit to the Project Manager for approval a practicable schedule, showing the order in which the Contractor proposes to carry on the work, the date on which he will start the several salient features (including procurement of materials, plant and equipment) and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion at any time. The Contractor shall update the chart with the actual progress monthly or at such intervals as directed by the Project Manager, and shall immediately deliver three copies thereof. If the Contractor fails to submit a progress schedule within the time herein prescribed, the Project Manager may withhold approval of progress payment estimates until such time as the Contractor submits the required progress schedule.

21.2 The Contractor shall prosecute the work in accordance with the latest approved Progress Schedule. In the event, that the progress of items along the critical path is delayed, the Contractor shall revise his planning to include additional forces, equipment, shifts or hours as necessary to meet the time or times of completion specified in this Contract. Additional costs resulting therefrom will be borne by the Contractor. The Contractor shall make such changes when his progress at any check period does not meet at least one of the following two tests:

21.2.1 The percentage of dollar value of completed work with respect to the total amount of the Contract is within ten percentage points of the percentage of the Contract time elapsed, or;

21.2.2 The percentage of dollar value of completed work is within ten percentage points of the dollar value which should have been performed according to the Contractors own network analysis previously approved by the Project Manager.

21.3 Failure of the Contractor to comply with the requirements under this provision will be grounds for determination that the Contractor is not prosecuting the work with such diligence as will ensure completion within the time of completion specified in this Contract. Upon such determination, the Owner may terminate the Contractor's right to proceed with the work, or any separate part thereof, in accordance with Article 38, TERMINATION FOR DEFAULT--DAMAGES FOR DELAY-TIME EXTENSIONS of these General Conditions.

## **ARTICLE 22**

### **SUSPENSION OF WORK**

22.1 The Owner reserves the right to suspend, delay or interrupt execution of the whole or any part of the work for such period of time as he may determine to be appropriate for his convenience.

22.2 If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Owner in the administration of this Contract or by his failure to act within the time specified in this Contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this Contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent (1) that performance would have been so suspended, delayed or interrupted by any other cause, including the fault or negligence of the Contractor or (2) for which an equitable adjustment is provided for or excluded under any other provision of this Contract.

22.3 No claim under this clause shall be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Owner in writing of the act of failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated is asserted in writing as soon as practicable after the termination of such suspension, delay, or interruption, but not later than the date of final payment under the Contract.

## **ARTICLE 23**

### **FINAL INSPECTION AND ACCEPTANCE**

23.1 Final inspection: When the Contractor notifies the Project Manager in writing that the work has been completed, the Owner will make the final inspection for the purpose of ascertaining that the work has been completed in accordance with the requirements of the Contract Documents.

23.2 Acceptance of the work: When the Owner has made the final inspection and has determined that the work has been completed in accordance with the Contract Documents, the Owner will accept the work. Immediately upon and after Final Acceptance, the Contractor will be relieved of the duty of maintaining and protecting the work as a whole. The Contractor will be relieved of his responsibility for injury to persons or property or damage to the work which occurs after Final Acceptance, except that the Contractor will not be relieved of his responsibility for injury to persons or property arising from his duties and obligations under Article 4, LIABILITY AND INDEMNIFICATION.

23.3 Final Acceptance shall be final and conclusive, and no further performance of work shall be required except with regards to latent defects, fraud or such gross mistakes as may amount to fraud, or with regard to the Owner's rights under any warranty or guarantee. All punch list items must be completed and building permits provided to Owner before final acceptance is issued.

23.4 Date of Substantial Completion for all Work shall be within the number of calendar days bid by the Contractor on the Bid proposal.

23.5 Date of Final Completion shall be the date specified on the Certificate of Final Completion.

## **ARTICLE 24 PROGRESS PAYMENTS**

24.1 The Owner will make progress payments monthly as the work proceeds, on estimates approved by the Project Manager. Payment will be made within 15 days after progress estimates are approved by the Project Manager and Department Head. On request of the Project Manager, the Contractor shall furnish a detailed estimate of the total contract price each showing the amount included therein for each principal category of the work, to provide a basis for determining the amount of progress payments. In the preparation of estimates, the Owner, at its sole discretion, may authorize material delivered on the site and preparatory work done to be taken into consideration which is to be submitted at the pre-construction meeting.

24.2 In making such progress payments, five percent of the estimated amount will be retained until Final Acceptance of the Contract work; in addition, the Owner shall retain from all Progress payments an amount equal to all statutory claims filed against the Contractor. Also, whenever the work is substantially complete, the Owner if it considers the amount retained to be in excess of the amount adequate for its protection, may release to the Contractor all or a portion of such excess amount. Substantial completion as used in this Paragraph 24.2 shall mean the following: Substantial completion of the work or a portion thereof shall be when, as determined by both the Project Manager and the Owner, the construction is sufficiently completed in accordance with the Contract Documents and any modification thereto as provided in the Contract to permit the Owner to occupy the work or a portion of the work for the use which it is intended.

24.3 Material and work covered by progress payments shall become the sole property of the Owner. This provision shall not be construed as relieving the Contractor from the sole responsibility for material and work upon which payments have been made, the restoration of damaged work or as waiving the right of the Owner to require the fulfillment of the terms of the Contract.

## **ARTICLE 25 PAYMENT TO SUBCONTRACTORS**

25.1 The Contractor shall pay all subcontractors for and on account of work performed by such subcontractors in accordance with the terms of their respective subcontract. Prior to final payment an unconditional lien waiver release form will be required by the Owner.

## **ARTICLE 26 PAYMENT OF TAXES**

26.1 The price or prices for the work will include full compensation for taxes that the Contractor is or may be required to pay. The Contractor shall bear the risk of any added or increased taxes occurring during the prosecution of the work. A change in taxes shall under no circumstances entitle the Contractor to an adjustment under the Contract.

26.2 The Contractor's attention is directed to the fact that this project is exempt from payment of City of Greeley Sales and Use taxes, and such taxes must not be included in the amount of bid.

26.3 The Contractor shall pay all sales and use taxes required to be paid, shall maintain such records in respect of his work, which shall be separate and distinct from all other records maintained by the Contractor and shall be available for inspection by the Owner at any and all reasonable times, and shall furnish the Owner with such data, as may be necessary to enable the Owner to obtain any refunds of such taxes which may be available to the Owner under the laws, ordinances, rules or regulations applicable to such taxes. The Contractor shall require each of his subcontractors to pay all sales and use taxes required to be paid and to maintain such records and furnish the Contractor with such data as may be necessary to enable the Owner to obtain a refund of the taxes paid by such subcontractors.

## **ARTICLE 27 FINAL PAYMENT**

27.1 After the Work has been accepted by the Owner, subject to the provisions of Article 11, WARRANTY OF WORK and Article 23, FINAL INSPECTION AND ACCEPTANCE of these General Conditions, a final payment due the Contractor under this Contract shall be paid upon the presentation of properly executed voucher and after the Contractor shall have furnished the Owner with a release of all claims against the Owner arising by virtue of this Contract, other than claims in stated amounts as may be specifically excepted by the Contractor from the operation of the release. If the Contractor's claim to amounts payable under the contract has been assigned under the assignment of Claims Act of 1940, as amended (31 U.S.C. 203, 41 U.S.C. 15), a release may also be required of the assignee.

27.2 If any mechanic's or material man's lien or notice of claim of such lien is filed or recorded against the project for labor, materials, supplies or equipment claimed to have been furnished to or incorporated into the Work, or for other alleged contribution thereto, the Owner will have the right to retain from payments otherwise due the Contractor, in addition to other amounts properly withheld under this Article or under other provisions of the Contract, an amount equal to such lien or liens claimed.

27.3 Further, the Owner will have the right to retain from final payment an amount equal to all liquidated damages claimed by the Owner.

27.4 Retainages held by the Owner for any state or federal statutory claim arising out of the project will be held by the Owner in addition to all retainages held under the provisions of the Contract.

## **ARTICLE 28 CHANGES**

28.1 The Owner may, at any time, without notice to the sureties, by written notice or order designated or indicated to be a Change Notice or Change Order, make any change in the work within the general scope of the Contract in accordance with all of the Owner's processes and procedures whether or not set forth herein, including but not limited to changes:

28.1.1 In the Contract (including drawings and designs);

28.1.2 In the method or manner of performance of the work;

28.1.3 In Owner furnished facilities, equipment, materials, services, or site; or

28.1.4 Directing acceleration in performance of the work.

28.2 Any other order (which terms as used in Paragraph 28.2 of this Article shall include direction, instruction, interpretation, or determination) from the Project Manager, which causes any change, shall be treated as a Change Notice under this Article provided that the Contractor gives the Project Manager written notice stating the date, circumstances and source of the order, and that the Contractor regards the order as a Change Notice. The Contractor shall notify the Project Manager when he receives direction, instruction, interpretation or determination from any source which may cause any change in the work. Such notification shall be given to the Project Manager before the Contractor acts on said direction, instruction, interpretation or determination.

28.3 Except as herein provided, no order, statement, or conduct of the Architect/ Project Manager or any other person shall be treated as a change under this Article or entitle the Contractor to an equitable adjustment hereunder.

28.4 If any change under this Article causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the Work under this Contract, whether or not changed by an order, an equitable adjustment will be made and the Contract modified accordingly by a written Change Order; provided, however, that except for claims based on errors in the Contract Documents, no claim for change under Paragraph 28.2 of this Article will be allowed for costs incurred more than 20 days before the Contractor gives written notice as herein required; and provided that in the case of errors in the Contract Documents for which the Owner is responsible, the adjustment will include increased cost, reasonably incurred by the Contractor in attempting to comply with such errors in the Contract Documents. No claim shall be made for the type of errors in the Contract Documents which are set forth in Article 2, INTERPRETATION.

28.5 If the Contractor intends to assert a claim for an equitable adjustment under this Article, he shall, within 30 days after receipt of a written Change Order under Paragraph 28.1 of this Article or the furnishing of a written notice under Paragraph 28.2 of this Article, submit to the Project Manager a written statement setting forth the general nature and monetary extent of such claim, unless this period is extended in writing by the Owner. The statement of claim hereunder may be included in the notice under Paragraph 28.2 of this Article.



28.6 No claim by the Contractor for an equitable adjustment hereunder will be allowed unless asserted as described in Paragraphs 28.4 and 28.5 above.

28.7 Payment will not be made under the provisions of this Article for such work or materials which are so required to be done or furnished in or about or for the performance of the Work and which are not mentioned, specified or indicated or otherwise provided for in this Contract or in the Contract Documents so far as such work or materials may be, in the opinion of the Project Manager, susceptible of classification under or reasonably inferred to be included in the Bid Items of the Bid Form.

28.8 In case the Contractor is ordered to perform work under this Article for which payments are not determined under Paragraph 28.7 of this Article, which in the opinion of the Owner it is impracticable to have performed by the Contractor's own employees, the Contractor will, subject to the approval of the Owner, be paid the actual cost to him of such work and, in addition thereto, a negotiated amount to cover the Contractor's superintendence, administration and other overhead expenses. The terms and conditions of any subcontract which the Contractor may propose to enter into in connection with work under the provision of this Article shall be subject to the written approval of the Project Manager before such subcontract is made. The contractor shall be responsible for the work of the subcontractors and shall be liable therefore as if he had performed the work directly.

28.9 In cases other than those described in Paragraphs 28.7 and 28.8 above, the Owner and the Contractor (on his own behalf and on behalf of his subcontractors) shall endeavor to negotiate a reasonable contract price and line adjustment in a Change Order on terms appropriate to the changed work. The Contractor will be required to submit a sufficiently detailed price proposal supported with sufficient documentation that (1) the Owner can determine that the proposal reflects all impacts on the Contract from work additions, deletions and modifications shown in the Change Notice being priced, (2) the proposed prices are set out in such a way that their reasonableness can be evaluated against prices based on adequate price competition, bid unit prices, established catalog or market prices of commercial items sold in substantial quantities to the general public, prices set by law or regulation, recognized published price lists and indices, independently developed cost estimates and other appropriate price comparisons, and (3) contract provisions relating to Contract changes costing over \$100,000.00 are complied with. If any prices or other aspects are conditional, such as on firm orders being made by a certain date or the occurrence or nonoccurrence of an event, the Contractor shall identify these aspects in his proposal. A negotiated Change Order shall set out prices, scheduling requirements, time extensions and all costs of any nature arising out of the issuance of a Change Notice except for those cost and time aspects explicitly reserved on the face of the Change Order. Except for these explicit reservations, the execution of a Change Order by both parties will be deemed accord and satisfaction of all claims of any nature arising from the issuance of the Change Notice negotiated.

28.10 In the event the Contractor and the Owner are unable to agree upon the Contractor's entitlement to an equitable adjustment or upon the amount thereof, or in the event that it is in the best interest of the Owner to have the Work proceed pending negotiation of amount of an equitable adjustment, the Owner may direct the Contractor to perform the Work in accordance with the Owner order, direction, instruction, interpretation, or determination, with any Contract price adjustments and progress payments for the Work to be determined on a Force Account basis in accordance with

Article 36. The Contractor shall continue diligently to perform the Contract in accordance with the Owner's order, direction, instruction, interpretation, or determination during negotiations with respect to the Contractor's entitlement to an equitable adjustment hereunder or to the amount of any Contract price adjustment or time extension. The Contractor and the Owner may agree on certain aspects of an equitable adjustment and take those aspects out of operation of Force Account provisions. In the event a mutually agreeable equitable adjustment cannot be made, the Contractor shall continue diligently to perform the orders as he proceeds with his remedies under Article 35, DISPUTES, and shall continue to receive compensation on a Force Account basis.

28.11 For contract changes, the Owner, State and Government or their representative shall have the audit and inspection rights as described below:

28.11.1 Where the agreed payment method for any contract changes is to be by cost reimbursement, time and material, labor hours or any combination thereof, the Contractor shall maintain and the Owner or its representatives shall have the right to examine books, records, documents and other evidence and accounting principles and practices sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred and anticipated to be incurred for the performance of the contract changes under this sub article.

28.11.2 Contract changes exceeding \$100,000.00 in cost: For submitted cost and pricing data in connection with pricing a contract modification referred to in this sub article, unless such pricing is based on bid unit prices, adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the public, or prices set by law or regulation, the Owner or his representatives and the Comptroller General of the United States and his representatives who are employees of the United States shall have the right to examine all books, records, documents and other data of the Contractor related to the negotiation of or performance under the contract Change Orders for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data submitted. The right of examination shall extend to all documents necessary to permit adequate evaluation of the cost or pricing data submitted, along with the computations and projections used therein.

28.11.3 Contract changes exceeding \$10,000.00 but not \$100,000.00 in cost: The Owner or his representatives prior to the execution of any contract Change Order in this sub article or for a period of twelve months after execution shall, unless such pricing is based on bid unit prices, adequate price competition, established catalog of market prices or commercial items sold in substantial quantities to the public, or prices set by law or regulation, have the right to examine all books, records, documents, and other data of the Contractor relating to the negotiation and contract Change Order for the purpose of evaluating the accuracy, completeness, and currency of the data is submitted upon which negotiation is or has been based. To the extent the examination reveals inaccurate, incomplete or noncurrent data, the Project Manager may renegotiate the contract Change Order price based on such data.

28.11.4 Contract changes of less than \$10,000.00 in cost: The Owner may require from the Contractor appropriate documentation to support the prices being negotiated for contract changes

under this sub article, and may refuse to complete negotiations until satisfactory documentation is submitted.

28.11.5 Availability: The materials described in Paragraphs 28.11.1 and 28.11.2 above shall be available at the office of the Contractor at all reasonable times for inspection, audit or reproduction until three years from the date of final payment under this Contract and for records which relate to Article 35, DISPUTES, or litigations or the settlement of claims arising out of the negotiation or the performance of contract changes over 100,000.00, records shall be made available until such litigations or claims have been resolved.

28.11.6 The Contractor shall insert a clause containing all the provisions in this Paragraph 28.11, including this subparagraph 28.11.6, in all subcontracts hereunder except altered as necessary for proper identification of the contracting parties and Owner.

28.11.7 For the purposes of Paragraph 28.11 of this Article, costs shall include liquidated damages which would be assessed if extension(s) of time were not granted by contract Change Order.

28.11.8 The requirements of this audits and records article are in addition to other audit, inspection and record keeping provisions elsewhere in the Contract Documents.

28.12 Changes involving aggregate increases and decreases in excess of \$100,000.00 shall be subject to the following:

28.12.1 A change involves aggregate increases and decreases in excess of \$100,000.00 if the total value of work affected, without regard to the arithmetic sign, exceeds this amount; for example, a change order adding work in the amount of \$75,000.00 and deleting work in the amount of \$50,000.00 will be considered to involve aggregate increases and decreases of \$125,000.00.

28.12.2 The Contractor shall submit in support of all items not based upon unit prices or lump sum prices contained in the Contract or upon the established prices at which commercial items are sold in substantial quantities to the public, statements by his vendors that the prices charged the Contractor are not greater than the prices charged by the respective vendors to their most favored customers for the same items in similar quantities.

28.12.3 Price reductions for Defective Cost or Pricing Data--Pricing Adjustments: If any price, including profit and fee, negotiated in connection with any price adjustment was increased by any significant sums because:

28.12.3.1 The Contractor furnished cost or pricing data which were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data;

28.12.3.2 A subcontractor, pursuant to Paragraph 28.13 of this Article entitled Subcontractor Cost or Pricing Data--Pricing Adjustments or any subcontract provision therein required, furnished costs or pricing data which were not complete, accurate, and current as certified in the Subcontractor's Certificate of Current Cost or Pricing Data;

28.12.3.3 The subcontractor or his prospective subcontractor furnished cost or pricing data which were required to be complete, accurate, and current and to be submitted to support a subcontract cost estimate furnished by the Contractor but which were not complete, accurate, and current as of the date certified in the Contractor's Certificate of Current Cost or Pricing Data; or

28.12.3.4 The Contractor or a subcontractor or his prospective subcontractor furnished any data, not within subparagraphs 28.12.3.1, 28.12.3.2, or 28.12.3.3 above, which were not complete, accurate, and current as submitted, the price shall be reduced accordingly and the Contract shall be modified in writing as may be necessary to reflect such reduction. Any reduction in the Contract Price due to defective subcontract data of a prospective subcontractor, when the subcontract was not subsequently awarded to such subcontractor, will be limited to the amount (plus applicable overhead and profit markup) by which the actual subcontract, or actual cost to the Contractor if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor, provided the actual subcontract price was not affected by defective cost or pricing data.

#### 28.13 Subcontract Cost of Pricing Data-- Pricing Adjustment:

28.13.1 When negotiating a change involving increases or decreases in excess of \$100,000.00, the Contractor shall require subcontractors hereunder to submit cost or pricing data under the following circumstances. Prior to award of any cost-reimbursement type, incentive or price redeterminable subcontract;

28.13.1.2 Prior to the award of any subcontract the price of which is expected to exceed \$100,000.00;

28.13.1.3 Prior to the pricing of any subcontract change modifications for which the price is expected to exceed \$100,000.00, except in the case of 28.13.1.2 and 28.13.1.3 where the price is based on adequate price competition, established catalog or market prices, commercial items sold in substantial quantities to the general public, or prices set by law or regulation.

28.13.2 The Contractor shall require subcontractors to certify to the best of their knowledge and belief that the cost and pricing data submitted under subparagraph 28.13.1 of this Article are accurate, complete, and current as of the date of execution, which date shall be as close as possible to the date of agreement on the negotiated price of the contract Change Order.

28.13.3 The Contractor shall insert the substance of Paragraph 28.13 of this Article, including this subparagraph 28.13.3, in each subcontract hereunder which exceeds \$100,000.00.

### **ARTICLE 29 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND**

29.1 The Contractor shall furnish a Performance Bond in the amount equal to one hundred percent (100%) of the Contract Sum as security for the faithful performance of this Contract and also a Labor and Material Payment Bond in an amount not less than one hundred percent (100%) of the

Contract Sum or in a penal sum not less than that prescribed by State, or local law, as security for the payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract. The Performance Bond and the Labor and Material Payment Bond may be in one or in separate instruments in accordance with local law and shall be delivered to the Owner not later than the date of execution of the Contract.

29.2 Performance Bonds, Labor and Material Payment Bonds and other such sureties shall provide that the surety and the Contractor are both jointly and severally liable and obligated under respective Bond or other surety agreement and shall incorporate acknowledge of applicable provisions of state law into all documents furnished in connection with the project.

### **ARTICLE 30 DIFFERING SITE CONDITIONS**

30.1 The Contractor shall within 10 days of actual or constructive notice of a differing site condition, promptly, and before such conditions are disturbed, notify the Project Manager in writing of: (1) subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract. The Project Manager will promptly investigate the conditions, and if such conditions materially differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under the Contract, whether or not changed as a result of such conditions, an equitable adjustment may be made subject to Owner's approval and the Contract modified in writing accordingly.

30.2 No claim of the Contractor under this Article will be allowed unless the Contractor has given the notice required in Paragraph 30.1 of this Article.

30.3 No claim by the Contractor for an equitable adjustment hereunder will be allowed if asserted after final payment under this Contract.

### **ARTICLE 31 CONTRACTOR PROPOSALS**

31.1 The Contractor may at any time submit to the Project Manager for his review proposed modifications to the Contract Documents, supported by a cost/price proposal. Upon acceptance of the proposed modifications by the Owner, a Change Order will be issued. Denial of the proposed modification will neither provide the Contractor with any basis for claim for damages nor release the Contractor from contractual responsibilities. An equitable adjustment in the form of a contract price reduction will be made if the change results in a reduction of the cost of performance and the Contractor will not be entitled to share in said savings unless the proposal is made under Paragraph 31.2 of this Article. Except as provided in Paragraph 31.2 of this Article, the Contractor will not be compensated for any direct, incidental or collateral benefits or savings the Owner receives as a result of the proposal.

31.2 Value Engineering Change Proposals: The Contractor may submit to the Project Manager one or more cost reduction proposals for changing the Contract requirements. The Proposals shall be based upon a sound study made by the Contractor indicating that the proposal:

31.2.1 Will result in a net reduction in the Total Contract amount;

31.2.2 Will not impair any essential function or characteristic of the Work such as safety, service life, reliability, economy of operation, ease of maintenance and necessary standardized features.

31.2.3 Will not require an unacceptable extension of the contract completion time; and

31.2.4 Will require a change in the Contract Documents and such change is not already under consideration by the Owner.

31.3 The Owner may accept in whole or in part any proposal submitted pursuant to the previous Paragraph 31.2 by issuing a Change Order which will identify the proposal on which it is based. The Change Order will provide for an equitable adjustment in the Contract Price and will revise any other affected provisions of the Contract Documents. The equitable adjustment in the Contract price will be established by determining the net savings resulting from the accepted change. The net savings resulting from the change will be shared between the Contractor and the Owner on the basis of 50 percent for the Contractor and 50 percent for the Owner and will be limited to this contract for any one Value Engineering Change Proposal. Net savings will be determined by deducting from the estimated gross savings, the Contractor's costs of developing and implementing the proposal (including any amount attributable to a subcontractor) and the estimated amount of increased costs to the Owner resulting from the change, such as evaluation, implementation, inspection, related items, and the Owner-furnished material. Estimated gross savings will include Contractor's labor, material, equipment, overhead, profit and bond. The Contract price will be reduced by the sum of the Owner's costs and share of the net savings. For the purpose of this Article, the applicable provisions of Article 28, CHANGES, shall be used to determine the equitable adjustment to the Contract price.

31.4 The Owner will not be liable for delay in acting upon, or for failure to act upon, any proposal submitted pursuant to Paragraph 31.2 of this Article. The decision of the Owner as to the Acceptance or rejection of any such proposal under the Contract will be final. The submission of a proposal by the Contractor will not in itself affect the rights or obligations of either party under the Contract.

31.5 The Contractor shall have the right to withdraw part or all of any proposal he may make under Paragraph 31.2 of this Article at any time prior to acceptance by the Owner. Such withdrawal shall be made in writing to the Project Manager. Each such proposal shall remain valid for a period of 60 days from the date submitted. If the Contractor wishes to withdraw the proposal prior to the expiration of the 60-day period, he will be liable for the cost incurred by the Owner in reviewing the proposal.

31.6 The Contractor shall specifically identify any proposals under Paragraph 31.2 of this Article with the heading "Value Engineering Change Proposal", or the proposal will be considered as made under Paragraph 31.1 of this Article.

31.7 The Contractor, in connection with each proposal he makes for a Contract Change Notice under this Article shall furnish the following information:

31.7.1 a description of the difference between the existing Contract requirement and the proposed change, and the comparative advantages and disadvantages of each, justification when a function or characteristic of an item is being altered, and the effect of the change on the performance of the end item;

31.7.2 an analysis and itemization of the requirements of the Contract which must be changed if the Value Engineering Change Proposal is accepted and a recommendation as to how to make each such change (e.g., a suggested specification revision);

31.7.3 a separate detailed cost estimate for both the existing Contract requirement and the proposed change to provide an estimate of the reduction in costs, if any, that will result from acceptance of the Value Engineering Change Proposal taking into account the costs of development and implementation by the Contractor;

31.7.4 a prediction of any effects the proposed change would have on collateral costs to the Owner such Government-furnished property costs, costs of related items, and costs of maintenance and operation;

31.7.5 a statement of the time by which a contract modification accepting the Value Engineering Change Proposal must be issued so as to obtain the maximum cost reduction, noting any effect on the contract completion time or delivery schedule; and

31.7.6 identification of any previous submission of the Value Engineering Change Proposal to the Owner, including the dates submitted, the numbers of contracts involved, and the previous actions by the Owner, if known.

## **ARTICLE 32 EXTENSION OF TIME**

32.1 In addition to the provisions stated in Article 38, the Contractor will be granted an extension of time and will not be assessed liquidated damages for any portion of the delay in completion of the Work, performed under the latest approved progress schedule, arising from acts of God, war, fires, floods, epidemics, quarantine restrictions, freight embargoes, or weather more severe than the norm, provided that the aforesaid causes were not foreseeable and did not result from the fault or negligence of the Contractor, and provided further that the Contractor has taken reasonable precautions to prevent further delays owing to such causes, and has notified the Project Manager in writing of the cause or causes of delay within five days from the beginning of any such delay. Within 15 days after the end of the delay, the Contractor shall furnish the Project Manager with detailed

information concerning the circumstances of the delay, the number of days actually delayed, the appropriate Contract Document references, and the measures to be taken to prevent or minimize the delay. Failure to submit such information will be sufficient cause for denying the delay claims. The Owner will ascertain the facts and the extent of the delay, and its findings thereon will be final and conclusive to provisions under Article 35, DISPUTES. The extension of time granted for these reasons shall not be the basis for additional compensation for any costs incurred during the time of delay.

32.1.1 Every effort shall be made by the Contractor to complete the project within the "Contract Time". The "Contract Time" anticipates "Normal" weather and climate. The Contractor's schedule must anticipate normal adverse weather delays on all weather dependent activities. The following specifies the procedure for determining time extensions for unusually severe weather. Listed below are the anticipated numbers of calendar days lost to normal adverse weather for each month.

#### Monthly Anticipated Calendar Days Lost to Adverse Weather Conditions

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	(7)	(4)	(4)	(4)	(6)	(3)	(4)
(2)	(3)	(3)	(2)	(5)														

The above schedule of anticipated adverse weather days will constitute the base line for monthly (or portion thereof) weather time evaluations. It is assumed that the work will be carried out Mondays through Fridays (holidays excepted) unless and approved construction schedule or written authorization from the Owner indicates otherwise.

An actual adverse weather day must prevent work for 50 percent or more of the Contractor's workday. When the Contractor anticipates documenting a weather day, he/she shall first notify the Project Manager or his/her designee observing the construction to determine whether or not work can proceed or if work is delayed due to adverse weather or the effects thereof. If in agreement, the Contractor shall formally request a weather day in writing to the Owner's Project Manager or his/her designee. The Contractor shall also notify the Owner's Project Manager in writing or his/her designee of any disagreement as to whether or not work could have proceeded on a given date within 2 calendar days of that date. The final decision regarding an adverse weather day will be made by the Project Manager or his/her designee.

The number of workdays delayed due to adverse weather or the effects thereof will then be converted to Calendar Days. Weekends and holidays will only count as calendar day delays if a workday delayed due to adverse weather is counted before and after the weekend/holiday. The number of calendar days of delay due to adverse weather or the impact thereof will then be compared to the monthly adverse weather schedule above. The Contract time period will then be increased by change order for the number of calendar days that are in excess of the above schedule and a new Contract Completion day and date will be set.

32.1.2 An extension of time will not be granted for a delay caused by a shortage of materials, except Owner-furnished materials, unless the Contractor furnishes to the Project Manager documentary



proof that he has diligently made every effort to obtain such materials from every known source within reasonable reach of the Work. The Contractor shall also submit proof that the inability to obtain such materials when originally planned did in fact cause a delay in final completion of the Work which could not be compensated for by revising the sequence of his operations. Only the physical shortage of material will be considered under these provisions as a cause for extension of time. No consideration will be given to any claim that material could not be obtained at reasonable, practical, or economical costs, unless it is shown to satisfaction of the Project Manager that such material could have been obtained only at exorbitant prices, entirely inconsistent with current rates taking into account the quantities involved and the usual practices in obtaining such quantities.

32.2 A Change Order will be furnished to the Contractor within a reasonable period of time after approval of a request for extension of time, specifying the number of days allowed, if any, and the new date for completion of the Work or specified portions of the Work.

32.3 See also Article 38, TERMINATION FOR DEFAULT--DAMAGES FOR DELAY--TIME EXTENSIONS.

### **ARTICLE 33 NOTICE OF POTENTIAL CLAIM**

33.1 The Contractor will not be entitled to additional compensation otherwise payable for an act or failure to act by the Owner, the happening of any event or occurrence, or any other cause, unless he shall have given the Project Manager a written notice of potential claim therefore as specified in this Article.

33.2 The written notice of potential claim shall set forth the reasons for which the Contractor believes additional compensation will or may be due, the nature of the costs involved, and insofar as possible, the amount of the potential claim. If based on an act or failure to act by the Owner, such notice shall be given to the Project Manager prior to the time that the Contractor has started performance of work giving rise to the potential claim for additional compensation. Notice shall be given within five days after the happening of the event or occurrence giving rise to the potential claim.

33.3 It is the intention of this Article that differences between the parties arising under and by virtue of the contract shall be brought to the attention of the Project Manager at the earliest possible time in order that such matters may be settled, if possible, or other appropriate action promptly taken.

33.4 The notice requirements of this Article are in addition to those required in other Articles of the General Conditions.

### **ARTICLE 34 SUBMITTAL OF CLAIMS**

34.1 Claims filed by the Contractor shall contain sufficient detail to enable the Owner to ascertain the basis and amount of said claims. The Owner will review and evaluate the Contractor's claims. It will be the responsibility of the Contractor to furnish when requested by the Project

Manager such further information and details as may be required to determine the facts or contention involved in his claims. Failure to submit such information and details will be sufficient cause for denying the Contractor's claims.

34.2 Each claim the Contractor may make for equitable adjustment on account of delay for any cause shall be accompanied by a progress schedule reflecting the effects of the delay and proposals to minimize these effects. If no progress schedule has been submitted to the Project Manager reflecting conditions prior to the delay for which relief is sought, then a progress schedule so reflecting these conditions shall be prepared and submitted with the claim.

34.3 Depending upon the grounds for relief and the nature of relief sought, additional submittals and conditions upon submitting claims may be required elsewhere in these General Conditions.

34.4 In no event shall claims be made after final payment is made under Article 27, FINAL PAYMENT, of these General Conditions.

34.5 Inasmuch as notice of potential claim requirements of Article 33, NOTICE OF POTENTIAL CLAIM, are intended to enable the Project Manager to investigate while facts are fresh and to take action to minimize or avoid a claim which might be filed thereafter, the Contractor's failure to make the required notice on time is likely to disadvantage the Owner. Therefore no claim for which a notice of potential claim is required will be considered unless the Contractor has complied with the notice of Article 33, NOTICE OF POTENTIAL CLAIM.

## **ARTICLE 35 DISPUTES**

35.1 General: Notwithstanding any other provisions of this Contract, disputes and disagreements by and between the Owner and the Contractor shall be resolved through progressive, sequential process of negotiation, mediation, and in certain cases, arbitration. For contracts which are for \$250,000 or less, amounts in dispute which are less than \$10,000 shall not progress beyond negotiation and shall ultimately be decided by the Owner if not by mutual agreement. For contracts which are for more than \$250,000, amounts in dispute which are less than \$25,000 should not progress beyond negotiation. For all contracts, amounts in dispute greater than those amounts set forth above, but less than \$100,000 shall be resolved through a sequential process of negotiation, mediation, and binding arbitration. Amounts in dispute which are \$100,000 or more shall be resolved through a sequential process of negotiation, mediation, and thence either arbitration or litigation.

35.2 Negotiation: In the event of disputes, unsettled claims, questions or disagreements between the contractor and the City relating to or arising out of the provisions of this Contract, the representatives of those parties shall meet promptly in recognition of mutual interests and in a good faith effort to resolve the dispute. Either the Contractor or the City shall arrange for this meeting at a time and place within the City of Greeley, mutually acceptable to both parties, within fifteen (15) days of notification of the dispute, unsettled claim, question, or disagreement between the parties. Seven (7) days prior to the meeting, the initiating party shall deliver to the other party, a written and complete

summary of the evidence and arguments substantiating its claim. If the parties do not reach a solution within thirty (30) days after said initial meeting, then upon notice of either party to the other, the dispute, claim, question, or difference, may be referred to a mediator pursuant to Section 35.3. The parties can extend the negotiation period by mutual written agreement.

35.3 Mediation: If the dispute, claim, question, or difference is not resolved by negotiation within thirty (30) days after the initial meeting between the parties or within the extended period agreed upon, the parties agree to next request that the American Arbitration Association provide a mediator to assist the Owner and Contractor in resolving the dispute, claim, question, or difference. The rules of mediation shall be the Construction Industry Mediation Rules of the American Arbitration Association. A different mediation/dispute resolution agency may be selected for mediation upon the mutual written agreement between the parties. The dispute resolution agency shall select a qualified mediator who shall have a background in construction. The selected mediator may be rejected by the parties only for bias. The mediator shall have thirty (30) days from the time of appointment to meet with the parties and sixty (60) days from the time of the appointment to resolve the dispute unless the parties mutually consent to an extension of the sixty day deadline. All reasonable fees, costs, and expenses of the mediator, the mediator's association and the mediation agency, shall be borne equally by the parties. Each party shall bear the expense of its own counsel, experts, witnesses, and preparation and presentation of proofs at mediation.

The Contractor shall not cause a delay of work during mediation proceedings except by mutual agreement. All mediation proceedings shall be conducted in the City of Greeley, unless an alternate location is agreed upon in writing by the Owner and the Contractor.

**Amounts in dispute which are less than \$10,000 shall not progress beyond mediation.**

35.4 Litigation prerequisites: The procedures enumerated in Sections 35.2 and 35.3 shall be a prerequisite to the filing of any litigation between the parties to the Contract. Failure of the Contractor to follow the provisions of Section 35.2 and Section 35.3 shall be a complete defense, and grounds for immediate dismissal of any litigation filed prior to Contractor engaging in negotiation and mediation with the City of Greeley as provided above. Litigation may be filed only if the amount in dispute is \$100,000 or more. In the event litigation is filed by and between the parties after mediation, venue and jurisdiction of any and all suits and causes of action in connection with this Contract shall lie exclusively in Weld County, Colorado.

35.5 Arbitration: After mediation, instead of litigation, any remaining unresolved controversy or claim arising out of or relating to this Contract or the performance or breach thereof, may be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. For amounts in dispute which are \$100,000 or more, arbitration shall be engaged only upon mutual written agreement by the Owner and the Contractor, and the written agreement shall specify whether the arbitration shall be binding or nonbinding; however, amounts in dispute which are less than \$100,000 shall necessarily be settled by binding arbitration. The sole arbitrator shall be appointed by the Arbitration Association, unless a different arbitrator or dispute resolution agency is mutually agreed upon. The award of the arbitrator shall be accompanied by a

reasoned opinion, and shall include findings of fact and conclusions. All fees and expenses of the arbitration, including the expense of each party's counsel, experts, witnesses, and preparation and presentation of proofs, shall be borne by the party against whom arbitration judgment is made.

35.6 Litigation: Each party shall bear its own litigation fees and expenses, including the expense of its counsel, experts, witnesses, and preparation and presentation of proofs, regardless of the prevailing party.

## **ARTICLE 36 FORCE ACCOUNT WORK**

36.1 This Article shall become operative upon failure of the Contractor and the Owner to arrive at an amount of compensation under Article 28, CHANGES. In the event that no equitable adjustment is arrived at either by mutual agreement or pursuant to the Article 35, DISPUTES, the compensation paid hereunder will be the total compensation.

36.2 Work Performed by or for Contractor: The Contractor will be paid for labor, materials, and equipment as hereinafter provided, except where agreement has been reached to pay in accordance with Paragraph 36.3 of this Article. The following percentages, as full compensation for profit, overhead and small tools, will be added to the totals computed as provided in subparagraphs 36.2.1 through 36.2.3 of this Article.

Labor 25 percent  
Materials 20 percent  
Equipment 10 percent

Labor, materials, and equipment shall be furnished by the Contractor or by a subcontractor. When work paid on a force account basis is performed by forces other than the Contractor's, the Contractor shall reach agreement with such other forces as to the distribution of the payment made by the Owner for such work and, except as specified herein, no additional payment therefore will be made by the Owner by reason of performance of work by a subcontractor or by others. In addition to the markups, if any, for labor, equipment, and materials, for subcontracted work, the Contractor may add an additional five percent markup. The cost of subcontracted work will be the actual cost to the contractor for work performed by a subcontractor as computed in accordance with this Paragraph 36.2 and its subparagraphs 36.2.1, 36.2.2, and 36.2.3.

36.2.1 Labor: The cost of labor used in performing the work, whether the employer is the Contractor or a subcontractor, will be the sum as determined on the basis of the following three subparagraphs:

36.2.1.1 The gross actual wages, including income tax withholdings but not including employer payments to or on behalf of workmen for health and welfare, pension, vacation, insurance and similar purposes.

36.2.1.2 To the gross actual wages, as defined in the previous subparagraph,

36.2.1.1, will be added a percentage based upon current State and Federal laws and applicable labor contracts concerning payments made to or on behalf of workmen other than actual wages, which percentage will constitute full compensation for all payments imposed by State and Federal laws and for all other payments made to or on behalf of the workmen, other than actual wages as defined in the previous subparagraph 36.2.1.1 and the subsistence and travel allowance as specified in the following subparagraphs 36.2.1.3. The Contractor shall compute a separate percentage for each craft, or a composite percentage for all crafts, if so approved by the Owner. Computed percentages shall be submitted to the Project Manager for approval by the Owner.

36.2.1.3 Subsistence and travel allowance paid to workmen as required by established agreements.

36.2.1.4 The charges for labor shall include all classifications up to but not including foremen, and when authorized by the Owner, shall include foremen engaged in the actual and direct performance of the work. Labor charges shall not include charges for assistant superintendents, office personnel, timekeepers, and maintenance mechanics, unless authorized by the Owner in advance of the start of work.

36.2.2 Materials: The cost of materials required for the accomplishment of the work will be delivered cost to the purchaser, whether contractor or subcontractor, from the supplier thereof, except as the following are applicable:

36.2.2.1 If a cash or trade discount by the actual supplier is offered or available to the Contractor, it shall be credited to the Owner notwithstanding the fact that such discount may not have been taken.

36.2.2.2 If materials are procured by the Contractor by a method which is not a direct purchase from and a direct purchase from and a direct billing by the actual supplier, the cost of such materials will be deemed to be the price paid to the actual supplier, as determined by the Owner. No additional markup for supplier work will be allowed except to the extent of actual cost to the Contractor in handling the material, not to exceed five percent of the price paid to actual supplier.

36.2.2.3 If the materials are obtained from a supply or source owned wholly or in part by the Contractor, payment therefore will not exceed the price paid for similar materials furnished from said source on Contract Items or the current wholesale price for such materials delivered to the work site, whichever price is lower.

36.2.2.4 If the cost of the materials is, in the opinion of Owner, excessive, then the cost of such materials will be deemed to be the lowest current wholesale price at which such materials are available in the quantities concerned, delivered to the job site, less discounts as provided in subparagraph 36.2.2.1 of this Article.

36.2.2.5 If the Contractor does not furnish satisfactory evidence of the cost of such materials from the actual supplier thereof, the cost will be determined in accordance with subparagraph 36.2.2.4 of this Article.

36.2.2.6 The Contractor shall have no claims for costs and profit on Owner-furnished materials.

36.2.3 Equipment: The Contractor will be paid for the use of contractor-owned or rented equipment at the rental rates shown in the Colorado State Department of Highways Construction Equipment Rental Rate Schedule, except as modified below, which edition shall be the latest edition in effect at the time of commencement of the Force Account work. For equipment used in excess of eight hours per day, the rental rate shall be 60 percent of the listed hourly rate. If it is deemed necessary by the Contractor to use equipment not listed in the C.D.O.H. Construction Equipment Rental Rate Schedule, the Contractor shall furnish the necessary cost data and paid invoices to the Project Manager for his use in establishment of such rental rate.

36.2.3.1 The rates paid as above provided will include the cost of fuel, oil, lubricants, supplies, small tools, necessary attachments, repairs and maintenance, depreciation, storage, insurance and incidentals.

36.2.3.2 Equipment operators will be paid for as stipulated in subparagraph 36.2.1 of this Article.

36.2.3.3 Equipment shall be in good working condition and suitable for the purpose for which the equipment is to be used.

36.2.3.4 Unless otherwise specified, manufacturer-approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer of that equipment.

36.2.3.5 Individual pieces of equipment or tools having a net individual value of \$300 or less, whether or not consumed by use, will be considered to be small tools and no payment will be made therefore.

36.2.3.6 Compensation will not be allowed while equipment is inoperative due to breakdown. Except as specified in paragraph 36.2.3.7 of this Article, time will be computed in half and full hours. In computing the time for use of equipment, less than 30 minutes shall be considered one half hour.

36.2.3.7 Equipment at the Work Site: The time to be paid for use of equipment on the work site will be the time the equipment is in operation on the force account work being performed. The time will include the time required to move the equipment to location of the force account work and return it to the original location or to another location requiring no more time than that required to return it to its original location. Moving time will not be paid for if the equipment is used at the site of the force account work on other than such force account work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power. No

payment for loading and transporting will be made if the equipment is used at the site of the force account work on other than such force account work.

36.3 Special Items of Work: If the Owner and the Contractor, by agreement, determine that (a) an item of force account work does not represent a significant portion of the total Contract price, and (b) such items of work cannot be performed by the forces of the Contractor or the forces of any of his subcontractors, and (c) it is not in accordance with the established practice of the industry involved to keep the records which the procedure outlined in Paragraph 36.2 of this Article would require, charges for such special force account work items may be made on the basis of invoices for such work without complete itemization of labor, materials, and equipment rental costs. To such invoiced price, less a credit to the Owner for any cash or trade discount offered or available, will be added five percent of the discounted price, in lieu of the percentages provided in Paragraph 36.2 of this Article. In no event will the price paid exceed the current fair market value of such work plus five percent.

6.4 Records: The Contractor shall maintain his records to provide a clear distinction between the direct costs of work paid for on a force account basis and costs of other operations.

36.4.1 The Contractor shall prepare and furnish to the Project Manager, on the following work day, report sheets in duplicate of each day's work paid for on a force account basis. The daily report sheets shall itemize the materials used and shall cover the direct cost of labor and the charges for equipment, whether furnished by the Contractor, subcontractor, or other forces, except for charges described in Paragraph 36.3 of this Article. The daily report sheets shall provide names or identifications and classifications of workmen and the hourly rate of pay and hours worked. In addition, a report of the size, type and identification number of equipment and hours operated shall be furnished to the Project Manager. Daily report sheets shall be signed by the Contractor or his authorized agent.

36.4.2 Material changes shall be substantiated by valid copies of vendor's invoices or conformed copies, certified true by the Contractor. Such invoices shall be submitted with the daily report sheets. Should the vendor's invoices not be submitted within 20 days after the date of delivery of the material or 15 days after acceptance of the work, whichever comes first, the Owner reserves the right to establish the cost of such materials at the lower current wholesale prices at which such materials are available in the quantities concerned delivered to the location of the work, less any discounts provided in subparagraph 36.2.1. of this Article.

36.4.3 The Project Manager will compare his records with the daily report sheets furnished by the Contractor, make any necessary adjustment and compile the costs of work paid for on a force account basis on daily force account work report forms. When these daily reports are agreed upon and signed by the Project Manager, they shall become the basis of payment for the work performed, but shall not preclude subsequent adjustment based on a later audit.

36.4.4 The Contractor's original cost records pertaining to work paid for on a force account basis shall be retained and shall be open to inspection and audit as required by Article 28, CHANGES, and any other provisions of the Contract.

36.5 If, in the Project Manager's opinion, the Contractor or any of his subcontractors, in performing Force Account work, is not making efficient use of labor, material or equipment or is proceeding in a manner which makes Force Account work unnecessarily more expensive to the Owner, the Project Manager may, in whole or part, direct the Contractor in the deployment of labor, material and equipment. By way of illustration, inefficiency may arise in the following ways: (1) the timing of the work, (2) the use of unnecessary labor or equipment, (3) the use of a higher percentage of apprentices than in non-force account work, (4) failure to procure materials at the lowest price, or (5) using materials of quality higher than necessary.

## **ARTICLE 37**

### **TERMINATION FOR CONVENIENCE OF THE OWNER**

37.1 The performance of Work under this contract may be terminated by the Owner in accordance with this Article in whole, or from time to time in part, whenever such termination is in the best interest of the Owner. Such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective.

37.2 After receipt of a Notice of Termination, and except as otherwise directed by the Owner, the Contractor shall:

37.2.1 Stop work under the Contract on the date and to the extent specified in the Notice of Termination.

37.2.2 Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the Contract as is not terminated;

37.2.3 Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the Notice of Termination;

37.2.4 Assign to the Owner in the manner, at the times, and to the extent directed by it, all of the rights, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the Owner will have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

37.2.5 Settle outstanding liabilities and claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Owner to the extent it may require, which approval or ratification shall be final for the purposes of this Article;

37.2.6 Transfer title and deliver to the Owner in the manner, at the times, and to the extent, if any directed by it, (a) the fabricated or unfabricated parts, work in process, completed work, supplies and other material procured as part of, or acquired in connection with the performance of, the work terminated by the Notice of Termination, and (b) the completed or partially completed plans,



drawings, information, and other property, which, if the Contract had been completed, would have been required to be furnished to the Owner;

37.2.7 Use his best efforts to sell, in the manner, at the times, to the extent, and at the price or prices direction or authorized by the Owner, property of the types referred to in (37.2.5) above; provided, however, that the Contractor (a) shall not be required to extend credit to any purchaser and (b) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Owner; provided further that the proceeds of any such transfer or disposition will be applied in reduction of any payments to be made by the Owner to the contractor under this Contract or will otherwise be credited to the price or cost of the work covered by this Contract or paid in such other manner as the Owner may direct;

37.2.8 Complete performance of each part of the work as shall not have been terminated by the Notice of Termination; and

37.2.9 Take such action as may be necessary, or as the Project Manager may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.

37.3 After receipt of a Notice of Termination, the Contractor shall submit to the Project Manager his termination claim, in the form and with certification prescribed by the Owner. Such claims shall be submitted promptly but in no event later than the earliest of the following: (1) one year from the effective date of termination or (2) thirty days after the remainder of the project has been accepted by the owner.

37.4 Subject to the provision of Paragraph 37.3, the contractor and the Owner may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of work pursuant to this Article, which amount or amounts may include an allowance for profit on work done; provided that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work terminated. The Contract will be amended accordingly, and the Contractor will be paid the agreed amount.

37.5 In the event of failure of the Contractor and the Owner to agree, as provided in Paragraph 37.4, upon the whole amount to be paid the Contractor by reason of the termination of work pursuant to this Article, the Owner will pay the Contractor the amounts determined by the Owner as follows, but without duplication of any amounts agreed upon in accordance with Paragraph 37.4;

37.5.1 With respect to contract work performed prior to the effective date of the Notice of Termination, the total (without duplication of any items) of:

37.5.1.1 The cost of such work;

37.5.1.2 The cost of settling and paying claims arising out of the termination of work under subcontracts or orders as provided in subparagraph 37.2.5 above, exclusive of the amounts paid or

payable on account of supplies or materials delivered or services furnished by the subcontractor prior to the effective date of the Notice of Termination of work under this Contract, which amounts shall be included in the cost on account of which payment is made under 37.5.1 above.

37.5.1.3 A sum, as profit on 37.5.1.1 above, determined by the Owner to be fair and reasonable; provided, however, that if it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit shall be included or allowed under this subparagraph 37.5.1.3 and an appropriate adjustment shall be made by reducing the amount of the settlement to reflect the indicated rate of loss.

37.5.2 The reasonable cost of the preservation and property incurred pursuant to subparagraph 37.2.9 and any other reasonable cost incidental to termination of work under this Contract, including expense incidental to the determination of the amount due to the Contractor as the result of the termination of work under this Contract.

37.5.3 The total sum to be paid to the contractor under paragraph 37.5.1 above will not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the Contract price of the work terminated.

37.6 In arriving at the amount due the Contractor under this Article, there will be deducted (1) any claim which the Owner may have against the Contractor in connection with this Contract, (2) the agreed price for, or the proceeds of sale, of materials, supplies or other things acquired by the contractor or sold, pursuant to the provisions of this Article, and not otherwise recovered by or credited to the Owner and (3) the full amount of any statutory or other claim against the Contractor filed with the Owner.

37.7 Unless otherwise provided for in this Contract, or by applicable statute, the Contractor, from the effective date of termination and for a period of three years after final settlement under this Contract, shall preserve and make available to the Owner at all reasonable times at the office of the Contractor but without direct charge to the Owner, all his books, records, documents, electronic/digital media and other evidence bearing on the costs and expenses of the Contractor under this Contract and related to the work terminated hereunder, or to the extent approved by the Owner, or other authentic reproductions thereof.

37.8 The Contractor shall insert in all subcontracts that the subcontractor shall stop work on the date of and to the extent specified in a Notice of Termination from the Owner and shall require that any tier subcontractors insert the same provision in any tier subcontracts.

37.9 Under no circumstances is the Contractor entitled to anticipatory, unearned profits or consequential damages as a result of a termination or partial termination under this Article.

## **ARTICLE 38**

### **TERMINATION FOR DEFAULT**

38.1 If, in the opinion of the Owner, the Contractor has failed to prosecute work, the Owner will notify the Contractor. The Contractor will then have 5 days to remedy the failure to prosecute work or to obtain the Owner's authorization for the delay or an extension of time as set forth in Article 32.

38.2 If the Contractor refuses or fails after reasonable notice as set forth above to prosecute Work, or any separable part thereof, with such diligence as will insure its completion within the time specified in this Contract, or refuses or fails to complete said Work within such time, the Owner may, by written notice to the Contractor, terminate for default his right to proceed with the Work or such part of the Work as to which there has been unauthorized delay. In such event the Owner may take over the work and prosecute the same to completion, by Contractor or otherwise, and may take possession of and utilize in completing the Work such materials, appliances, and plant as may be on the Work Site and necessary therefore. Whether or not the Contractor's right to proceed with the Work is terminated, he and his sureties shall be liable for any damage to the Owner resulting from his refusal or failure to complete the Work in the specified time.

38.3 If the Owner so terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such time as may be required for final completion of the Work together with any increased costs incurred by the Owner in completing the Work as further set forth in Article 41.

38.4 If, after Notice of Termination of the Contractor's right to proceed under the provisions of this Article, it is determined for any reason that the Contractor was not in default under the provisions of this Article or that the Contractor was entitled to an extension of time under Article 32, EXTENSION OF TIME, the rights and obligations of the parties shall be the same as if the Notice of Termination had been issued pursuant to Article 37, TERMINATION FOR CONVENIENCE OF THE OWNER.

38.5 The right to terminate for default and any other rights and remedies of the Owner provided in this clause are in addition to any other rights and remedies provided by law or under this Contract.

## **ARTICLE 39**

### **TERMINATION OF RIGHT TO PROCEED FOR CERTAIN DEFAULTS**

39.1 In addition to the Owner's right to terminate for default under other Articles of this Contract, the Owner will have the right to terminate the Contractor's performance of work in whole or in part for default for any of the following reasons:

39.1.1 The Contractor's or subcontractor's performance of work is in violation of the terms of the Contract.

39.1.2 The Contractor or subcontractor has violated an authorized order or requirement of the Owner.

39.1.3 Abandonment of Contract.

39.1.4 Assignment or subcontracting of the Contract or any work under the Contract without approval of the Owner.

39.1.5 Bankruptcy or appointment of a receiver for the Contractor's property.

39.1.6 Performance of the Contractor in bad faith.

39.1.7 Contractor allowing any final judgment to stand against him for a period of 48 hours (excluding weekends and legal holidays).

39.2 If, in the opinion of the Owner, the Contractor is in default of the Contract, the Owner will notify the Contractor. If the Contractor fails to remedy or commence to remedy the default within five days after receipt of such notice, the Owner may terminate the Contractor's right to proceed with the Work or that portion of the Work which the Owner determines is most directly affected by the default.

39.3 If, after Notice of Termination of Contractor's right to proceed under this Article it is determined for any reason Contractor was not in default, the rights and obligations of the parties shall be the same as if the Notice of Termination had been issued pursuant to Article 37, TERMINATION FOR CONVENIENCE OF THE OWNER.

## **ARTICLE 40**

### **RIGHTS AND OBLIGATIONS OF PARTIES AT TERMINATION FOR DEFAULTS**

40.1 This Article shall apply to terminations for defaults covered in Article 15, 38, and 39 of these General Conditions.

40.2 On receipt of a Notice of Termination from the Owner, the Contractor shall:

40.2.1 Stop all work under the Contract on the date and to the extent specified in the Notice of Termination.

40.2.2 Place no further orders or subcontracts for materials, equipment or services except as they relate to the performance of work covered by the Notice of Termination.

40.2.3 Cancel or terminate all orders or subcontracts to the extent that they relate to the performance of work covered by the Notice of Termination.

40.2.4 Comply with all other requirements of the Owner as may be specified in the Notice of Termination.

40.3 Upon the Owner termination of the Contractor's right to proceed with the Work because of the Contractor's default under the Contract, the Owner will have the right to complete the Work by whatever means and method it deems advisable. The Owner shall have the right to take possession of and use any or all the Contractor's materials, plat, tools, equipment and property of any kind provided by or on behalf of the Contractor for the purpose of the Work, or a portion of them, without being responsible to the Contractor for fair wear and tear. The Contractor shall have no rights in such property during their use by the Owner. The Owner will not be required to obtain the lowest prices for completing the Work but shall make such expenditures as, in the Owner's sole judgment, best accomplish such completion.

40.4 The expense of completing the Work, together with a reasonable charge for engineering, managerial and administrative services, as certified by the Owner, will be charged to the Contractor and the expense so charged will be deducted by the Owner out of such monies as may be due or may at any time thereafter become due to the Contractor. In case such expense is in excess of the sum which otherwise would have been payable to the Contractor under the Contract, the Contractor or his surety shall promptly pay the amount of such excess to the Owner upon notice from the Owner of the excess so due. The Owner may, in its sole discretion, withhold all or any part of any progress payments otherwise due the Contractor until completion and final settlement of the Work covered by the Notice of Termination of Contractor's right to proceed.

40.5 The Contractor shall insert in all subcontracts that the subcontractor will stop work on the date of or to the extent specified in a Notice of Termination from the Owner and shall require the subcontractors to insert the same provision in any tier subcontracts.

40.6 The Contractor shall immediately upon receipt communicate any Notice of Termination issued by the Owner to the affected subcontractors and suppliers at any tier.

40.7 Rights of Surety: The Surety on the Performance Bond provided for in this Contract shall not be entitled to take over the Contractor's performance of work in case of termination under this Article, except with the consent of the Owner.

## **ARTICLE 41 LIQUIDATED DAMAGES**

41.1 Time is of the essence of the Contract. In the event the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, or fails to meet any other time requirement or the time limit set forth in the Contract, after due allowance for any extension or extensions of time made in accordance with the Contract, the Contractor shall pay to the Owner as fixed, agreed and liquidated damages, pursuant to the clause of the Contract entitled TERMINATION FOR DEFAULT—DAMAGES FOR DELAY—TIME EXTENSIONS, the sum of \$500.00 for each

calendar day of delay unless otherwise stated in the Special Provisions. Such liquidated damages shall be assessed for each and every day that the Contractor shall be in default. The Owner shall have the right to deduct said liquidated damages from any amount due or that may become due the Contractor, or to collect such liquidated damages from the Contractor or its surety.

41.2 Liquidated damages in the amount stipulated do not include any sums of money to reimburse the City for actual damages which may be incurred between Substantial Completion and Final Completion because of the Contractor's failure to achieve Final Completion within the Contract Time. For such delay in Final Completion, the Contractor shall reimburse the City, as a mitigation of City damages and not as a penalty, those administrative costs incurred by the City as a result of such failure.

41.3 Liquidated damages in the amounts stipulated do not include any sums of money to reimburse the City for extra costs which the City may become obligated to pay on other contracts which were delayed or extended because of the Contractor's failure to complete the Work within the Contract Time. Should the City incur additional costs because of delays or extensions to other contracts resulting from the Contractor's failure of timely performance, the City will assess these extra costs against the Contractor, and these assessments will be in addition to the stipulated liquidated damages.

41.4 The City reserves all of its rights to actual damages from the Contractor for injury or loss suffered by the City from actions or omissions of the Contractor, including but not limited to any other breach or default of the Contract, outside of the scope of the above sections.

## **ARTICLE 42 USE AND POSSESSION PRIOR TO COMPLETION**

42.1 The Owner shall have the right to take possession of or use any completed or partially completed parts of the Work. Such possession or use will not be deemed an acceptance of Work not completed in accordance with the Contract. While the Owner is in such possession, the Contractor, notwithstanding the provisions of Article 18, DAMAGE TO WORK AND RESPONSIBILITIES FOR MATERIALS, will be relieved of the responsibility for loss or damage to the work other than that resulting from the Contractor's fault or negligence or breach of warranty. If such prior possession or use by the Owner delays the progress of the Work or causes additional expense to the Contractor, an equitable adjustment in the Contract price or the time of completion will be made, and the Contract will be modified in writing accordingly.

## **ARTICLE 43 RIGHTS IN SHOP DRAWINGS AND WORKING DRAWINGS**

43.1 Shop Drawings and Working Drawings, submitted to the Project Manager by the Contractor, subcontractor or any lower tier subcontractor pursuant to the Work, may be duplicated by the Owner and the Owner may use and disclose, in any manner and for any purpose, Shop Drawings and Working Drawings delivered under this Contract.

43.2 This Article, including this Paragraph 43.2, shall be included in all subcontracts hereunder at all tiers.

#### **ARTICLE 44 PATENT AND COPYRIGHT**

44.1 The Contractor shall warrant that the materials, equipment or devices used on or incorporated in the Work shall be delivered free of any rightful claim of any third party for infringement of any United States patent or copyright. If notified promptly in writing and given authority, information and assistance, the Contractor shall defend, or may settle, at his expense, any suit or proceeding against the Owner or the Project Manager based on a claimed patent or copyright infringement which would result in a breach of his warranty. The Contractor shall pay all damages and costs awarded therein against the Owner or the Project Manager due to such breach. If any use of materials, equipment or devices is held to constitute an infringement and such use is enjoined, the Contractor shall, at his expense and option, either procure for the Owner the right to continue using said materials, equipment or devices, or replace same with noninfringing materials, equipment or devices, or modify same so it becomes noninfringing. The Contractor shall report to the Owner promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this Contract of which the Contractor has knowledge. In the event of any claim or suit against the Owner on account of any alleged patent or copyright infringement arising out of the performance of this Contract or out of the use of any supplies furnished or work or services performed hereunder, the Contractor shall furnish to the Owner when requested by the Owner, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Owner except where the Contractor has agreed to indemnify the Owner. This clause shall be included in all subcontracts.

#### **ARTICLE 45 HISTORICAL, SCIENTIFIC AND ARCHAEOLOGICAL DISCOVERIES**

45.1 All articles of historical, scientific or archaeological interest uncovered by the Contractor during progress of the Work shall be preserved in accordance with applicable law and reported immediately to the Project Manager. Further operations of the Contractor with respect to the find, including disposition of the articles, will be decided by the Owner in accordance with applicable law.

#### **ARTICLE 46 SUBSTITUTIONS**

46.1 Where reference is made to one or more proprietary products but restrictive descriptive material of only one manufacturer is used, it is understood that the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the plans and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the Owner and the Project Manager. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design.

46.2 The Contractor may propose the substitutions of any material as a supplement to his bid with the monetary amount, additive or deductive as may be the case, clearly stated. Manufacturer's information, catalog numbers, and complete descriptive information shall be included with the proposed substitution. This shall be completely apart and separate from the base bid quotation and shall be solely for the information of the Owner, and the use of such proposed substitutions shall be strictly at the decision of the Owner. If substitution is accepted by the Owner, the Contract sum shall be adjusted from the base bid either up or down as indicated on the supplementary list.

## **ARTICLE 47 INSURANCE**

### **47.1 General**

47.1.1 The Contractor shall provide from insurance companies, acceptable to the Owner, the insurance coverage designated hereinafter and pay all costs. The Contractor also indemnifies the Owner as further described in Article 4.

47.1.2 Before commencing work under this Agreement, the Contractor shall furnish the Owner with certificates of insurance specified herein showing the type, amount, class of operations covered, effective dates, and date of expiration of policies. Furthermore, each such certificate shall contain a valid provision or endorsement that the policy may not be cancelled, terminated, changed or modified without first giving ten (10) days written notice to the Owner, which notice must be sent registered mail, return receipt requested, to the Project Manager.

47.1.3 In case of the breach of any provision of this Article, the Owner, at his option, may take out and maintain, at the expense of the Contractor, such insurance as the Owner may deem proper at the Contractor's expense and may deduct the cost of such insurance from any monies which may be due or become due the Contractor under this Agreement.

47.1.4 The Contractor shall either: (1) require each of his subcontractors to procure and maintain during the life of his subcontract, subcontractors' comprehensive General Liability, Automobile Liability and Property Damage Liability Insurance of the type and in the same amounts as specified in this subparagraph, or (2) insure the activity of his subcontractors in his own policy.

47.1.5 Co-Insurance: The Contractor herein agrees to name the Owner as an insured party on all liability insurance policies provided for by this Article 47, INSURANCE.

47.1.6 No insurance shall be cancelled or otherwise voided during the Contract period, without at least 10 days prior written notice to the Owner, nor shall any insurance be invalidated should the insured waive any or all right of recovery against any party.

47.1.7 Liability insurance may be arranged by Comprehensive General Liability and



Comprehensive Automobile Liability policies for the full limits required; or by a combination of underlying Comprehensive Liability policies for lesser limits with the remaining limits provided by an Excess or Umbrella Liability policy.

47.1.8 The Owner shall purchase and maintain such boiler and machinery insurance as may be required by the Contract Documents or by law. This insurance shall include the interest of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work.

47.1.9 Any loss insured under Article 47 is to be adjusted with the Owner and made payable to the Owner as trustee for the insured, as their interests may appear, subject to the requirements of any applicable mortgage clause. The Contractor shall pay each subcontractor a just share of any insurance monies received by the Contractor, and by appropriate share of any insurance monies received by the Contractor, and by appropriate agreement, written where legally required for validity, shall require each subcontractor to make payments to his subcontractors in similar manner.

47.1.10 If the Contractor requests in writing that insurance for risks other than those described in this Article or other special hazards be included in the Owner's property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

47.1.11 The Owner as trustee shall have power to adjust and settle any loss with the insurers.

47.1.12 If the Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion thereof, such occupancy or use shall not commence prior to a time mutually agreed to by the Owner and Contractor and to which the insurance company or companies providing the property insurance have consented by endorsement to the policy or policies. This insurance shall not be cancelled or lapsed on account of such partial occupancy or use. Consent of the Contractor and of the insurance company or companies to such occupancy or use shall not be unreasonably withheld.

#### 47.2 Workmen's Compensation and Employer's Liability Insurance:

47.2.1 The Contractor shall provide coverage and amounts as required by the Workmen's Compensation Act of the State of Colorado.

47.2.2 The Contractor shall provide Employer's Liability Insurance in an amount not less than \$100,000 for each occurrence.

47.2.3 The Contractor shall require any subcontractor to provide Workmen's Compensation and Employer's Liability Insurance in the same amounts for all of the subcontractor's employees to be engaged in work under this Agreement.

#### 47.3 General Liability

47.3.1 General Liability Insurance shall be on a Comprehensive General Liability form and shall provide coverage for the following: Premises and Operations, Owners and Contractors Protective, Elevators, Independent Contractors, Products and Completed Operations, Contractual, Personal Injury, and Broad Form Property Damage; "XCU" exclusions must be deleted.

47.3.2 Minimum requirements for Comprehensive General Liability are: bodily injury, \$1,000,000.00 each person, \$2,000,000.00 each occurrence; property damage, \$1,000,000.00 each occurrence.

#### 47.4 Automobile Liability

47.4.1 Comprehensive Automobile Liability Insurance shall include coverage for all owned motor vehicles and hired and non-owned motor vehicles.

47.4.2 Minimum requirements for Comprehensive Automobile Insurance are: bodily injury, \$1,000,000.00 each person, \$2,000,000.00 each occurrence; property damage, \$1,000,000.00 each occurrence.

#### 47.5 Property Insurance:

47.5.1 The Owner may require the Contractor to purchase and maintain "Builder's Risk" Property Insurance for all work at the site to the full insurable value thereof. The Owner and the Project Manager shall be named as co-insured.

### **ARTICLE 48 UNCOVERING AND CORRECTION OF WORK**

48.1 During construction, whenever materials requiring inspection in place by the Project Manager and the Owner to be permanently covered up, it shall be Contractor's responsibility to notify the Project Manager at least 24 hours in advance of commencement of such covering operation. In the event of failure by Contractor to give such notification, Contractor shall, at his own expense, uncover such portions of work as required by the Project Manager or the Owner, and reinstall such covering after satisfactory inspection and correction of any and all deficiencies.

### **ARTICLE 49 EQUAL OPPORTUNITY**

49.1 The Contractor agrees to comply with the letter and spirit of the Colorado Antidiscrimination Act of 1957, as amended, and other applicable laws respecting discrimination and unfair employment practices (24-34-402, CRS 1973, as amended). The Contractor shall be responsible for any discriminatory or unfair employment practices of his subcontractors. Neither the Contractor nor any subcontractor will discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, religion, ancestry, mental or physical handicap, or age. Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, national

origin, sex, religion, ancestry, mental or physical handicap, or age. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment, or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

49.2 Contractor and all subcontractors shall, in all solicitations or advertisement for employees placed by them or on their behalf, state that qualified applicants will receive consideration for employment without regard to race, creed, color, national origin, sex, religion, ancestry, mental or physical handicap, or age.

## **ARTICLE 50 CLAIMS**

50.1 The Contractor shall not assert any claim arising out of any act or omission by any officer, agent or employee of the Owner in the execution or performance of this Contract against such officer, agent or employee in his or her individual or official capacities.

50.2 The Contractor shall require each Separate Contract Design Professional or Contractor to agree in his Contract not to make any claim against the Owner, its officers, agents or employees, by reason of such Contract with the contractor.

50.3 Nothing in this Contract shall be construed to give any person other than the Owner and the Contractor any legal or equitable right, remedy or claim under this Contract; and it shall be held to be for the sole and exclusive benefit of the Owner and the Contractor.

## **ARTICLE 51 NOTICES**

51.1 Except as otherwise provided herein, any notice, approval, acceptance, request, bill, demand or statement hereunder from either party to the other shall be in writing and shall be deemed to have been given when either delivered personally or deposited in a U.S. mailbox in a postage prepaid envelope, addressed to the other party via certified mail. Notices to the Owner shall be addressed to the Project Manager by name. Either party may at any time change such address by delivering or mailing, as aforesaid, to the other party a notice stating the change and the changed address.

## **ARTICLE 52 LEGAL INSERTIONS, ERRORS, INCONSISTENCIES, OR DISCREPANCIES IN CONTRACT**

52.1 It is the intent and understanding of the parties to this Contract that each and every provision of law required to be inserted in this Contract shall be and is inserted herein. Furthermore, it is hereby stipulated that every such provision is deemed to be inserted herein, and if through mistakes or otherwise, any such provision is not inserted in correct form, then this Contract shall upon application of either party, be amended by such insertion so as to comply strictly with the law and without prejudice to the right of either party.

52.2 If this Contract contains any errors, inconsistencies, ambiguities, or discrepancies, including typographical errors, the Contractor shall request a clarification of same by writing to the Project Manager whose decision shall be binding upon the parties.

### **ARTICLE 53 CAPTIONS OR HEAD NOTES**

53.1 The captions or head notes on articles or sections of this Agreement, and marginal notes are intended for convenience and reference purposes only and in no way define, limit or describe the scope or intent hereof, or of this Agreement not in any way affect this Agreement.

### **ARTICLE 54 EFFECTIVE AND BINDING**

54.1 This Contract shall not become effective or binding upon the Owner unless it has been authorized and executed in accordance with the ordinances of the City of Greeley.

### **ARTICLE 55 CONTRACTOR**

55.1 All personnel assigned to the Project by the Contractor shall be required to cooperate fully with personnel of the Owner and if in the sole discretion of the Owner the Contractor's personnel fails so to cooperate, the Contractor shall relieve them of their duties on the Project when required by the Owner.

55.2 Within seven (7) consecutive calendar days after date of written notice to commence work, the Contractor shall designate in writing one person who, on his behalf, shall be responsible for coordinating all of the services to be rendered by the Contractor hereunder. Such designee shall be subject to the approval of the Owner. Any change to the approved designee shall be proposed in writing seven (7) days in advance and subject to Owner approval.

55.3 The Contractor shall engage, at his sole expense, all engineers, architects, cost estimators, lawyers, experts and Contractors as may be required for the proper performance of the Contract. The Contractor shall be responsible for the performance of the work of all architects, engineers, cost estimators, lawyers, experts and Contractors so engaged by him, including maintenance of schedules, correlation of their work and resolution of all difference between them. It is understood that all architects, engineers, cost estimators, lawyers, experts and Contractors are employees of the Contractor and not of the Owner, and the Contractor alone is responsible for their work.

55.4 All drawings, tracings, specifications, digital media/electronic files and other material prepared and furnished under and for this Contract shall become the property of the Owner upon substantial completion and/or their acceptance by the Owner and/or upon termination of the services

of the Contractor. Such documents shall be promptly delivered to the Owner upon demand and thereafter may be used by the Owner in whole or in part or in modified form, for those purposes it may deem advisable without further employment of, or payment of additional compensation to, the Contractor.

55.5 The Contractor shall not, without the prior written approval of the Owner, specify for the project, or necessarily imply the required use of any article, product, material, fixture or form of construction, the use of which is covered by a patent, or which is otherwise exclusively controlled by a particular firm or group of firms.

55.6 Should any claim be made or any action brought against the Owner relating to the design and satisfactory operation of the Project herein, the Contractor shall diligently render to the Owner without additional compensation any and all assistance which may be requested by the Owner.

55.7 The Owner's Project Manager's decision shall be final and binding upon the Contractor as to all matters arising in connection with or relating to this Contract. The Project Manager shall determine the amount, quality, acceptability and fitness of the work being performed hereunder and shall determine all matters relative to the fulfillment of this Contract on the part of the Contractor and such determination shall be final and binding on the Contractor. Acceptance by the Owner of any document hereunder and all supporting documents shall not relieve the Contractor of sole responsibility for work performed under this contract, including, but not limited to, the final design of the Project, including the plans, specifications and all supporting documents, except as to any feature thereof which the Owner had specifically directed in writing to be included over the written objection of the Contractor. In case any question shall arise, the decision of the Owner's Project Manager, who is hereby accepted by the Contractor as the arbiter, shall be a condition precedent to the right of the Contractor to receive any money under this Contract.

## **ARTICLE 56 APPEALS**

56.1 Except as otherwise provided in this Contract, any dispute concerning a question of fact arising under this Contract which is not disposed of by Agreement shall be decided by the Project Manager, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Project Manager shall be final and conclusive unless, within fifteen (15) days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Project Manager a written notice of appeal.

56.2 In the event a decision of the Project Manager is the subject of an appeal, such dispute may be settled by appropriate legal proceeding, or, if the parties mutually agree, through arbitration or administrative process. Pending any binding arbitative or administrative decision, appeal, or judgment referred to in this section or the settlement of any dispute arising under this Contract, the Contractor shall proceed diligently with the performance of this Contract.

56.3 Venue and jurisdiction of any suit, right, or cause of action arising under or in connection with this Contract shall lie exclusively in Weld County, Colorado.

**ARTICLE 57  
PROHIBITED INTEREST**

57.1 No member, officer or employee of the City of Greeley shall have any financial or pecuniary interest, direct or indirect, in this Contract or the proceeds thereof.

**ARTICLE 58  
FINDINGS CONFIDENTIAL**

58.1 Any reports, information, data, etc., available to or prepared or assembled by Contractor under this Contract shall not be made available to any individual or organization by Contractor without consent in writing from the Owner subject to applicable law.

**ARTICLE 59  
GENERAL PROVISIONS**

59.1 Services and work performed by Contractor under this Contract shall conform to reasonable and normal professional standards known and accepted within the community.

59.2 No reports, graphics or other material produced directly or indirectly for the Owner under this Contract shall be the subject of an application for copyright or trademark by or on behalf of Contractor.

59.3 The laws of the State of Colorado and applicable Federal, state and local laws, regulations and guidelines shall govern hereunder.

59.4 The headings of the articles, clauses, and paragraphs of this Contract are inserted for reference purposes only and are not restrictive as to content.

59.5 This Contract and any subsequent amendment shall be deemed an original having identical legal effect, and all of which together constitute one and the same instrument.

59.6 Nothing contained herein shall be deemed to give any third party any claim or right of action against the Owner which does not otherwise exist without regard to this Contract.

59.7 Where a number of days is specified in this Contract it shall mean calendar days unless otherwise specified.

59.8 This Contract shall not be assigned, in whole or in part, without the written consent of the Project Manager and Contractor.

59.9 The Owner certifies the following;  
A. An amount of money equal to or greater than the Contract amount has

been appropriated and budgeted for the Project which this Contract concerns.

B. No Change Order which requires additional compensable work to be performed by the Contractor will be issued by the Owner unless an amount of money has been appropriated and budgeted sufficient to compensate the Contractor for such additional compensable work unless such work is covered under the remedy-granting provisions of this Contract.

C. As used in this paragraph, "remedy granting provision" shall mean any clause of this Contract which permits additional compensation in the event of a specific contingency or event occurs. This term shall include, but not be limited to, change clauses, differing site conditions clauses, variation in quantities clauses, and termination for convenience clauses.

## **ARTICLE 60 CONTRACTOR ACCEPTANCE**

60.1 The acceptance by the Contractor, his successors or assigns of any payment made on the final acceptance of the Project under this Contract or of any final payment due on termination of this Contract, shall constitute a full and complete release of the Owner from any and all claims, demands and causes of action whatsoever which the Contractor, his successors or assigns have or may have against the Owner under the provisions of this Contract.

60.2 No action shall be maintained by the Contractor, its successors or assigns, against the Owner on any claims based upon or arising out of this Contract or out of anything done in connection with this Contract unless such action shall be commenced within 180 days after the date of filing of the voucher for final payment hereunder in the office of the Finance Director, or within 180 days of the termination of this Contract.

## **ARTICLE 61 SUCCESSORS AND ASSIGNS**

61.1 The Contractor binds itself, its partners, successors, assigns and legal representatives to the other party to this Contract and to the partners, successors, assigns and legal representatives of such other party with respect of all covenants of this Agreement. The Contractor shall not transfer, assign, or subcontract any interest in this Agreement.

## **ARTICLE 62 SEVERABILITY CLAUSE**

62.1 If any provision of this Agreement is subsequently declared by legislative or judicial authority to be unlawful, unenforceable, or not in accordance with applicable laws, statutes, and regulations of the United States of America and the State of Colorado, all other provisions of this Agreement shall remain in full force and effect.

## **ARTICLE 63 AGREEMENT**

63.1 This Agreement represents the entire and integrated Agreement between the Owner and the Contractor and supersedes all prior negotiations, representations or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both Owner and Contractor.

#### **ARTICLE 64 COLORADO LABOR**

64.1 In accordance with C.R.S. §8-17-101, all parties contracting with the City of Greeley on public works projects shall employ Colorado labor to perform the work to the extent of not less than eighty percent (80%) of each type or class of labor in the several classifications of skilled and common labor employed on this project.

#### **ARTICLE 65 ELECTRONIC SIGNATURE**

65.1 The Contract Documents may be executed in two or more counterparts, each of which shall be deemed an original but all of which together shall constitute one and the same document. The Contract Documents, including all component parts set forth above, may be executed and delivered by electronic signature by any of the parties and all parties consent to the use of electronic signatures.

#### **ARTICLE 66 FORCE MAJEURE**

66.1 To the extent that either party is not able to perform an obligation under this Agreement due to fire; flood; acts of God; severe weather conditions; strikes or labor disputes; war or other violence; acts of terrorism; plague, epidemic, pandemic, outbreaks of infectious disease or any other public health crisis, including quarantine or other employee restrictions; act of authority whether lawful or unlawful, compliance with any law or governmental order, rule, regulation or direction, curfew restriction, or other cause beyond that Party's reasonable control, that Party may be excused from such performance so long as such Party provides the other Party with prompt written notice describing the condition and takes all reasonable steps to avoid or remove such causes of nonperformance and immediately continues performance whenever and to the extent such causes are removed.





SECTION 00520  
SUBCONTRACTORS/MATERIALS SUPPLIERS AND RELATED DATA

Firm Name: \_\_\_\_\_ City Contractors License # \_\_\_\_\_  
Primary Contractor \_\_\_\_\_  
PROJECT: \_\_\_\_\_ Address: \_\_\_\_\_

For each Subcontractor and/or Materials Suppliers to be utilized, please provide the following information  
(use additional sheets as necessary):

Phone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_  
Proposed work and percentage of total work to be assigned \_\_\_\_\_  
Percentage: \_\_\_\_\_ %

Firm Name: \_\_\_\_\_ City Contractors License # \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_  
Proposed work and percentage of total work to be assigned \_\_\_\_\_  
Percentage: \_\_\_\_\_ %

Firm Name: \_\_\_\_\_ City Contractors License # \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_  
Proposed work and percentage of total work to be assigned \_\_\_\_\_  
Percentage: \_\_\_\_\_ %

Firm Name: \_\_\_\_\_ City Contractors License # \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_  
Proposed work and percentage of total work to be assigned \_\_\_\_\_  
Percentage: \_\_\_\_\_ %

Firm Name: \_\_\_\_\_ City Contractors License # \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_  
Proposed work and percentage of total work to be assigned \_\_\_\_\_  
Percentage: \_\_\_\_\_ %

If the Primary Contractor adds any Subcontractors or Materials Suppliers during the duration of the project, the Primary Contractor will supply the City with an updated form before the Subcontractor or Materials Supplier will be allowed to work on the project.

## **CONTRACT DOCUMENTS**

# **35<sup>TH</sup> AVENUE WIDENING & 35<sup>TH</sup> AVENUE UTILITY PROJECT PHASE 1**

**FOR THE  
CITY OF GREELEY**



**November 2020**

**35<sup>TH</sup> AVENUE WIDENING  
&  
35<sup>TH</sup> AVENUE UTILITY PROJECT PHASE 1**

**October 2020**

**PROJECT DESCRIPTION**

The City of Greeley will upgrade 35<sup>th</sup> Avenue an urban minor arterial street, from 4<sup>th</sup> Street north to F Street. The project also includes box culvert extensions at No. 3 Canal and F Street.

The completed minor arterial street will have a painted two-way left turn lane or a raised / landscaped median, curb, gutter, sidewalks, on-street bike lanes, a modified traffic signal at 4<sup>th</sup> Street, a new emergency traffic signal at the Fire Station, and a new pedestrian HAWK Beacon signal for the trail crossing along No. 3 Canal. This project involves box culvert extensions, wing walls, retaining walls, channel grading, bridge rail, guardrail, and storm drainage improvements.

Phase 1 of the 35<sup>th</sup> Avenue Utility Project includes installation of a 24-inch diameter non-potable water line from the GIC #3 to F Street, construction of a dissipation structure at GIC #3, installation of a 20-inch diameter potable water line from C Street to F Street, and installation of 18-inch diameter and 24-inch diameter sanitary sewer line from C Street to F Street. The potable water line will have 12-inch stub-outs that run east and west from 35<sup>th</sup> Avenue at F Street and east from 35<sup>th</sup> Avenue north of C Street to allow future developments to tie in for water service.

Work will include, but is not limited to:

- Coordination with utilities
- Construction surveying and required record drawing surveying
- Clearing and grubbing
- Removal of storm culvert, signs, fences, and trees
- Erosion and sediment control
- Construction traffic control measures including road and sidewalk closures and detours including temporary pavements as well as temporary signal modifications at 4<sup>th</sup> Street. Two-way traffic on 35<sup>th</sup> Avenue as well as access to all properties along the project is required to be maintained at all times.
- Earthwork excavation and embankment with excavated "native" and borrow material
- Removal of the existing asphalt mat
- Removal of existing concrete curb, gutter, and sidewalk within project limits
- Miscellaneous adjustments of valve and manhole covers
- Concrete curb and gutter, curb ramps, sidewalks and concrete median, intersection crosspans and driveways
- Caisson installation
- Box Culvert Extensions at No. 3 Canal and F Street
- Bridge Rail and Pedestrian Rail fabrication and installation
- Storm drain piping, manholes and inlets
- Stoneybrook Pond modifications
- Retaining wall construction
- Pavement surface repair and construction including aggregate base course compaction, hot bituminous pavement, and concrete pavement
- Permanent pavement markings and signs
- Traffic signal modification at 4<sup>th</sup> Street intersection
- Emergency Traffic Signal at the Fire Station
- Pedestrian HAWK Beacon Signal near No. 3 Canal
- Seeding, mulching, and sod.

- Boulders
- Irrigation sleeves and irrigation facilities
- Trees, shrubs, perennials, ornamental grasses and plugs
- Installation of 20-inch diameter PVC waterline, including all fittings, thrust blocks, valves, air relief vaults, etc.
- Installation of fire hydrants.
- Installation 12-inch diameter PVC waterline stub-outs.
- Removal and abandonment in place of existing 4-inch diameter PVC water line.
- Removal of 18-inch diameter VCP sanitary sewer and manholes.
- Installation of 18-inch diameter and 24-inch diameter PVC sanitary sewer and associated manholes.
- Installation of 24-inch diameter PVC non-potable waterline.
- Construction of concrete dissipation structure.
- Other miscellaneous work shown on the Drawings and specified herein.

### **PHASE 1 DESCRIPTION**

The 35<sup>th</sup> Avenue Widening Project will only be constructed to approximately Station 33+00, See the 35<sup>th</sup> Avenue Transition Plan Sheet for reference. This roadway widening project will include the completion of the roundabout at C Street and the improvements at the Stoneybrook Pond.

The Sanitary Sewer Line is to be completed in its entirety.

The Potable Water Line is to be completed through the fire hydrant at station 304+49.99. Install an MJ cap with a thrust block after the tee for the fire hydrant to allow for future tie in. Additionally, the stub out from station 600+00 to 601+00 will be included.

The Non-Potable Water Line includes a bid alternate. The bid alternate includes Station 214+00.00 to prior to the 45 deg bend at Station 225+12.19. Install an MJ cap with a thrust block to allow for future tie in.

New Landscape and Irrigation work is not included in this Contract. New Irrigation sleeves will be installed with surveyed as-built provided. Restoration of disturbed landscape and irrigation shall be completed as soon as possible following disturbance. All topsoil work shall be completed except imported topsoil. All disturbed non-irrigated areas will be seeded. The City will Contract for new landscape and irrigation work separately. The Contractor shall coordinate work if timing of construction overlaps.

### **BID SCHEDULES**

The project is divided into two bid schedules: The Roadway Widening Project (approximate STA 1+00 to 33+00) and the Utility Project Phase 1 (limits described above). The Utility Project Phase will also include a bid alternate. The City intends to award a single contract based on the total of all base bid schedules (without alternates).

### **SITE VISIT**

Each bidder shall be responsible for visiting the site/sites and fully acquaint himself/herself with the existing conditions relating to the construction of improvements and inform himself/herself as to the facilities involved, the difficulties and the restrictions attending the performance of the contract.

**GOVERNING SPECIFICATIONS**

This project shall be constructed in accordance with these Special Provisions and to the latest edition of the following standard specifications:

- City of Greeley General Conditions to the Construction Contract ("General Conditions")
- City of Greeley Design Criteria and Construction Specifications Manual (DCCSM)– Volume I (Streets), Volume II (Storm Drainage), and Volume III (Potable Water Distribution, Sanitary Sewer Collection, and Non-Potable Irrigation Systems).
- MGPEC Pavement Design Standards and Construction Specifications (MGPEC)
- Manual of Uniform Traffic Control Devices (MUTCD)
- The Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction, the CDOT M & S Standards, CDOT Construction Manual and CDOT Materials Manuals, latest editions.

In case of conflict, documents shall have the following priorities: (1) Special Provisions, (2) General Conditions, (3) Plans, (4) City of Greeley Design and Construction Specifications Volumes I-III, (5) CDOT Standard Special Provisions, (6) CDOT Standard Specifications (2017).

The 35<sup>th</sup> Avenue Widening Project is subject to the following project special specifications:

- Topsoil
- Dewatering
- Soil Prep, Seeding and Sodding
- Hydro Mulch
- Landscape Boulders
- Landscaping
- Cementitious Coating for Manhole Rehabilitation
- Colored Concrete for Splash Block
- Traffic Signal
- Traffic Signal Controller Cabinet
- Irrigation
- Irrigation Controller

The 35<sup>th</sup> Avenue Utility Project Phase 1 is subject to the following project special specifications:

- Dewatering
- Bypass Pumping
- Slide Gate
- Riprap

**LICENSE, FEES, AND PERMITS**

Conform to GC Section 00510 Article 16. Conform to "Streets Volume I" Section 01010. A pre-construction conference shall be held prior to the issuance of any permits for construction.

The Contractor will be required to obtain dewatering and storm water discharge permits from State of Colorado, Department of Public Health & Environment, Water Quality Control Division.

City permit fees will be waived. A permit from Public Works is required for work in right-of-way. Permits from Building Inspection is required for electrical, plumbing and landscaping work.

Contractor is responsible for obtaining all necessary permits required to complete the Work in accordance with federal, state, and local regulations. Contractor is responsible for compliance with all permits. Contractor to provide copies of necessary permits to the City prior to construction.

**PRE-CONSTRUCTION MEETING**

After Contract Notice of Award, the Contractor shall attend a pre-construction conference with the City prior to commencement of construction. Refer to General Conditions for Pre-construction conference requirements of the Contractor. The Contractor shall submit the following information at the preconstruction meeting:

- Storm Water Management Plan
- Traffic Control Plan
- Asphalt and Concrete Mix Designs
- Materials Source Submittals
- Materials Suppliers List
- List of Subcontractors
- Insurance Certificates
- Bar graph construction progress schedule in accordance with General Conditions Article 21

**SCALE TICKETS**

The Contractor shall provide certified scale tickets for each truck load of material to be paid by unit weight that is delivered to and incorporated in the project. The Contractor shall submit tickets to the designated City project representative at the time material is delivered to the site.

**SUBMITTALS - CONSTRUCTION MATERIALS**

Contractor shall submit manufacturers' information and materials specifications, testing results, and certifications that the materials proposed for this project meet the specification requirements outlined in the Standard Specifications and these Supplemental Specifications. Refer to individual sections within the Standard Specifications and Supplemental Specifications for specific material submittal requirements.

The Contractor shall submit manufacturers' information and certification that all materials conform to materials specifications for the following items. Receive approval in writing before work commences and before confirmation of order. Deliver two (2) copies of all submittals and one (1) electronic version to the Project Manager within 10 working days from the date of Notice to Proceed. Provide information in a 3-ring binder with table of contents and index sheet. Provide sections that are indexed for different components and labeled with the specification section numbered and the name of the component. Submittals must be made for all components on the material list. Indicate which items are being supplied on the catalog cut sheets when multiple items are shown on one sheet. Submittal package must be complete prior to being reviewed by the Project Manager. Incomplete submittals will be returned without review:

**CONTRACTOR USE OF SITE - PROTECTION OF THE PUBLIC**

The Contractor shall, at all times, conduct his or her work as to ensure the least possible inconvenience to the general public and adjacent property owners to the project site, and to ensure safety of persons and property. Fire hydrants on or adjacent to the Work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by the Contractor to ensure the use of access roads / driveways to adjacent properties. The Contractor shall be responsible for providing fencing, barricades and any necessary safety equipment to keep the site and the public safe at all times. Contractor shall keep work and equipment within the limits of disturbed area at all times.

The concrete trail and irrigation ditch access along No. 3 Canal will remain open during construction. Except as shown and noted below the City's properties are not available for Contractor use.

**EQUIPMENT STAGING/PARKING**

The Contractor may use the City of Greeley Bestway property for Construction Staging. See Appendix A for Staging Location. Or the Contractor is responsible for obtaining permission from adjoining property owners for any other equipment staging and storage areas.

The Contractor will be responsible for the security of the sites, including tools and equipment. Clean-up and restoration of the sites will also be the responsibility of the Contractor. These areas shall be restored to the City's satisfaction.

**CONTRACT TIME, LIQUIDATED DAMAGES, BONUSSES**

*The Contract Time for completing the contract work is **200 calendar days**.* Contract time commences on the date of the Notice to Proceed. Where a number of days is specified in this Contract it shall mean "Calendar Days" unless otherwise specified according to Article 59 of the General Provisions. There shall not be any "free time". The City intends to issue the Notice to Proceed by **January 4, 2021**.

The project, or defined project phase shall be considered substantially complete when, as determined by the Engineer, the Contractor has completed his or her work. The liquidated damages for project delays of substantial completion will be in the amount of \$1,000.00 for each calendar day. Liquidated damages are based on additional costs to the City of Greeley for delay of project, or defined project phase completion and are not a "late penalty".

Listed below are the anticipated numbers of calendar days lost to normal adverse weather for each month.

Monthly Anticipated Calendar Days Lost to Adverse Weather Conditions												
Month	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Normal Days Lost	7	4	4	4	6	3	4	2	3	3	2	5

The following work must be completed for the project or defined phase to be considered substantially complete.

- Final lift of asphalt pavement installed and concrete pavement for RAB completed
- All striping completed
- All signage reset or installed.
- Roadway open to traffic
- All pipelines fully operational (including acceptance/verification of all pressure tests).

Contractor will be awarded a bonus of \$1000 per day for each day (up to 10 calendar days) for Substantial Completion prior to the 200 day construction timeframe.

**GIC #3 (GREELEY NO. 3 CANAL)**

The Contractor shall coordinate with GIC #3 and the City of Greeley on the construction schedule of the dissipation structure and box culvert extension. Construction of the dissipation structure, box culvert extension and placement of all embankment material shall be completed by **March 25, 2021** or liquidated damages in the amount of the following will be charged each calendar day:

- \$5,000.00 for each calendar day beginning March 26, 2021 through April 1, 2021.
- \$25,000.00 for each calendar day after April 1, 2021.

Dates related to GIC #3 work will not be changed regardless of the NTP date.

**PROTECTION OF EXISTING UTILITIES / UTILITY COORDINATION**

The Contractor shall contact all appropriate utility companies prior to construction to notify of construction, to verify location of utilities in the construction area, and to coordinate utility company relocation, adjustment, or installation work with Contractor's work. Locations of utilities shown on plans are approximate, only based on "field locates" by the affected utility and limited pothole information. The Contractor shall verify prior to construction.

The Contractor shall comply with Article 5 of the General Conditions ("Protection of Existing Vegetation, Structures, Utilities, and Improvements and Land Survey Monuments") when excavation or grading is planned in the area of underground utility facilities. Protection of existing utilities and coordination with utility companies for relocations / manhole lid adjustments shall be in accordance with Streets Volume 1, Section 01010. No additional payment will be made for this coordination. All new landscaping shall be installed after completion of all Utility work.

The Contractor shall notify all affected utilities at least three (3) business days prior to commencing such operations. Contact the Colorado 811 (previously Utility Notification Center of Colorado) to have locations of registered lines marked by member companies. All other underground facilities shall be located by contacting the respective company. Utility service laterals shall also be located prior to beginning excavating or grading.

All cost incidental to the foregoing requirements will not be paid for separately but shall be included in the work.

The City will not be responsible for any construction down time due to failure on the Contractor's part to notify and coordinate with utility companies regarding conflicts.

To assist the Contractor with utility conflicts and relocates that will be necessary as part of this roadway widening project the following information is available:

- "Relocation by Others" Table on the Demolition Plan provides the Stationing/Offset, Item to Relocate out of the construction zone, and the Utility Owner
- A Test Hole Summary Table is included in the Construction Plan Set and provides the Utility, Owner, and Station/Offset for each Test Hole performed by T2
- Test Holes were completed at the storm sewer crossings. The utility conflicts with the proposed storm sewer system are identified on the Storm Plan and Profile Sheets
- Subsurface Utility Engineering Plans and Test Hole Fields Logs:
  - Appendix B1 -35th Avenue Widening Test Hole Field Logs completed by T2
  - "Appendix B2 - 35<sup>th</sup> Avenue Wet Utility Design" Subsurface Utility Engineer Plan by SurvWest
  - Appendix B3 - Summary of Test Hole Information and Coordinates by SurvWest

Contractor is responsible for field verifying the location of utilities within the project limits and immediately notifying the City of Greeley of any potential discrepancies or conflicts between the Work and the existing utility.

**The Contractor is hereby notified that high pressure gas lines are present within the project corridor. It is the responsibility of the Contractor to locate these gas lines prior to roadway excavation or subgrade scarification. These are owned by DCP Midstream, Xcel and Atmos Energy. The contractor shall coordinate with all utility owners to ensure that a representative from the utility is on site if required when working near their facilities.**



**TRAFFIC CONTROL AND CONSTRUCTION PHASING**

XCEL Energy will not have the overhead power lines and utility poles removed from the project corridor prior to the beginning of construction in January 2021. The Contractor will be required to work around the existing overhead power lines and utility poles along 35<sup>th</sup> Avenue until XCEL Energy is finished with their work.

**Traffic Control Notes and Guidelines for 35<sup>th</sup> Avenue include:**

- The City of Greeley will allow two-way traffic for local traffic only from 4<sup>th</sup> Street to and from the Bestway Property.
- A one-way north bound lane will remain open for emergency traffic only for the Fire Station. They will have emergency access through the whole project corridor the entire duration of construction.
- The Bestway Property access will remain open throughout the duration of the project and will be accessible for local business traffic only. Contractor shall coordinate closely with the Business Owners to make sure access is available to their property at all times with minimal disruptions.
- Detour routes are 59<sup>th</sup> Avenue (west of 35<sup>th</sup> Ave.) or N 23<sup>rd</sup> Avenue (east of 35<sup>th</sup> Ave.)
- Friendly Village Entrance/Exit onto 35<sup>th</sup> Avenue at Village Drive will remain closed for the duration of the project.
- Stoneybrook Entrance/Exit onto 35<sup>th</sup> Avenue at C Street will remain closed for the duration of the project.
- C Street east of 35<sup>th</sup> Avenue will remain open with two-way traffic going north to F Street during Phase 1 Construction. However, during Phase 2 Construction C Street will be closed at the entrance to Friendly Village at Rodeo Circle.

**Construction Phasing for 35<sup>th</sup> Avenue includes:**

- Construction of the dissipation structure, box culvert extension and placement of all embankment material at No. 3 Canal will be the Contractor's first priority. All work in the No. 3 Canal shall be completed by **March 25, 2021** or liquidated damages will be charged each calendar day.
- It is anticipated the Contractor will complete the west portion of the project first working around the existing utility poles up to the bottom of the asphalt section or concrete section. After the west portion of the project is built, local business traffic will run two-way on the base while the east portion of the project is built.

Paving will be accomplished after the utility poles are removed and traffic will need to be managed similarly for the paving operations.

**RIGHT OF WAY, EASEMENTS AND RIGHTS OF ENTRY**

The City will acquire the permanent right-of-way, permanent easements, temporary construction easements, and rights of entry for construction of the project. The Contractor shall verify with the City that acquisitions have been completed prior to scheduling work in proposed ROW and easements and that there are no other agreements related to temporary easements (facilities requiring protection, schedule items, etc.).

**PROPERTY OWNER NOTIFICATION**

The City will provide the Contractor with sufficient copies of written notices describing project activity and Contractor's proposed schedule of work. The Contractor shall deliver notices to all property owners and/or business operators located within 500 feet of project limits and to all other homes or businesses abutting or immediately adjacent to the project.

The Contractor shall coordinate with property owners prior to initiating removal / construction activities on areas outside of public right of way and shall provide a minimum of 5 days' notice to property owners prior to these activities.

The Contractor shall also give notice 24 hours prior to start of any construction activity that will restrict access to the affected property or when construction will be within 500 feet of that business or residence. The Contractor shall re-notify all property owners if the previously noticed schedule is delayed by 3 or more days.

All damage to private property must be repaired. If the City determines that unnecessary damage to private property has occurred, it will be the Contractor's responsibility to repair said damages at no cost to the City.

**Prior to construction of the dissipation structure and box culvert, coordinate with the GIC # 3 and the City of Greeley on the proposed construction dates for final approval.**

**SOILS INVESTIGATION & PAVEMENT DESIGN REPORT**

A Subsurface Exploration/Pavement Design Report for 35<sup>th</sup> Avenue Improvements was prepared by Earth Engineering Consultants, LLC (EEC) dated December 3, 2019.

A geotechnical engineering report entitled "Geotechnical Engineering Report 35<sup>th</sup> Avenue Pipelines Greeley, Colorado" dated September 3, 2020 and revised October 14, 2020 was prepared by Olsson for this project.

Copy of these reports are included in Appendix C. It is the Contractor's responsibility to review and become familiar with these reports prior to bidding.

**EXCAVATION / EMBANKMENT**

Conform to "Streets Volume I" Section 02220 and these special provisions and the geotechnical reports for the project.

Material from the project deemed unsuitable by the Engineer shall be removed from the project and legally disposed of at no additional cost to the City (removal of this material and the replacement with suitable material for the roadway project will be paid with the Unsuitable Material (CIP) item).

If excavated usable material must be stockpiled prior to placement, the Contractor shall identify the stockpile area to the Engineer. Further moving of stockpiled materials to embankment locations will not be paid for separately but shall be included in the cost of the work.

Refer to the Bid schedule and Appendix D for Summary of Earthwork for unit quantities and calculations for the respective excavation, embankment, and borrow items designated within the construction documents.

**EROSION AND SEDIMENT CONTROL:**

Contractor is responsible for control and routing of storm water runoff draining onto and from the construction area to prevent erosion or other damage. Contractor shall comply with City of Greeley Environmental Municipal Construction Best Management Practices (BMP). The Contractor will obtain and continually be in compliance with the Colorado Construction Stormwater Discharge Permit. The Contractor is responsible for all implementation, removals, maintenance, inspections and documentation to keep the project in strict compliance with this permit. The Contractor will be required to appoint their own Erosion Control Supervisor and needs to display due diligence towards the maintenance of the sediment and erosion control bid items.

Initial Construction Erosion Control measures are included in the plans and 35<sup>th</sup> Avenue Widening Design Drainage and Erosion Control Memorandum which can be found in Appendix E. The Contractor is responsible for submitting a Stormwater Management Plan (SWMP) with schedule identifying Erosion Control Supervisor, erosion control methods and timing as well as any construction means and methods items at Preconstruction Meeting.

Not all BMP's shown on Plans are intended for initial installation. BMP's shall be requested/approved by City prior to implementation. Additional BMPs may be required and shall be implemented at the request of the City. Additional BMPs, approved by the City, will be paid per the unit bid price.

**Concrete Washout Structure**

No earthen pit wash out areas will be allowed without approval from the City regarding their location. Washout pans should be placed to coincide with construction phasing. Washout pans must be clearly signed per City detail for washout areas. Recycled concrete is specifically prohibited for use as vehicle tracking pad aggregate.

**Erosion Control Maintenance**

Contractor shall provide periodic maintenance of the site, particularly during and after storms, to maintain barricades, provide necessary dust control and ensure general maintenance. Disregard of this provision shall cause for suspension of the project. It will be the Contractor responsibility to ensure that existing streets adjacent to the area under construction be kept free of all concrete or other foreign material. The cost of maintenance and replacement of BMPs is included with the cost of the initial installation of the BMP.

**CONSTRUCTION TRAFFIC CONTROL**

The Contractor shall comply with the requirements of Section 01010, Paragraph 1.3 G of DCCSM. The Contractor shall not perform any construction work in the public right-of-way prior to receiving approval of the Traffic Control Plan from the City of Greeley. The TRAFFIC CONTROL PLAN will include the City's Traffic Control Plan review Form.

The Contractor will appoint a Traffic Control Supervisor (TCS) to this project. The TCS does not need to be on site but must be available twenty-four (24) hours a day. The name and phone of the TCS will be provided to the City at the Pre-Construction Meeting. The Contractor will also provide the name and phone number of an alternate local traffic control company that will act on the Contractor's behalf in case the designated TCS cannot be reached. If Contractor is unresponsive or otherwise is deemed to not be performing traffic control duties in accordance with submitted plan, the City or its subcontractor may perform traffic control services, at cost to the Contractor.

The Contractor will be notified in writing when the traffic control for any work site is not acceptable. The Contractor will not be allowed to continue work at the location until the problems are corrected. Failure to correct the traffic control deficiencies prior to continuance of the work will result in non-payment for the work performed at the locations in question.

Refer to the Construction Phasing Plans for anticipated phasing of the project.

The Contractor shall coordinate driveway closures with property owners. For properties have more than one access the contractor shall keep one access open at all times. Properties with one driveway shall have the driveway reconstructed in a manner where the drive is usable during construction.

For paving and striping operations, the Contractor shall coordinate with the City of Greeley to determine the appropriate method of handling traffic.

### **DUST CONTROL**

The Contractor shall control dust in and around the construction site. If dusty conditions prevail, the site shall be watered at least twice daily. No separate payment will be made for dust control by watering. The Contractor shall include costs of dust control by watering into bid price of related items.

### **TESTING**

The Contractor shall provide Quality Control Sampling and Testing. The types of tests and minimum test frequencies are described in the City "Streets Volume I" Schedule for Quality Control Sampling and Testing Table in the Appendix. Cost shall be included in the bid price of the applicable item.

Quality Acceptance Testing shall be done by the City of Greeley's Construction Services or their representative. The City will pay for all Quality Assurance Testing. It is important that the Contractor inform the project Inspector or assigned representative as to when they will be ready for tests. A 24-hour advanced notice will be required.

### **HOT MIX ASPHALT (HMA) PAVEMENT**

Per EEC's Subsurface Exploration/Pavement Design Report dated December 3, 2019 the HMA Pavement section is:

- 3" HMA (Grade S) (75) (PG 64-22)
- 4" HMA (Grade S) (75) (PG 58-28)
- 12" ABC Class 5 or 6

### **CONCRETE**

Concrete shall be as specified in the plans for structures, caissons, etc. The Contractor may substitute appropriate CDOT mix designs with approval of the Engineer.

Conform to "Streets" Section 03310 except as modified herein:

2.1 REFERENCES – delete this section and replace with the following:

"Materials and construction methods shall meet the requirements of MGPEC Item 11 except as noted herein."

2.2 CLASSIFICATION – delete the first 7 lines of this section referring to CDOT concrete classes and replace with the following:

"Use Portland Cement Concrete as specified in MGPEC Item 11.2.7 for sidewalks,

Conform to City of Greeley Design Criteria and Construction Specifications Section 03300 except as modified herein:

3.1 MIX DESIGN – Delete this section and replace with the following:

- A. Concrete shall develop a minimum field compressive strength of 4500 psi after 28 days, unless otherwise specified by the City (i.e. thrust blocks).
- B. The water/cement ratio shall not exceed 0.45 by weight.
- C. Slump: 4 inches plus or minus 1 inch.
- D. Air entrainment: between 6% and 9% as tested from the truck prior to pumping, or between 5% and 8% as tested in place.

### **EXCAVATION AND FILL**

Conform to City of Greeley Streets Design Criteria and Construction Specifications and the geotechnical report for the project.

### **20" WATER LINE**

The contractor shall furnish and install pressure class 235 PVC per AWWA C900 as shown in the plans. Work shall comply with City of Greeley Water and Sewer Construction Specifications Sections 01713, 02510, 02511, 02513, 02514, and 02516. Pipe shall be laid between the points of connection to the existing waterline. Prior to tying into the existing waterlines, the Contractor shall pressure test and disinfect the waterline.

Conform to the City of Greeley Water and Sewer Design Criteria Specifications Section 02515 except as modified herein:

#### **2.2 GATE VALVES**

##### **i. General**

1. Delete this paragraph and replace with the flowing:

*"Four-inch (4") through twelve-inch (12") diameter gate valves shall be designed for a minimum working pressure of 200 psi and a test pressure of 400 psi. Sixteen-inch (16") through twenty-four-inch (24") diameter gate valves shall be designed for a minimum working pressure of 150 psi and a 300 psi test pressure."*

2. Deleted this paragraph and replace with the following:

*"Sixteen-inch (16") through twenty-four-inch (24") bonnets shall be set vertically."*

### **24" NON-POTABLE WATER LINE**

The contractor shall furnish and install pressure class 235 PVC per AWWA C900, purple color as shown in the plans. Work shall comply with City of Greeley Water and Sewer Construction Specifications Section 15140 except as modified herein:

#### **2.5 VALVES**

## B. Gate Valves

## 1. General

a. Delete this paragraph and replace with the following:

*“Four-inch (4”) through twelve-inch (12”) diameter gate valves shall be designed for a minimum working pressure of 200 psi and a test pressure of 400 psi. Sixteen-inch (16”) through twenty-four-inch (24”) diameter gate valves shall be designed for a minimum working pressure of 150 psi and a 300 psi test pressure.”*

b. Delete this paragraph and replace with the following:

*“Sixteen-inch (16”) through twenty-four-inch (24”) bonnets shall be set vertically.”*

**SANITARY SEWER PIPE**

Conform to the City of Greeley Water and Sewer Construction Specifications Section 02530, 02533, and 02535.

Conform to the City of Greeley Water and Sewer Construction Specifications Section 01715 except as modified herein:

Add the following to the end of Table 3.3A:

Pipe Size (in)	Base I.D.	5% Deflection Mandrel	7.5% Deflection Mandrel
18”	17.054	16.20	15.77
21”	20.098	19.09	18.59
24”	22.587	21.46	20.89

Add the following to the end of Table 3.4 D:

Pipe Diameter (in)	Pipe Length (ft)						
	0-150	200	250	300	350	400	500
18	19:14	25:39	32:03	38:28	44:52	51:17	64:06
21	26:11	34:54	43:38	52:21	61:05	69:48	87:15
24	34:11	45:35	56:59	68:23	79:47	91:10	113:58

**FINAL CLEANUP**

The Contractor shall, at completion of construction and prior to submitting request for final payment, clean up the site, removing all related debris. The Contractor shall notify the City when final cleanup is ready for inspection. This task includes any cleanup related to the SWMP.

**PROJECT CHANGES**

The City reserves the right to alter the project. Quantities may be added or deleted and adjustment will be made to the contract price according to the unit prices in the Bidding Schedule. However, if quantities are

increased or decreased more than 25%, changes and adjustments may be negotiated so that a mutually agreeable adjustment can be made.

**PROJECT WARRANTY**

The Contractor is responsible for providing a TWO-YEAR warranty to the City of Greeley for all work completed under this contract. The beginning of the TWO-YEAR warranty period will be established with the issuance of the Certificate of Final Acceptance. If the concrete fails, spalls, or deteriorates during the first and second year, the concrete shall be replaced under this warranty. There will be no additional cost to the City or the property owner for material, equipment, labor, and/or traffic control for warranty work.

Warranty work will be completed in accordance with these contract specifications and within 30 days of written notification by the City of Greeley.

**NOTICE TO CONTRACTOR ON INCIDENTAL ITEMS**

The Contractor shall consider Property Owner Notification and Public Outreach, Potholing, Construction Survey and all As-Built Survey required for the City and utilities as incidental to the project and include the costs associated with these incidental items into the unit prices of the associated bid items.

**35<sup>th</sup> AVENUE WIDENING MEASUREMENT AND PAYMENT:**

This contract is a unit price contract in which the Contractor will be reimbursed for the actual quantities of work performed and installed in accordance with the contract documents unless otherwise noted. No additional payment for work described in these documents will be allowed, whether a bid item exists or not. The Contractor shall include the costs of all incidentals of construction, labor, equipment, and materials in the appropriate bid item.

Measurement and payment for bid items listed in the Bid schedule shall be on the basis of the description in the applicable standard specifications or as identified in these supplemental specifications and Construction Drawings.

It is the intention of the contract documents to describe a complete project. Merge the cost of any and all miscellaneous work items (if not separately identified as bid items) shown on the Plans or implied as standard items of work necessary to achieve a complete and operational system in the unit price contained in the Bid for the nearest related bid item.

Merge all costs of labor, materials, supervision, fuel, equipment, surveying, potholing and other incidentals necessary to accomplish each work item into the unit price contained in the Bid for that item. Payment will be made at bid unit price for completed items unless otherwise noted. The basis for payment will be the *measured* in-place quantity, or quantity documented by delivery tickets, unless the item unit is Lump Sum (LS), or *plan quantity* is specified on bid schedule.

Unit Quantities: The estimates of quantities are only approximate. Refer to the Bid schedule for unit quantities. It shall be the Contractor's responsibility to satisfy himself as to the accuracy of the estimates prior to bid. The City reserves the right to increase or decrease individual items in such amounts as may be necessary in their sole judgment to the City's best interests depending upon conditions encountered or observed during the Project.

Payment shall be made at the contract unit bid price listed in the Bid schedule. The price listed therein shall be for unit quantities includes full compensation for required labor, tools, equipment, products, materials, haul, disposal, plant and facilities, transportation, services, erection, application or installation of item of the work; overhead and profit required to construct the respective bid items according to the Contract Documents incidental thereto.

Bid Schedule A Items with Additional Explanation for the 35<sup>th</sup> Avenue Widening Project are as follows:

**Bid Item 1 – CLEARING AND GRUBBING**

Clearing and Grubbing shall include tree removal for trees less than 6" in diameter with the trunk being measured 18" above the adjacent ground surface. Clearing and grubbing shall apply to the entire project site including the landscape boulders at the entrance of the Stoneybrook Subdivision.

**Bid Item 2 – REMOVAL OF IRRIGATION STRUCTURE**

This item is located on the NW corner of 4<sup>th</sup> and 35<sup>th</sup> Ave and shall include all work necessary to remove the irrigation structure, slide valve and adjacent hydrant complete in place.

**Bid Item 4 – REMOVAL OF ABANDONED STORM STRUCTURE**

This item is located near Sta. 16+00 and shall include all the work necessary to remove the abandoned storm structure, backfill, compact and prepare the excavated area for the roadway construction. ....



**Bid Item 11 – REMOVAL OF EXISTING CULVERT WINGWALLS**

This item shall include all work necessary to remove the existing concrete culvert walls near Greeley No. 3 Canal Culvert and F Street Culvert. All concrete related to the removal of this wall shall become the property of the Contractor and disposed of properly.

**Bid Item 12 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

This item shall include all work necessary to remove the abandoned 66" RCP for the construction of the box culvert extension at the No. 3 Canal. This bid item includes the removal of the 66" pipe to the limits of the culvert extension, structure excavation and structure backfill (class 1) to subgrade elevation and plugging both ends of the culvert, complete in place.

**Bid Items 24, 26, 27, AND 29 – REMOVAL OF CONCRETE, CURB & GUTTER, ASPHALT PAVEMENT, AND ASPHALT MILLINGS**

All concrete, curb, gutter, and sidewalk removed shall become the property of the Contractor and be disposed of properly. Saw cutting to a clean edge is incidental to the items. Engineer shall determine exact removal limits in the field. If tying into existing curb or sidewalk in poor condition (i.e. heaving), Contractor shall remove to the next expansion joint. Saw cutting of existing pavements / concrete shown on the construction plans shall be considered an incidental expense to removal and no separate payment will be made for this item.

Removal of Asphalt Mat shall include all labor, materials, excavation, haul, saw cutting, disposal, grading, and other items of expense necessary to the limits shown on the demolition plans and in accordance with "Streets Volume I" specifications. Payment for this item shall be made in accordance with the Bid schedule and shall be per square yard of asphalt material removed.

Removed Asphalt Millings and Asphalt Mat shall be returned to the City of Greeley at 1140 East 8<sup>th</sup> Street in Greeley, CO.

**Bid Item 30 – REMOVAL OF GROUND SIGN**

Contractor shall remove existing street signs at the direction of the Engineer and deliver them to a City facility as directed by the Engineer.

**Bid Item 31 – REMOVAL OF BUSINESS SIGN**

Contractor shall remove the existing business signs at the direction of the Engineer and return them to the property owner as directed by the Engineer.

**Bid Item 33– REMOVAL OF TRAFFIC SIGNAL**

This item shall include all work necessary to remove the existing traffic signal located at the intersection of 4<sup>th</sup> Street and 35<sup>th</sup> Avenue on the northeast corner. This bid item shall also include the removal of the traffic signal vaults associated with this signal pole. The existing signal pole, mast arm, and signal heads shall salvaged and become the property of the City. Coordination with City Traffic Group will be required by the Contractor.

**Bid Item 34 – UNCLASSIFIED EXCAVATION (COMPLETE IN PLACE)**

Conform to the City of Greeley Construction Standards and Specifications and the Geotechnical Report.

Unit bid price for this item shall include the costs of all labor, supervision, material, and equipment to excavate material and place that material as embankment to finished subgrade line and grade as shown on the plans and cross sections and as staked. Plan quantity does not include any allowance for material

removed during clearing and grubbing. Plan quantity is calculated to the estimated bottom plane of the proposed aggregate base course and topsoil. Plan quantity does not include any allowance for shrinkage, required compaction, or swell. Water required for compaction of embankment areas is incidental to this item. Reference Summary of Earthwork Tabulation in Appendix D.

Payment for the item shall be plan quantity. Engineer will make no separate measurement of cubic yards of excavation or embankment.

**Bid Item 35 – UNSUITABLE MATERIAL (COMPLETE IN PLACE)**

Conform to the City of Greeley Construction Specifications and the Geotechnical Report.

Remove and replace areas of unsuitable material. Item includes removal and replacement of unsuitable sub-grade materials and shall be paid on a per cubic yard basis as measured in the field by the City's construction representative and as outlined in the Bid schedule. Payment shall include all labor, equipment, materials, suitable replacement material, haul off of unsuitable materials, disposal, compaction, geotextiles, and any and all other items of expense required to remove and replace unsuitable material complete in place. Reference Summary of Earthwork Tabulation in Appendix D.

**Bid Item 36 – BORROW (COMPLETE IN PLACE)**

Unit bid price for this item shall include the costs of all labor, supervision, material, and equipment to haul the borrowed material from the City of Greeley Bestway property that is located near the project corridor and place, compact and water the borrow material to finish subgrade line and grade as shown on the plans and cross sections and as staked. Plan quantity does not include any allowance for material removed during clearing and grubbing. Plan quantity is calculated to the estimated bottom plane of the proposed aggregate base course and topsoil. Plan quantity does not include any allowance for shrinkage, compaction or swell. Water required for compaction of embankment areas is incidental to this item. Topsoil removal and replacement, reseeding and repair of the Bestway irrigation systems is included in the Repair Existing Bestway Irrigation System and Reseed item. Reference Summary of Earthwork Tabulation in Appendix D.

Payment for the item shall be at plan quantity. Engineer will make no separate measurement of cubic yards of excavation.

**Bid Item 37– FLOWFILL EX TEST HOLE**

Work shall include means, method, labor and materials to remove the temporary backfill material from the existing Test Holes performed by T2 as part of the initial utility investigation for the 35<sup>th</sup> Avenue Widening Project and backfill the Test Hole with flowable fill.

**Bid Item 38– STRUCTURE EXCAVATION**

Work shall include means, method, labor and materials to excavate the existing materials for the proposed box culvert extensions near Greeley No. 3 Canal and F Street Culvert. Contractor shall follow Section 206 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

Payment for the item shall be at plan quantity.

**Bid Item 39 – STRUCTURE BACKFILL (CLASS 1)**

Work shall include means, method, labor and materials to backfill the proposed box culverts. Contractor shall follow Section 206 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

Payment for the item shall be at plan quantity.

**Bid Item 40 – TOPSOIL STRIP (4 INCH)**

Payment for Topsoil Strip shall be made on a per cubic yard basis for existing topsoil stripped to a 4" depth for cuts and fills along the 35<sup>th</sup> Avenue roadway project limits. The stripping limits are from the existing edge of pavement to the proposed catch line along 35<sup>th</sup> Avenue. The work shall include all means, method, labor, and equipment to strip the native material and either haul off excess topsoil or reduce borrow needed by thickening topsoil replaced on backslopes. Reference Summary of Earthwork Tabulation in Appendix D.

Payment for the item shall be at plan quantity.

**Bid Item 41 – TOPSOIL REPLACEMENT (4 INCH BACKSLOPE)**

Conform to Additional Project Special Specifications for Topsoil and Seeding for amendment requirements prior to topsoil replacement.

Payment for Topsoil Replacement shall be made on a cubic yard basis for stockpiling, amending and redistributing the topsoil once construction is complete. Work shall include all labor, materials, equipment, placement, fine grading, and all other items of expense required for stockpiling the stripped topsoil, amending the existing topsoil prior to replacement, and placing the amended topsoil at locations and grades shown on the construction plans.

The topsoil replacement thicknesses shall be 4" minimum depth for areas behind the proposed back of sidewalk to the proposed catch line along 35<sup>th</sup> Avenue.

Payment for the item shall be at plan quantity.

**Bid Item 42 – TOPSOIL/SQUEEGEE IN MEDIANS (PRE-AMENDED W/COMPOST) (12 INCH DEPTH)**

Conform to Additional Project Special Specification for Topsoil and Seeding.

Payment for topsoil/squeegee mix shall be made on a per cubic yard basis for installation to the limits described on the contract drawings and shall include all labor, materials, equipment, placement, fine grading, and all other items of expense required for the complete placement of topsoil/squeegee in accordance with these contract documents. Thickness of topsoil/squeegee is 12 inches in depth for all raised medians.

**Bid Item 43 – TOPSOIL IN TREE LAWNS (PRE-AMENDED W/ COMPOST) (4 INCH DEPTH)**

Conform to Additional Project Special Specification for Topsoil and Seeding.

Payment for topsoil in tree lawns shall be made on a per cubic yard basis for installation to the limits described on the contract drawings and shall include all labor, materials, equipment, placement, fine grading, and all other items of expense required for the complete placement of topsoil in the tree lawns in accordance with these contract documents. Thickness of topsoil in the tree lawns shall be 4 inches in depth for in tree lawns/parkways along the 35<sup>th</sup> Avenue roadway project limits.

**Bid Item 44 - 48 – EROSION CONTROL ITEMS**

These items shall include the installation of field erosion control measures in accordance with the State and Federal temporary storm water discharge permits, as shown on the Grading and Erosion Control Plans and the Construction Detail Plans, and as outlined in the 35<sup>th</sup> Avenue Final Drainage Memorandum found in Appendix E of the specifications. Measurement and payment shall be made and paid for by each or the linear footage of the erosion control item installed per the construction details, as directed by the Engineer, and per the 35<sup>th</sup> Avenue Final Drainage Memorandum. The erosion control items shall

include all labor, materials, equipment, and other items of expense needed to initially install the required erosion control items. Maintenance, and replacement, and removal of BMPs during construction will be incidental to project.

**Bid Item 49 – EROSION CONTROL MANAGEMENT**

This item shall consist of the ongoing inspection, administration and management of field erosion control measures in accordance with the State and Federal temporary storm water discharge permits and provisions outlined in the Plans and 35<sup>th</sup> Avenue Final Drainage Memorandum found in Appendix E of the specifications. All labor, materials, equipment, and other items of expense needed to inspect and manage the erosion control measures required for this project shall be included within this payment item.

**Bid Item 50 – RELOCATE BUSINESS SIGN**

This item shall include all work necessary to remove, store, and relocate the existing business sign near Sta. 19+26 'Alpine Veterinary Hospital' to finished grade at location specified by Owner or Engineer. This item complete and accepted by the Engineer will be paid for at the unit price per each as shown in the bid schedule.

**Bid Item 51 – RELOCATE BUS STOP STRUCTURE & AMENITIES**

This item shall include all work necessary to remove, store and relocate the existing bus stop structure and amenities near Sta. 25+40 to the location identified on the plans.

**Bid Item 52 – RELOCATE EXISTING LANDSCAPING BLOCKS**

This item shall include all work necessary to remove, store, relocate and rebuild the existing landscape block wall at the entrance of Village Way near Sta. 24+50, complete in place.

**Bid Item 54 – MODIFY AND ADJUST EX STORM MH TO CONNECT w/ PROPOSED STORM**

This item shall include all labor, equipment and materials needed to modify and adjust the existing storm manhole near Sta. 8+00 along 35<sup>th</sup> Avenue to final grades. The item shall also include the necessary materials needed to connect proposed storm drains to the existing manholes at the locations and grades shown on the plans. This item complete and accepted by the Engineer will be paid for at the unit price per each as shown in the bid schedule.

**Bid Item 55 – MODIFY EXISTING SANITARY MANHOLE**

Conform to Additional Project Special Specification for Cementitious Coating for Manhole Rehabilitation.

This item shall include all labor, equipment and materials needed to modify and adjust the existing sanitary manhole near Sta. 43+75 along 35<sup>th</sup> Avenue to final grades. The item shall also include the necessary materials needed to connect proposed storm drains to the existing manholes at the locations and grades shown on the plans. This item complete and accepted by the Engineer will be paid for at the unit price per each as shown in the bid schedule.

**Bid Items 56 - 60 – ADJUST WATER VALVE, WATER METER PIT, FIRE HYDRANT ASSEMBLY, TRAFFIC VAULT, AND MANHOLES**

This item shall include all labor, equipment and materials needed to modify and adjust the existing water valves, water meter pit, fire hydrant assembly, traffic vaults, and manholes (Storm, Water, and Sanitary Sewer) along 35<sup>th</sup> Avenue at the locations and final grades shown on the plans. Installation of curb stop valves, risers, locking lids, and all other appurtenances shall be all inclusive to this item.

This item complete and accepted by the Engineer will be paid for at the unit price per each as shown in the bid schedule

**Bid Item 61 – DEWATERING (ROADWAY WIDENING PROJECT)**

Conform to Additional Project Special Specification for Dewatering.

Dewatering will not be measured but will be paid as Lump Sum on this project.

**Bid Item 62 – SWITCHGRASS PLUGS**

Furnish and install Switchgrass plugs including transportation, equipment, excavation, planting mix, maintenance, watering, incidental efforts and material required for a complete item. Measurement for payment of Switchgrass plugs shall be per each plug.

**Bid Item 63 – LOW GROW NATIVE SEED MIX (NON-IRRIGATED) (INCLUDES HYDRAULIC MULCHING)**

Conform to Additional Project Special Specifications for Soil Prep, Seeding & Sodding and Hydro Mulch.

Furnish and install Seed including transportation, equipment, maintenance, incidental efforts and material required for a complete item. Measurement for payment of Low Grow Native Seed shall be per square foot.

**Bid Item 64 – BUFFALO GRASS SEED (INCLUDES HYDRAULIC MULCHING)**

Conform to Additional Project Special Specifications for Soil Prep, Seeding & Sodding and Hydro Mulch.

Furnish and install Seed including transportation, equipment, maintenance, incidental efforts and material required for a complete item. Measurement for payment of Buffalo Grass Seed shall be per square foot.

**Bid Item 65 – BLUEGRASS SOD (INCLUDES FINE GRADING AND SOD)**

Conform to Additional Project Special Specifications for Soil Prep, Seeding & Sodding.

Furnish and install Sod including transportation, subgrade preparation, fine grading, and incidental efforts and materials required for a complete installed finished product. Measurement for payment of Bluegrass Sod shall be per square foot.

**Bid Item 66 – LANDSCAPE WEED BARRIER FABRIC (IN COBBLE MULCH & UNDER BOULDERS)**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Weed Barrier including transportation, equipment, excavation, pins, incidental efforts and material required for a complete item. Measurement for payment of Weed Barrier shall be per square foot.

**Bid Item 67 – WOOD (ORGANIC) MULCH (4" DEPTH)**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Wood Much including transportation, equipment, excavation, placement, incidental efforts and material required for a complete item. Measurement for payment of Wood Mulch shall be per cubic yard.

**Bid Item 68 – COBBLE MULCH (3" TO 6" DIAMETER TAN RIVER ROCK) (4" DEPTH)**

Furnish and install Cobble Mulch including transportation, equipment, excavation, placement, incidental efforts and material required for a complete item. Measurement for payment of Cobble Mulch shall be per ton.

**Bid Item 69 – SAND/PEA GRAVEL/AGGREGATE ROCK MIX (4" DEPTH)**

Furnish and install Sand/Pea Gravel/Aggregate Mix including transportation, equipment, excavation, placement, compaction, incidental efforts and material required for a complete item. Measurement for payment of Sand/Pea Gravel/Aggregate Mix shall be per ton.

**Bid Item 70 – LANDSCAPE BOULDERS**

Conform to Additional Project Special Specifications for Landscape Boulders.

Furnish and install Landscape Boulders including transportation, equipment, excavation, placement, stabilizing, incidental efforts and material required for a complete item. Measurement for payment of Boulders shall be per ton.

**Bid Item 71 – ORNAMENTAL TREES (1.5" CALIPER)**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Trees including transportation, equipment, excavation, planting mix, staking, tree wrap, maintenance, watering, incidental efforts and material required for a complete item. Measurement for payment of Ornamental Trees shall be per each tree.

**Bid Item 72 – DECIDUOUS SHADE TREES (2" CALIPER)**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Trees including transportation, equipment, excavation, planting mix, staking, tree wrap, maintenance, watering, incidental efforts and material required for a complete item. Measurement for payment of Deciduous Shade Trees shall be per each tree.

**Bid Item 73 – CONIFEROUS TREES**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Trees including transportation, equipment, excavation, planting mix, staking, tree wrap, maintenance, watering, incidental efforts and material required for a complete item. Measurement for payment of Coniferous Trees shall be per each tree.

**Bid Item 74 – PERENNIALS**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Perennials including transportation, equipment, excavation, planting mix, maintenance, watering, incidental efforts and material required for a complete item. Measurement for payment of Perennials shall be per each.

**Bid Item 75 – ORNAMENTAL GRASSES (1 GALLON)**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Ornamental Grasses including transportation, equipment, excavation, planting mix, maintenance, watering, incidental efforts and material required for a complete item. Measurement for payment of Ornamental Grasses shall be per each.

**Bid Item 76 – SHRUBS (5 GALLON)**

Conform to Additional Project Special Specifications for Landscaping.

Furnish and install Shrubs including transportation, equipment, excavation, planting mix, maintenance, watering, incidental efforts and material required for a complete item. Measurement for payment of shrubs shall be per each shrub.

**Bid Item 77 – SOIL RETENTION BLANKET (STRAW-COCONUT) (BIODEGRADABLE CLASS I)**

Conform to CDOT Standard Specification Section 216 – Soil Retention Covering for material requirements for a Straw-Coconut Biodegradable Class I Soil Retention Blanket.

Work shall include means, method, labor and materials as required by the manufacture including overlapping material and staples to install the soil retention blanket where shown in the construction plans. Measurement for payment for the soil retention blanket shall be by square yard of finished surface, excluding overlap, complete in place and accepted by the Engineer.

**Bid Item 89 – HYDROVAC CAISSON EXCAVATION**

There is an existing deep high pressure gas line near the Hawk Beacon Signal caisson on the east side of the roadway that will need to be protected in place. Contractor shall hydrovac excavate the location of the caisson rather than drilling. Coordination with the Engineer and the utility company will be necessary. The concrete and steel for the caisson is also included in the "Drilled Caisson 36" quantity. This item is only for the alternate excavation method. The Hydrovac caisson item will be measured and paid by the linear of depth excavated for this caisson.

**Bid Items 90 – RETAINING WALL (DRY-STACK)**

The Contractor shall bid assuming the use of Redi-Rock dry-stack wall type.

Measurement and payment for dry-stack retaining wall shall include all labor, materials, concrete block, excavation, geogrid, backfill, drainage, compaction, leveling pad, and all other items of expense necessary for installation to the lines and grades shown in the contract plans and documents. The dry-stack retaining wall shall be paid by the square foot of block face area.

**Bid Item 91 – RIPRAP (TYPE L) (BURIED) (COMPLETE IN PLACE)**

Riprap Type L Buried will be measured by the cubic yard including both the rock (riprap) and soil. Geotextile and granular material are not paid for separately but included in the cost of the work.

Prepare subgrade to receive riprap. Compact to ninety five percent (95%) of Maximum Standard Proctor Density (ASTM D698) to re-establish the subgrade. Unstable material shall be removed from the project site and disposed of by the Contractor. Removal and replacement of unstable material shall only be completed at the direction of Engineer and shall be paid for under bid item Unsuitable Material.

Place first lift of interlocking riprap of approximate D50 thickness. Then add existing native soil materials (not necessarily topsoil) from the site (may be alluvial soils with variety of sizes) on top of the lift, and vibrate into voids using large vibratory equipment or backhoe bucket to create a tight, dense, interlocking mass. Then place the next layer of riprap and repeat as above, until full specified thickness is achieved. Fill the voids of the top layer as necessary with existing soil materials. The final installation shall be approximately 70% interlocking riprap and 30% voids that are filled with native materials.

The soil material shall be further wetted to encourage void filling in between lifts.

Riprap shall be fully interlocking with soil filling only the void space between interlocking riprap pieces.

For buried soil riprap, the top surface shall be covered with six inches of topsoil (or to the depth required on the plans) such that no rock points are protruding.

The final surface shall be thoroughly wetted for good compaction, smoothed and compacted by vibrating equipment; the surface shall then be hand raked to receive planting or seeding in accordance with the plans.

**Bid Item 92 – RIPRAP (TYPE M) (COMPLETE IN PLACE)**

Work shall include means, method, labor and materials as required to install the riprap per the construction details and at the locations and grades shown in the plans. This includes but not limited to excavation, rock excavation, filter fabric, bedding material, and riprap. Measurement for payment for the riprap shall be by the cubic yard of riprap installed complete in place and accepted by the Engineer.

Section 506 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

**Bid Item 93 – PEDESTRIAN RAILING (STEEL)**

Work shall include means, method, labor and materials to fabricate, deliver and install the pedestrian railings for the proposed culvert structure. Conform to sections 514 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

**Bid Item 94 – CONCRETE SEALER**

Work shall include means, method, labor and materials to construct the concrete sealer for the proposed culvert structures. Contractor shall follow Section 515 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

**Bid Item 95 – WATERPROOFING (ASPHALT)**

Work shall include means, method, labor and materials for waterproofing the proposed culvert structures. Contractor shall follow Section 517 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

**Bid Item 96 – HEADWALL (HW STORM)**

Work shall include means, method, labor and materials to construct storm drain headwalls. Contractor shall follow Plan Details, Section 601 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions. The walls shall be paid by the square foot face area.

**Bid Items 97 AND 98 – CONCRETE CLASS D (WALL) AND CONCRETE CLASS D (BOX CULVERT)**

Work shall include means, method, labor and materials to construct the cast-in-place concrete elements for the proposed culvert structures. Contractor shall follow Section 601 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

**Bid Item 99 – REINFORCING STEEL**

Work shall include means, method, labor and materials to construct the reinforcing steel elements for the proposed culvert structure. Contractor shall follow Section 602 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.



**Bid Items 100 - 110 – STORM DRAINAGE PIPES AND END SECTIONS**

Conform to Greeley Standards and Specifications for materials and installation requirements. All storm drain pipe shall be Class III reinforced concrete pipe or ADS HP pipe as shown in the plans. Pipe joint grouting designated on the contract construction plans shall be considered incidental expenses to the installation of the storm drain lines. No additional payment will be made for trenching, drainage rock, backfill material, pipe bedding material or MIRAFLI fabric which shall be considered an incidental expense to the installation of the storm pipes.

18" RC End Section w/ Cutoff Wall is located near Sta. 31+50 and will include the concrete end section and concrete wall complete in place and as detailed on the construction plans.

36" RC End Section (Special) is located near Sta. 32+00 and will include a concrete cutoff wall with a water quality notch complete in place and as detailed on the construction plans.

All material, labor, and equipment required to construct the storm drain in phases, shall be included in the unit bid items:

<u>Pay Item</u>	<u>Pay Unit</u>
12" ADS HP (Complete In Place)	LF
15" RCP (Complete In Place)	LF
18" RCP (Complete In Place)	LF
24" RCP (Complete In Place)	LF
30" RCP (Complete In Place)	LF
36" RCP (Complete In Place)	LF
12" ADS End Section (Complete In Place)	EA
18" RC End Section w/ Cutoff Wall (Complete In Place)	EA
24" RC End Section (Complete In Place)	EA
30" RC End Section (Complete In Place)	EA
36" RC End Section (Special) (Complete In Place)	EA

**Bid Item 111 – STORM CROSSING OVER WATER OR SANITARY SEWER PIPES**

Work shall include means, method, labor and materials needed to cross existing or proposed water and sanitary sewer lines with the proposed storm drain pipes. The work shall include but not limited to the pipe cradles, the joint wrap, and flowfill necessary to complete the pipe crossing as detailed on the plans and shown on the Storm Plan and Profile Sheets.

**Bid Item 112 – 7X5 FOOT CONCRETE BOX CULVERT (PRECAST)**

Work shall include means, method, labor and materials to construct the cast-in-place concrete elements for the proposed twin box culvert structure. Contractor shall follow Section 603 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

**Bid Items 113 - 126 – STORM DRAINAGE INLETS, MANHOLE BOX BASE, AND MANHOLES**

Conform to City of Greeley Standards and Specifications for materials and installation requirements. The measurement for payment for each pay item will be on a unit price basis. The unit price includes but is not limited to furnishing and placement of materials and labor required to install the drainage structure in the accordance with the Drawings and Specifications. The work includes but is not limited to excavation and disposal of any excess material, dewatering, sub-grade preparation, backfill material, bedding material, MIRAFLI fabric, subgrade stabilization, installation of drainage structure as shown on plans, connections of pipes to existing drainage structure, joint encapsulation, verification of positive conveyance through drainage structure, and furnishing and installing all other necessary materials, work,

and equipment required to construct the pay item in accordance with the Drawings and Specifications. Payment shall be made based on the actual quantity of drainage structure installed complete in place.

12" ADS Inline Basin w/ Dome Grates are located along C Street and at the SW corner of the C Street and 35<sup>th</sup> Avenue RAB. The bid item will include the construction of the basin with dome grate as detailed on the construction plans, complete in place.

Modified Type C Inlet w/ Dry Well are located along F Street. The bid item will include the construction of the modified basin open bottom set on a concrete manhole base beams as detailed on the construction plans, complete in place.

10' Type R Inlet Modified (5 Ft) is located near Sta. 29+00 and will include a 10' curb cut which will slope to the throat of inlet that is offset from the flowline. This modified Type R Inlet will be constructed as detailed on the construction plans, complete in place.

Median Area Inlets will include a 36" drain basin and Neenah Grate as detailed on the construction plans, complete in place.

4' Storm Drain Manhole & 15" Pipe Stub (Connect to Ex Irr Line) is located on the NW corner of 4<sup>th</sup> and 35<sup>th</sup> Ave and shall include all work necessary to install a 4' diameter manhole with a 15" pipe stub. This work shall also include the all necessary pipe fittings to the connect the 15" pipe stub to the existing irrigation line, complete in place.

All material, labor, and equipment required to construct the drainage structure in phases, shall be included in the unit bid items:

<u>Pay Item</u>	<u>Pay Unit</u>
12" ADS Inline Basin w/ Dome Grate	EA
Modified Type C Inlet w/ Dry Well	EA
5' Type R Inlet (5 Ft)	EA
5' Type R Inlet (10 Ft)	EA
5' Type R Inlet (15 Ft)	EA
10' Type R Inlet (5 Ft)	EA
10' Type R Inlet Modified (5 Ft)	EA
10' Type R Inlet (10 Ft)	EA
10' Type R Inlet (15 Ft)	EA
Median Area Inlet (with 36" Drain Basin and Neenah Grate)	EA
Storm Drain Manhole Box Base	EA
4' Storm Drain Manhole & 15" Pipe Stub (Connect to Ex Irr Line)	EA
4' Storm Drain Manhole	EA
5' Storm Drain Manhole	EA

#### **Bid Item 127 – EXISTING STILLING BASIN WALL CORE CONNECTION (24" AND 36" PIPES)**

The will not be measured by paid for on a lump sum bid item which shall include but not limited to all labor, materials, equipment, and hardware necessary to core into the existing concrete stilling basin structure located at the NE corner of the C Street and 35<sup>th</sup> Avenue RAB with a 24" RC and a 36" RC pipe, and grout the connections to the existing structure, complete in place.

#### **Bid Items 128 - 130 – WATER QUALITY ITEMS**

The measurement for payment will be for each water quality item on a unit price basis and shall include all labor, materials, equipment, hardware, and all other items of expense required for the complete placement of the water quality filter bag or structure at the grades and locations indicated on the plans and in accordance with the manufacture's recommendations and as detailed on the construction plans.

**Bid Item 131 – WATER QUALITY BIOSWALE**

The measurement for payment will be for actual linear foot of water quality bioswale installed per details in the construction plans and shall include all labor, materials, and other expenses necessary to furnish and install the water quality bioswale as detailed on the plans. Once the item is complete and accepted by the Engineer it will be paid for at the unit price per lineal foot as shown in the bid schedule.

**Bid Item 132 – BRIDGE RAIL TYPE 10M (SPECIAL)**

Work shall include means, method, labor and materials to fabricate, deliver and install the bridge railings for the proposed bridge structure. Conform to sections 509, 514 and 606 of the CDOT Construction Standards (2019) with applicable Standard Special Provisions.

**Bid Item 146 – SPLASH BLOCK**

Conform to Additional Project Special Specification for the concrete color and concrete pattern of the splash block.

The measurement for payment will be for actual linear foot splash block installed per details in the construction plans and shall include all labor, materials, and other expenses necessary install the splash block. Once the item is complete and accepted by the Engineer it will be paid for at the unit price per lineal foot as shown in the bid schedule.

**Bid Items 147 – 155 – ELECTRICAL CONDUIT**

Work shall include means, method, labor and materials needed to install electrical conduit and appurtenances as shown on the Construction plans and in accordance with City of Greeley Ordinance No. 9, 2019 for the future fiber optic lines as well as electrical conduit supporting signals, etc.

It is expected that each size conduit shown in the bid tabulation will have the exact same unit price for the same size conduit. For example, all 4 Inch conduit no matter if it is used for Roadway, Traffic, or Electrical will have the same unit price. It is broken out on the bid tabulation separately for clarity so the Contractor can identify what conduit is associated with which drawing.

These electrical conduit and appurtenances shall be included in the unit bid items:

<u>Pay Item</u>	<u>Pay Unit</u>
2" PVC Conduit (Electrical Plans)	LF
2 Inch Electrical Conduit (Traffic Signal Plans)	LF
2 Inch Electrical Conduit (Bored) (Traffic Signal Plans)	LF
2 Inch Electrical Conduit (4 – 2" Conduit w/ single trench 4,075 LF)(FO)	LF
2 Inch Electrical Conduit (Sidewalk of Bridge Deck)	LF
3 Inch Electrical Conduit (Traffic Signal Plans)	LF
3 Inch Electrical Conduit (Bored) (Traffic Signal Plans)	LF
4 Inch Electrical Conduit (Sidewalk of Bridge Deck)	LF
6 Inch Electrical Conduit (Sidewalk of Bridge Deck)	LF

**Bid Item 156 - 181 – TRAFFIC SIGNAL AND CONTROLLER CABINET**

Conform to Additional Project Special Specification for the City of Greeley Traffic Signal and Traffic Signal Controller Cabinet.

The City of Greeley will be purchasing most of the Traffic Signal Equipment. The Contractor will be responsible for installing only the items listed on the Bid Tabulation as "INSTALL ONLY". All other traffic items the Contractor will be responsible for furnishing and installing the traffic signal equipment.

**Bid Item 182 - 184 – SIGN PANEL (CLASS I) AND SIGN POST**

Signs and Posts shall be installed per City of Greeley Standard Details. Signs set in concrete shall include a 4" PVC pipe sleeve placed when concrete is poured. If this left out, concrete shall be cored. No separate measurement or payment will be made for concrete core or PVC pipe.

Sign Panel (Class I) bid item shall be measured and paid by the square foot and include background, message, date of manufacture, and all hardware necessary to mount the new signs and all labor and materials necessary to install the sign as shown on the contract documents.

Sign Post bid item shall be measured and paid for by the linear footage of post and includes but not limited to panel, post, concrete, backfill, and hardware necessary to mount the new signs and all labor and materials necessary to install the sign as shown on the contract documents.

**Bid Item 186 – IRRIGATION (MEDIANS AND TREE LAWNS)**

Conform to Additional Project Special Specification for the City of Greeley Irrigation.

This item shall consist installing irrigation systems within the medians and tree lawn in the locations shown on the construction plans. The measurement and payment will be based on the square footage of area new irrigation being installed, complete in place. All labor, materials, equipment, and other items of expense needed to install the irrigation facilities required for this project shall be included within this payment item.

**Bid Item 187 –IRRIGATION (BLUEGRASS SOD PRIVATE IRRIGATION REPAIRS)**

Conform to Additional Project Special Specification for the City of Greeley Irrigation and Irrigation Controller.

This item shall consist of the repair to all existing irrigation systems within bluegrass sod areas adjacent to the project that are impacted by the project. This shall include but is not limited to the repair of the systems, moving any of the irrigation sprinklers as needed, or replacement of irrigation sprinklers. The measurement and payment will be based on the square footage of area repaired on private irrigations systems. All labor, materials, equipment, and other items of expense needed to repair existing irrigation facilities required for this project shall be included within this payment item

**Bid Item 188 –IRRIGATION CONTROLLER SYSTEM**

Conform to Additional Project Special Specification for the City of Greeley Irrigation and Irrigation Controller.

A new irrigation controller will be installed at the Fire Station. The bid item will include the controller, two wire and grounding needed to install a new irrigation controller at the Fire Station, complete in place.

**Bid Item 189 – EXISTING BESTWAY IRRIGATION AND RESEED**

An existing irrigation system is located around the Bestway Pond. As part of the roadway construction and if the Contractor will be using Borrow Material from this site, the Contractor is responsible for repairing and replacing any irrigation facilities that are damaged, re-topsoil and reseed these areas.

The irrigation system repair, installation of topsoil, and seeding will not be measured by paid for as a lump sum bid item.

**Bid Items 193 - 199 – TRAFFIC CONTROL ITEMS**

The measurement and payment for traffic control shall be on a unit price basis and shall include all the work, materials, and equipment required for traffic control required for constructing the 35<sup>th</sup> Avenue Widening Project.

The Temporary Asphalt Pavement will be measured and paid for by the square yard of temporary asphalt placed during the phasing of construction. No addition payment will be given for repairing, maintaining, and removing the temporary asphalt.

The Temporary Signal at 4<sup>th</sup> Street will be not be measured but paid for by lump sum item. This item will include all the necessary equipment need to place, maintain, and remove the temporary signal at 4<sup>th</sup> Street for phasing construction.

These traffic control items shall be included in the unit bid items:

<u>Pay Item</u>	<u>Pay Unit</u>
Construction Traffic Control Devices	DAY
Flagging	HR
Traffic Control Inspection	DAY
Traffic Control Management	DAY
Portable Message Sign Panel	EA
Temporary Asphalt Pavement	SY
Temporary Signal at 4 <sup>th</sup> Street	LS

**Bid Item 201 – Roadway Widening and Storm Sewer Mobilization**

Measurement and payment for mobilization and demobilization shall be on a lump sum basis. The lump sum bid price shall include all the Contractor's costs of whatsoever nature including site management and full-time supervision, labor, material, and any incidental work and equipment necessary for mobilization and demobilization of personnel, equipment and supplies for the 35<sup>th</sup> Avenue Roadway Widening Project - Phase 1. This item includes installation of temporary fencing around project work and staging areas, and any other fencing/security items as deemed necessary by the Contractor. This item also includes obtaining necessary permits. This item may also include provision of required bonds, insurance and preparation of the project schedule. The removal of the Contractor's equipment, supplies, excess materials, and cleanup of the site are also included in this item. 50 percent Payment will be made upon completion of Mobilization. Remaining 50 percent will be paid upon Demobilization and Restoration is complete.

**35<sup>TH</sup> AVENUE UTILITY PROJECT PHASE 1  
MEASUREMENT AND PAYMENT**

This contract is a unit price contract in which the Contractor will be reimbursed for the actual quantities of work performed and installed in accordance with the contract documents unless otherwise noted. No additional payment for work described in these documents will be allowed, whether a bid item exists or not. The Contractor shall include the costs of all incidentals of construction, labor, equipment, and materials in the appropriate bid item.

Measurement and payment for bid items listed in the Bid schedule shall be on the basis of the description in the applicable standard specifications or as identified in these supplemental specifications and Construction Drawings.

It is the intention of the contract documents to describe a complete project. Merge the cost of any and all miscellaneous work items (if not separately identified as bid items) shown on the Plans or implied as standard items of work necessary to achieve a complete and operational system in the unit price contained in the Bid for the nearest related bid item.

Merge all costs of labor, materials, supervision, fuel, equipment, surveying, potholing, and other incidentals necessary to accomplish each work item into the unit price contained in the Bid for that item. Payment will be made at bid unit price for completed items unless otherwise noted. The basis for payment will be the *measured* in-place quantity, or quantity documented by delivery tickets, unless the item unit is Lump Sum (LS), or *plan quantity* is specified on bid schedule.

Unit Quantities: The estimates of quantities are only approximate. Refer to the Bid schedule for unit quantities. It shall be the Contractor's responsibility to satisfy himself as to the accuracy of the estimates prior to bid. The City reserves the right to increase or decrease individual items in such amounts as may be necessary in their sole judgment to the City's best interests depending upon conditions encountered or observed during the Project.

Payment shall be made at the contract unit bid price listed in the Bid schedule. The price listed therein shall be for unit quantities includes full compensation for required labor, tools, equipment, products, materials, haul, disposal, plant and facilities, transportation, services, erection, application or installation of item of the work; overhead and profit required to construct the respective bid items according to the Contract Documents incidental thereto.

Bid Schedule B Items with Additional Explanation are as Follows:

**Water, Non-Potable, and Sanitary Sewer Bid Items****Bid Item 1 – Water, Non-Potable, and Sanitary Sewer Mobilization**

Measurement and payment for mobilization and demobilization shall be on a lump sum basis. The lump sum bid price shall include all the Contractor's costs of whatsoever nature including site management and full-time supervision, labor, material, and any incidental work and equipment necessary for mobilization and demobilization of personnel, equipment and supplies for the 35<sup>th</sup> Avenue Utility Project - Phase 1. This item includes installation of temporary fencing around project work and staging areas, and any other fencing/security items as deemed necessary by the Contractor. This item also includes obtaining necessary permits. This item may also include provision of required bonds, insurance and preparation of the project schedule. The removal of the Contractor's equipment, supplies, excess materials, and cleanup of the site are also included in this item. 50 percent Payment will be made upon completion of Mobilization. Remaining 50 percent will be paid upon Demobilization and Restoration is complete.

**Bid Items 2 – Dewatering**

Conform to Additional Project Special Specification Dewatering. Dewatering will not be measured but will be paid as Lump Sum on this project.

**Bid Item 3 – Install Fire Hydrants**

This item shall include all work necessary to install fire hydrants to finished grade at locations identified on the plans including 6-inch lines off of the 20-inch or 12-inch main and all associated valves, bends, thrust blocks, potholing, staking, as-builts, and appurtenances. This item complete and accepted by the Engineer will be paid for at the unit price per each as shown in the bid schedule.

**Bid Item 4 – 2" Air/Vacuum Relief Valve and Vault for 20-inch Potable Water Line**

The measurement for payment for each pay item will be on a unit price basis. Work shall include all means, methods, labor and materials to construct air/vacuum relief valves and vaults for the 20-inch PVC potable water line. Work shall include excavation, dewatering, stabilization material, vault, air/vacuum relief valve, valves, piping, manhole cover, air vents, bollards, potholing, staking, as-builts, and all other ancillary equipment required to result in a functioning air/vacuum relief valve and vault in accordance with the Drawings and Specifications. Payment shall be based on the actual quantity of air/vacuum relief valves and vaults installed.

**Bid Item 5 – 20-inch Pressure Class 235 PVC (Restrained Joints)**

This bid items shall consist of the installation of new waterline as shown in the plans. This item shall include all pipe materials, excavation, dewatering, tracer wire, temporary water as needed, joint restraint, caps, solid sleeves, thrust blocks, connection, labor, pipe bedding, backfilling, disinfection and testing (including test stations), potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the pipeline and appurtenances in accordance with the Contract Documents including utility crossings not specifically listed in other Bid Items. Measurement for payment of pipe shall be per linear foot, measured horizontally along the centerline as shown in the Contract Documents. No adjustments in payment will be made to reflect variations in the field as to the final in-place limits of the class, thickness, or type of installed pipe.

**Bid Item 6 – 20-inch MJ Bends and Tees**

This bid items shall consist of the installation of all bends and tees on the 20-inch water line. This item shall include all bends, tees, excavation, dewatering, tracer wire, joint restraint, thrust blocks, connection, labor, pipe bedding, backfilling, disinfection and testing, potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the bends and appurtenances in accordance with the Contract Documents. Measurement for payment of pipe shall be per bend or tee, as shown in the Contract Documents.

**Bid Item 7 – 20-inch Gate Valves**

This bid items shall consist of the installation of all gate valves on the 20-inch water line. This item shall include all gate valves, excavation, dewatering, tracer wire, joint restraint, thrust blocks, connection, labor, pipe bedding, backfilling, disinfection and testing, potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the gate valves and appurtenances in accordance with the Contract Documents. Measurement for payment of pipe shall be per gate valve, as shown in the Contract Documents.

**Bid Item 8 – 12-inch Pressure Class 235 PVC (Restrained Joints)**

This bid items shall consist of the installation of new waterline as shown in the plans. This item shall include all pipe materials, excavation, dewatering, tracer wire, temporary water as needed, joint restraint, caps, solid sleeves, thrust blocks, connection, labor, pipe bedding, backfilling, disinfection and testing (including test stations), potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the pipeline and appurtenances in accordance with the Contract Documents including utility crossings not specifically listed in other Bid Items. Measurement for payment of pipe shall be per linear foot, measured horizontally along the centerline as shown in the Contract Documents. No adjustments in payment will be made to reflect variations in the field as to the final in-place limits of the class, thickness, or type of installed pipe.

**Bid Item 9 – 12-inch MJ Bends and Tees**

This bid items shall consist of the installation of all bends and tees on the 12-inch water line. This item shall include all bends, tees, excavation, dewatering, tracer wire, joint restraint, thrust blocks, connection, labor, pipe bedding, backfilling, disinfection and testing, potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the bends and appurtenances in accordance with the Contract Documents. Measurement for payment of pipe shall be per bend or tee, as shown in the Contract Documents.

**Bid Item 10 – 12-inch Gate Valves**

This bid items shall consist of the installation of all gate valves on the 12-inch water line. This item shall include all gate valves, excavation, dewatering, tracer wire, joint restraint, thrust blocks, connection, labor, pipe bedding, backfilling, disinfection and testing, potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the gate valves and appurtenances in accordance with the Contract Documents. Measurement for payment of pipe shall be per gate valve, as shown in the Contract Documents.

**Bid Item 11 – Connect to Existing 16-inch Water line**

Work shall include means, method, labor and materials necessary to furnish and install transition couplings, fittings and components associated with connection to the existing 16-inch ductile iron waterline, as shown in the Contract Documents. Work shall include potholing to determine location and vertical and horizontal angle of the existing pipe, excavation, disinfection of components, potholing, staking, as-builts, and backfilling. The tie-in shall be made after the 20-inch potable water line is constructed to the first valve and approved by the Owner. The 20-inch water line is paid as a separate Bid Item. Payment for the tie-ins shall be made per each on a lump sum basis.

**Bid Item 12 – 2-inch Air/Vacuum Relief Valve and Vault for 24-inch Non-Potable Water Line**

The measurement for payment for each pay item will be on a unit price basis. Work shall include all means, methods, labor and materials to construct air/vacuum relief valves and vaults for the 24-inch PVC non-potable water line. Work shall include excavation, dewatering, stabilization material, vault, air/vacuum relief valve, valves, piping, manhole cover, potholing, staking, as-builts, and all other ancillary equipment required to result in a functioning air/vacuum relief valve and vault in accordance with the Drawings and Specifications. Payment shall be based on the actual quantity of air/vacuum relief valves and vaults installed.

**Bid Item 13 – 24-inch Pressure Class 235 PVC (Restrained Joints)**



This bid items shall consist of the installation of new waterline as shown in the plans. This item shall include all pipe materials, excavation, joint restraint, mechanical bends, fittings, connection, labor, excavation, pipe bedding, backfilling, testing (including test stations), potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the pipeline and appurtenances in accordance with the Contract Documents including utility crossings not specifically listed in other Bid Items. Measurement for payment of pipe shall be per linear foot, measured horizontally along the centerline as shown in the Contract Documents. No adjustments in payment will be made to reflect variations in the field as to the final in-place limits of the class, thickness, or type of installed pipe.

#### **Bid Item 14 – 24-inch MJ Bends and Tees**

This bid items shall consist of the installation of all bends and tees on the 24-inch non-potable water line. This item shall include all bends, tees, excavation, dewatering, tracer wire, joint restraint, thrust blocks, connection, labor, pipe bedding, backfilling, testing, potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the bends and appurtenances in accordance with the Contract Documents. Measurement for payment of pipe shall be per bend or tee, as shown in the Contract Documents.

#### **Bid Item 15 – Dissipation Structure Riprap and Riprap Bedding**

Riprap will be measured as lump sum including both the rock (riprap) and riprap bedding. Geotextile is not paid for separately but included in the cost of the work.

Prepare subgrade to receive riprap. Compact to ninety five percent (95%) of Maximum Standard Proctor Density (ASTM D698) to re-establish the subgrade. Unstable material shall be removed from the project site and disposed of by the Contractor. Removal and replacement of unstable material shall only be completed at the direction of Engineer and shall be paid for under Unstable Subgrade Excavation.

Riprap bedding shall be placed uniformly under all placed riprap material, to a minimum thickness of six-inches (6"). Riprap bedding shall not account for the minimum thickness of the riprap material.

Riprap shall be placed to grade in a manner to ensure the larger rock fragments are uniformly distributed and the smaller rock fragments serve to fill the spaces between the larger rock fragments.

#### **Bid Item 16 – Dissipation Structure**

Work shall include all means, methods, labor, and materials to construct dissipation structure. Work shall include labor, excavation, dewatering, forms, concrete, rebar, slide gate, trash rack, grate, and all other materials and equipment necessary to construct the dissipation structure in place as shown in the Contract Documents. Payment shall be lump sum.

#### **Bid Item 17 – Embankment Fill, Tree Root Removal, and Grading**

Work shall include all means, methods, labor, and material to provide the embankment fill, 4-inch aggregate base course, tree root removal, and grading near the dissipation structure and over the non-potable water line. Work shall include labor, excavation, fill, and all other materials and equipment necessary to complete the embankment fill, 4-inch aggregate base course, tree root removal, and grading as shown in the Contract Documents. Payment shall be lump sum.

#### **Bid Item 18 – 24-inch DR 26 PVC Sanitary Sewer Pipe**

The measurement for payment for pipe will be on a unit price basis. The unit price includes but is not limited to furnishing and installation of the sanitary sewer complete in accordance with the Drawings and Specifications. The work includes but is not limited to excavation and disposal of any excess material;

investigative potholing for field verification of existing utility depths pipe material and pipe outside diameters at tie-in locations; furnishing and installation of sanitary sewer, bypass pumping, dewatering, potholing, staking, as-builts, furnishing and compacting all materials required for preparation of a stable subbase; furnishing and compacting all pipe bedding, backfill, flow fill, and other backfill material; furnishing and compacting imported backfill material or flow fill as required, if no suitable on-site material is available; and all other necessary materials, work, and equipment required to complete the installation of a sanitary sewer complete, in place, and in accordance with the Drawings and Specifications. Dewatering methods and discharge shall be in accordance with all approved permits for this project. Work shall also include sanitary sewer backfill compaction testing, pressure testing, deflection testing, and closed-circuit TV inspection of the sanitary sewer in accordance with the City standard specifications.

Determination of unstable subsurface conditions for the sewer construction shall be made by the City and City's geotechnical engineer on the project. If subsurface conditions are determined to be unstable, Contractor will provide specified ballast rock for proper stabilization prior to sewer placement.

Payment shall be made based upon the quantity of pipe measured along the horizontal plane from beginning station to ending station for each portion of the pipeline as installed. Pipeline length shall be measured on a continuing line through all fittings.

#### **Bid Item 19 – 18-inch DR 26 PVC Sanitary Sewer Pipe**

The measurement for payment for pipe will be on a unit price basis. The unit price includes but is not limited to furnishing and installation of the sanitary sewer complete in accordance with the Drawings and Specifications. The work includes but is not limited to excavation and disposal of any excess material; investigative potholing for field verification of existing utility depths pipe material and pipe outside diameters at tie-in locations; furnishing and installation of sanitary sewer, bypass pumping, dewatering, potholing, staking, as-builts, furnishing and compacting all materials required for preparation of a stable subbase; furnishing and compacting all pipe bedding, backfill, flow fill, and other backfill material; furnishing and compacting imported backfill material or flow fill as required, if no suitable on-site material is available; and all other necessary materials, work, and equipment required to complete the installation of a sanitary sewer complete, in place, and in accordance with the Drawings and Specifications. Dewatering methods and discharge shall be in accordance with all approved permits for this project. Work shall also include sanitary sewer backfill compaction testing, pressure testing, deflection testing, and closed-circuit TV inspection of the sanitary sewer in accordance with the City standard specifications.

Determination of unstable subsurface conditions for the sewer construction shall be made by the City and City's geotechnical engineer on the project. If subsurface conditions are determined to be unstable, Contractor will provide specified ballast rock for proper stabilization prior to sewer placement.

Payment shall be made based upon the quantity of pipe measured along the horizontal plane from beginning station to ending station for each portion of the pipeline as installed. Pipeline length shall be measured on a continuing line through all fittings.

#### **Bid Item 20 – 5-foot Diameter Manholes**

The measurement for payment for each pay item will be on a unit price basis. The unit price includes but is not limited to furnishing and placement of materials and labor required to install the manhole in the accordance with the Drawings and Specifications. The work includes but is not limited to excavation and disposal of any excess material, dewatering, potholing, staking, as-builts, sub-grade preparation, installation of manholes as shown on plans, connections of pipes to manhole, manhole joint encapsulation, verification of positive drainage through manhole, and furnishing and installing all other necessary materials, work, and equipment required to construct the pay item in accordance with the Drawings and Specifications. Payment shall be made based on the actual quantity of manholes installed.

#### **Bid Item 21 – 6-foot Diameter Manholes**

The measurement for payment for each pay item will be on a unit price basis. The unit price includes but is not limited to furnishing and placement of materials and labor required to install the manhole in the accordance with the Drawings and Specifications. The work includes but is not limited to excavation and disposal of any excess material, dewatering, potholing, staking, as-builts, sub-grade preparation, installation of manholes as shown on plans, connections of pipes to manhole, manhole joint encapsulation, verification of positive drainage through manhole, and furnishing and installing all other necessary materials, work, and equipment required to construct the pay item in accordance with the Drawings and Specifications. Payment shall be made based on the actual quantity of manholes installed.

**Bid Item 22 – 7-foot Diameter Doghouse Manhole**

The measurement for payment for each pay item will be on a unit price basis. The unit price includes but is not limited to furnishing and placement of materials and labor required to install the doghouse manhole in the accordance with the Drawings and Specifications. The work includes but is not limited to excavation and disposal of any excess material, dewatering, potholing, staking, as-builts, sub-grade preparation, installation of manholes as shown on plans, connections of pipes to manhole, manhole joint encapsulation, verification of positive drainage through manhole, and furnishing and installing all other necessary materials, work, and equipment required to construct the pay item in accordance with the Drawings and Specifications. Payment shall be made based on the actual quantity of manholes installed.

**Bid Item 23 – Crush Existing Sanitary Sewer Line**

The measurement for payment for each pay item will be on a unit price basis. Bid item shall include means, method, labor and materials to crush sections of the existing sanitary sewer line. Measurement for payment shall be per linear foot of pipe removed, measured horizontally along the centerline as shown in the Contract Documents.

**Bid Item 24 – Remove Existing Sanitary Sewer Manholes**

The measurement for payment for each pay item will be on a unit price basis. Bid item shall include means, method, labor and materials to remove and dispose of certain existing sanitary sewer manholes. Measurement for payment shall be per manhole removed as shown in the Contract Documents.

**Bid Item 25 – 16-inch Water Line Encasement**

The work shall include means, method, labor and material to encase the 16-inch water line to the extents of the manhole excavation. Measurement for payment shall be lump sum.

**Bid Item 26 – Repair of Existing Potholes**

All potholes in concrete or asphalt shall be restored per MEGPEC Item 18.3.7 (special provision) that states Pot Holes “shall be filled with flow fill up to the bottom of the existing pavement. The rest of the hole shall be filled to within one quarter (1/4) inch of the finished grade with a non-shrink grout.” Measurement for payment shall be per pothole repaired.

**Sanitary Sewer Pipeline (end of roadway project to end of sanitary sewer line)**

**Bid Item 27 – Clearing and Grubbing**

Clearing and Grubbing shall include tree removal for trees less than 6” in diameter with the trunk being measured 18” above the adjacent ground surface. Clearing and grubbing shall apply to the entire project site. Payment for clearing and grubbing will be paid as a lump sum.

**Bid Item 28-32 – Erosion Control**

These items shall include the installation of field erosion control measures in accordance with the State and Federal temporary storm water discharge permits, as shown on the Grading and Erosions Control Plans and the Construction Detail Plans, and as outlined in the 35<sup>th</sup> Avenue Final Drainage Memorandum found in Appendix. Measurement and payment shall be made and paid for by each or the linear footage of the erosion control item installed per the construction details, as directed by the Engineer, and per the 35<sup>th</sup> Avenue Final Drainage Memorandum. The erosion control items shall include all labor, materials, equipment, and other items of expense needed to install the required erosion control items.

**Bid Item 33 – Erosion Control Management**

This item shall consist of the ongoing maintenance and management of field erosion control measures in accordance with the State and Federal temporary storm water discharge permits and provisions outlined in the 35<sup>th</sup> Avenue Final Drainage Memorandum found in Appendix. No separate measurement shall be made for this bid item which shall be paid on a lump sum basis in accordance with the contract bid schedule. All labor, materials, equipment, and other items of expense needed to maintain and manage the erosion control measures required for this project shall be included within this payment item.

**Bid Alternate – Non-Potable Water Line (Station 214+00.00 to prior to the 45 deg bend at Station 225+12.19)****Bid Item 1 – Clearing and Grubbing**

Clearing and Grubbing shall include tree removal for trees less than 6" in diameter with the trunk being measured 18" above the adjacent ground surface. Clearing and grubbing shall apply to the entire project site. Payment for clearing and grubbing will be paid as a lump sum.

**Bid Item 2 – Dewatering**

Conform to Additional Project Special Specification Dewatering. Dewatering will not be measured but will be paid as Lump Sum on this project.

**Bid Item 3-7 – Erosion Control**

These items shall include the installation of field erosion control measures in accordance with the State and Federal temporary storm water discharge permits, as shown on the Grading and Erosions Control Plans and the Construction Detail Plans, and as outlined in the 35<sup>th</sup> Avenue Final Drainage Memorandum found in Appendix. Measurement and payment shall be made and paid for by each or the linear footage of the erosion control item installed per the construction details, as directed by the Engineer, and per the 35<sup>th</sup> Avenue Final Drainage Memorandum. The erosion control items shall include all labor, materials, equipment, and other items of expense needed to install the required erosion control items.

**Bid Item 8 – Erosion Control Management**

This item shall consist of the ongoing maintenance and management of field erosion control measures in accordance with the State and Federal temporary storm water discharge permits and provisions outlined in the 35<sup>th</sup> Avenue Final Drainage Memorandum found in Appendix. No separate measurement shall be made for this bid item which shall be paid on a lump sum basis in accordance with the contract bid schedule. All labor, materials, equipment, and other items of expense needed to maintain and manage the erosion control measures required for this project shall be included within this payment item.

**Bid Item 9 – 2-inch Air/Vacuum Relief Valve and Vault for 24-inch Non-Potable Water Line**

The measurement for payment for each pay item will be on a unit price basis. Work shall include all means, methods, labor and materials to construct air/vacuum relief valves and vaults for the 24-inch PVC

non-potable water line. Work shall include excavation, dewatering, stabilization material, vault, air/vacuum relief valve, valves, piping, manhole cover, potholing, staking, as-builts, and all other ancillary equipment required to result in a functioning air/vacuum relief valve and vault in accordance with the Drawings and Specifications. Payment shall be based on the actual quantity of air/vacuum relief valves and vaults installed.

**Bid Item 10 – 24-inch Pressure Class 235 PVC (Restrained Joints)**

This bid items shall consist of the installation of new waterline as shown in the plans. This item shall include all pipe materials, excavation, joint restraint, mechanical bends, fittings, connection, labor, excavation, pipe bedding, backfilling, testing (including test stations), potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the pipeline and appurtenances in accordance with the Contract Documents including utility crossings not specifically listed in other Bid Items. Measurement for payment of pipe shall be per linear foot, measured horizontally along the centerline as shown in the Contract Documents. No adjustments in payment will be made to reflect variations in the field as to the final in-place limits of the class, thickness, or type of installed pipe.

**Bid Item 11 – 24-inch MJ Bends and Tees**

This bid items shall consist of the installation of all bends and tees on the 24-inch non-potable water line. This item shall include all bends, tees, excavation, dewatering, tracer wire, joint restraint, thrust blocks, connection, labor, pipe bedding, backfilling, testing, potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the bends and appurtenances in accordance with the Contract Documents. Measurement for payment of pipe shall be per bend or tee, as shown in the Contract Documents.

**Bid Item 12 – Vac Truck Connection**

This bid items shall consist of the installation of the vac truck connection on the 24-inch non-potable water line. This item shall include all piping, gate valves, bends, cam lock fittings, excavation, dewatering, joint restraint, valve boxes, thrust blocks, connection, labor, pipe bedding, backfilling, testing, potholing, staking, as-builts, and appurtenances. This Bid Item shall include the cost of all other miscellaneous work not specifically identified in other Bid Items associated with constructing the vac truck connection and appurtenances in accordance with the Contract Documents. Measurement for payment of pipe shall be per vac truck connection, as shown in the Contract Documents.

**35<sup>TH</sup> AVENUE WIDENING PROJECT**  
**PROJECT SPECIAL SPECIFICATIONS**

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**TOPSOIL**

**Conform to City of Greeley Landscaping Standard Specifications Section 02900 except as follows:**

Part 1, 1.3A

Add: 8. Stake Cap

Part 1, 1.4D

Add:

1. Report suitability of topsoil and subsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory soil mixture.
2. The Contractor shall perform soil test immediately following the award of the Contract and prior to mobilizing for landscape construction.
3. Soil testing shall be provided by Colorado Analytical Laboratory, 240 S. Main Street, Brighton, CO 80601, (303) 659-2313, or an approved testing facility. Soil shall be tested for soluble salts and nutrient levels. Testing facility shall provide interpretation of results and recommendation for soil amendments for each type of planting.
4. Deficient nutrients shall be corrected with the addition of appropriate fertilizer and amendment materials. The Contractor shall submit a Change Order Request for all additional materials that are recommended but are not included in this Specification. Owner will be credited by Contractor for any specified materials not used.

Part 1, 1.5H

Add: H. Landscape Areas Acceptance: Initiating work in an area without prior approval from the Owner's Representative will render the Contractor responsible for any and all corrections including, but not limited to, grading corrections, trash removal, debris removal, rock removal and other miscellaneous elements.

Part 2, 2.5A

Add:

2. Topsoil Source-Medians: Import topsoil from off-site sources. Obtain topsoil from naturally well-drained sites where topsoil occurs at least 4-inches (100 mm) deep; do not obtain from bogs or marshes.
3. Provide the attached Topsoil Letter of Certification found at the end of this section
4. Provide 50/50 mix of topsoil and squeegee mix in medians

Part 2, 2.6C

Add:

1. Provide the attached Soil Amendment Letter of Certification found at the end of this section.

**END OF SECTION**

**DEWATERING – ROADWAY WIDENING PROJECT****SECTION 02240  
DEWATERING****PART 1- GENERAL****1.1 DESCRIPTION OF WORK**

- A. Provide all material, equipment, and labor to install and maintain all pumps, piping, drains, well points, and other facilities required to effectively control, collect, and dispose of groundwater or surface water to permit safe and proper completion of the Work (embankment fill in the pond north of C Street, the Canal No. 3 Box Culvert Extension and as required for roadway construction). Use appropriate equipment and methods for dewatering based on existing site conditions.
- B. Maintain the foundations and other portions of the Work free from water as required for constructing each part of the Work.
- C. Comply with all applicable environmental protection laws and requirements in operation of the dewatering system.
- D. Remove all components of the dewatering system after it is no longer required.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01330: Submittals.
- B. Dewatering Plan: Submit a Dewatering Plan prepared by a qualified dewatering specialist, with experience in design, installation, and operation of dewatering installations. The Dewatering Plan shall be prepared by a Licensed Professional Engineer in the State of Colorado and include the following:
  - 1. Details regarding the anticipated types and locations of various dewatering facilities, and design calculations required substantiating the Dewatering Plan.
  - 2. Superintendence plan and schedule, indicating who will be responsible for observing the dewatering system and the proposed schedule describing when personnel will be on site to observe and maintain the system.
  - 3. Coordination with other work including schedule, dewatering and diversion methods and operations, erosion and sediment control measures, equipment, and location and elevation of pumps, pipes, and any other features planned for use in the dewatering plan
  - 4. Final recommendations for dewatering.
  - 5. If the Contractor purchases, rents, installs, or mobilizes to the site any elements of the dewatering system before approval of the dewatering submittal, the Contractor does so at its own risk, and will not be due any additional compensation from the Owner if such elements are not subsequently used for the work.
  - 6. Approval of the dewatering system proposed by the Contractor will only be with respect to the basic principles of the methods the Contractor intends to employ. Approval does not relieve the Contractor of full responsibility for adequacy of the dewatering system.



**1.3 DEFINITIONS****A. Definitions**

1. Dewatering: Removing water by single or multiple stage wellpoints, deep wells, ejector wells or sumps, or other pumping methods, as approved based on the Contractor's submittals.
2. Hydrostatic Groundwater Level: The groundwater level at any location during construction and before dewatering.
3. Sump: A depression excavated or constructed, from which water is pumped as part of dewatering.

**1.4 AVAILABLE DATA**

A. A Subsurface Exploration/Pavement Design Report for 35<sup>th</sup> Avenue Improvements was prepared by Earth Engineering Consultants, LLC dated December 3, 2019.

B. The Contractor may refer to the boring and test pit logs on the Report and Drawings, but shall draw their own conclusions as to the applicability of the information contained therein. The Contractor may choose to perform additional investigations to develop their dewatering plan. It is the Contractor's responsibility to evaluate site subsurface conditions with respect to required dewatering facilities.

C. The subsurface conditions and groundwater observations from the test pits and borings apply only to the locations of the test pits and borings and at the time of the explorations and measurements. The subsurface conditions at the site may be different at the time of construction as compared to when observations were made and recorded, and the groundwater level can be expected to fluctuate. These factors should be appropriately considered in developing the Contractor's Dewatering Plan.

**1.5 QUALITY ASSURANCE AND QUALITY CONTROL**

A. Dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

**PART 2- PRODUCTS****2.1 DEWATERING SYSTEM**

A. The dewatering system shall be single- or multiple-stage wellpoints, deep wells, ejector wells, or sumps used for dewatering and which fulfill the dewatering requirements specified in this Section. The materials and construction of the dewatering wells will be selected by the Contractor and the Contractors' dewatering specialist.

**PART 3- EXECUTION****3.1 GENERAL**

A. Design, furnish, install, maintain, and operate a dewatering system that prevents loss of fines, boiling, quick conditions, or softening of foundation strata and maintain stability of bottom of excavations so that every phase of the work can be performed in a dry, safe, and stable

environment. Operate dewatering systems such that excavation bottoms are firm, suitably dry, and free from standing water at all times.

B. Locate elements of the dewatering system such that interference with excavation and construction activity is minimized. Locations are subject to approval by the Engineer.

C. At all times during construction, provide ample means and devices to remove promptly, and dispose of properly, all water entering excavations and keep the bottoms of excavations firm and free of standing water until structures to be built thereon are completed and/or backfill to be placed therein is placed. Conduct pumping and dewatering operations such that no disturbance to foundation subgrade materials or to fill materials supporting any other work will result. Discharged water shall be piped to an approved area.

D. Install silt barriers or other discharge control measures at dewatering discharge locations, to control and prevent siltation. Provide suitable discharge controls in accordance with applicable federal, state, and local permit regulations. Do not allow dewatering discharge to cause siltation or other negative environmental impact on natural waterways or other property.

### **3.2 INSTALLATION AND OPERATION**

A. Operate the dewatering system to lower water levels as required and then operate continuously 24 hours per day, 7 days per week until all facilities and structures affected by the dewatering have been satisfactorily constructed, including removal of unsuitable material and placement of fill materials.

B. Maintain groundwater levels low enough to fulfill the requirements of this Section and do not allow the water level to rise until constructed facilities are complete, so that the water can be allowed to rise without damaging facilities, their foundations, or surrounding areas and structures.

C. Provide superintendence in accordance with the approved plan during all periods of dewatering. Superintendence means providing qualified Contractor personnel knowledgeable in operation and maintenance of dewatering system(s). The Contractor is responsible for any damage resulting from failure to maintain the dewatering system.

D. Provide complete standby equipment and power sources available for immediate operation as may be required, to adequately maintain the dewatering on a continuous basis in the event that all or any part of the dewatering system becomes inadequate or fails. Provide an automatic switchover system to the standby power source to ensure uninterrupted power supply to pumps in an emergency. Spare pumps shall be automatically engaged if primary pumps fail for any reason.

E. When the dewatering system does not meet the specified requirements, and as a consequence, loosening or disturbance of the foundations strata, instability of the slopes, or damage to the foundations or structures occurs, the Contractor is responsible for supplying all materials and labor and performing all work for restoring foundation soils, slopes, foundations, and structures, to the satisfaction of the Engineer, and at no additional cost to the Owner.

F. When failure to provide adequate dewatering and drainage causes disturbance of the soils below design foundation or excavation grade, provide adequate dewatering and excavate and re-fill the disturbed areas with approved, properly compacted fill material. Such work shall be at the Contractor's expense and at no additional cost to the Owner.

**3.3 REMOVAL**

- A. Obtain written approval from the Engineer before discontinuing operation of any portion of the dewatering system(s).
- B. Remove all elements of the dewatering system(s) from the site at the completion of dewatering work.

**END OF SECTION**

**SOIL PREP, SEEDING AND SODDING****PART 1 - GENERAL****1.01 SUMMARY:**

- A. Section Includes:
  - 1. Fine grading and preparing areas to be seeded.
  - 2. Furnishing and applying soil amendments.
  - 3. Furnishing and applying fertilizer, herbicides.
  - 4. Furnishing and seeding new areas.
  - 5. Furnishing and sodding new areas.

**1.02 SUBMITTALS:**

- A. Certificates: State, Federal and other inspection certificates shall be submitted to the City prior to acceptance of material.
- B. Seed: Certification of grass seed from seed vendor including the composition of each grass-seed mixture, stating the botanical and common name, percentage by weight of each species and variety, percentage of purity, germination, and weed seed. Include the year of production and date of packaging. Seed packaging and identification tags are to be submitted to the owner at completion of seeding.
- C. Sod: Sod supplier's product data and certification.
- D. Imported Soil Amendment Test Report: Submit test analysis to City for acceptance prior to delivery of material.
- E. Fertilizer: State, Federal and other certificates shall accompany invoices for materials showing sources of origin. Submit to City prior to acceptance of material.
- F. Squeegee: Submit zip lock bag (1 quart)
- G. Compost: Submit soil test analysis to City for review prior to delivery of material.
- H. Herbicide: manufacturer's product data sheet and instructions.

**1.03 DELIVERY, STORAGE AND HANDLING:**

- B. General: Handle and transport in a safe manner in compliance with local state, and federal regulations. Comply with MSDS requirements.
- C. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law, bearing name and warranty of producer.
- D. Soil Amendments: Do not stockpile. Distribute and till immediately upon arrival at site (same day).
- E. Seed: Deliver seed in original sealed, labeled, and undamaged containers. All material shall be furnished in original manufactures shipping bags or containers and remain in these bags or containers until used. All materials shall be stored in a manner which will prevent them from coming into contact with precipitation, surface water, or other contaminating substances. All materials which have become wet, moldy or otherwise damaged in transit, or stored improperly shall not be used.

- F. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within twenty-four (24) hours of harvesting. Protect sod from breakage and drying.

#### 1.04 PROJECT/SITE CONDITIONS:

- A. General: Do not perform work when climate and existing site conditions will not provide satisfactory results.
- B. Site Information: The Contractor shall be held to have examined the site, to ascertain the state thereof and the conditions under which the work is to be done. Note: Drawings typically indicate the physical dimensions of the site, but do not show the extent of all obstructions and subsurface conditions.
- C. Existing Utilities: Protect from damage any sewer, water, gas, electric, phone, cable TV, irrigation or other pipelines or conduits uncovered during the work until the matter has been reviewed by the City. If such lines are found to be abandoned and not in use, remove without extra cost. If such lines are found to be in use, carefully protect and carry on work around them. If City deems it advisable to move such lines, City will pay cost of moving.
- D. Existing Site Features: Protect from damage as noted herein or on drawings.
- E. Vehicular Access:
  - 1. Vehicular accessibility on site shall be kept to a minimum. Repair damage to prepared ground and surfaces caused by vehicular movement during work under this Section to original condition at no additional cost to City. Repair, to original condition, vehicular damage to the surrounding area at no additional cost to the City.
  - 2. Only those vehicles identified with Company Name/Logo are allowed in the parks.
- F. Environmental Requirements:
  - 1. Install seed between spring and fall; March 15 - September 30.
  - 2. Do not install seed on saturated or frozen soil.
  - 3. Do not install seed until soil preparations have been approved by the City.
  - 4. Do not install seed until irrigation system is installed and tested.
  - 5. Proceed with planting only when existing and forecast weather conditions are suitable for work.

#### 1.05 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Warrant the following materials for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions, unusual for warranty period, or incidents such as damage due to vandalism, hail, fire, owner neglect, or other circumstances that are beyond Contractor's control.
  - 1. Seed
  - 2. Sod

- C. Remove unsatisfactory materials within seven (7) days of notification, replace dead materials within 10 days of notification from owner's representative unless required to plant in the succeeding planting season.
- D. Seed and sod are to be warranted throughout the warranty period and shall be replaced with materials of the same size and variety.

## PART 2 – MATERIALS

### 2.01 TOP SOIL AND SOIL AMENDMENTS: (Note that percentages are by weight and not by volume.)

- A. Topsoil: ASTM D 5268, PH range of 6.3 to 8.2, three percent (3%) organic material minimum, free of extraneous materials harmful to plant growth.
- B. Topsoil Source:
  - 1. The source of topsoil for this project is undesignated. Topsoil shall be fertile, friable, sandy loam or loam. Topsoil shall be of any admixture of subsoil or slag and shall be free of stones, lumps, refuse, plants or their roots, sticks, noxious weeds, salts, soil sterilant or other material detrimental to plant growth. Imported topsoil shall be obtained from a well-drained site that is free of flooding. Topsoil shall not be delivered or used onsite in any manner while in a frozen or muddy condition.
  - 2. Imported topsoil shall be from an approved point of origin satisfactory to the Project Manager prior to delivery or placement in planting areas. Should noxious weeds be present at the topsoil source, the Project Manager will make recommendations to the Contractor as to appropriate treatment of the topsoil prior to delivery to the project site. The Contractor shall supply a sample of topsoil to the Colorado State University Soil Testing Laboratory for analysis a minimum of thirty (30) days prior to delivery of topsoil to the project site. The Contractor shall also contact the Project Manager to inspect and approve all planting areas prior to delivery or placement of topsoil. The Contractor shall submit to the Project Manager a Certificate of Compliance from the CSU Testing Laboratory verifying organic matter content, pH, sodium absorption ratio, electrical conductivity (paste test) and nutrient levels.
- C. Provide analysis for the following:
  - 1. Mechanical Analysis:
    - a. 1" Screen Passing = 100%, Retained = 0%
    - b. ½" Screen Passing = 97 - 100%, Retained = 3 - 0%
    - c. No. 100 Mesh Sieve Passing = 40 - 60%, Retained = 60 - 40%
  - 2. Laboratory Analysis:
    - a. Organic Matter Content: 3 - 8% (dry basis)
    - b. Soluble Salts Concentration (EC paste test): 1.8 dS (mmhols/cm) or less (as received)
    - c. PH range: 6.3 to 8.0 (as received)
    - d. Nutrient Content (dry weight basis): N 1% or above, P 1% or above, K 0.5% or above.
    - e. Sodium Absorption Ratio (SAR): 8.0
  - 3. Certification of Topsoil Testing: The Contractor shall furnish to the City a signed statement certifying that the topsoil furnished is from the lot that has been tested.

- I. Soil Amendments:
  1. Compost: One hundred percent (100%) humus rich organic matter. The compost shall be a well decomposed, stable, weed free organic matter derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings, or source-separated or mixed solid waste. Product must be certified as fully composted at a permitted solid waste processing facility. Product to be registered with the Colorado Department of Agriculture and approved for use on Colorado Certified Organic Farms by the Division of Plant Industry of the State of Colorado. Product shall contain no solid particle greater than one-half inch ( $\frac{1}{2}$ " ) in length or diameter and be free from un-composted or non-stabilized wood bulking agents. Product shall contain no substances toxic to plants and shall be reasonably free (<1% by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.
  2. Provide analysis for the following:
    - a. Organic Matter Content: 30 - 70% (dry basis)
    - b. Soluble Salt Concentration (EC paste test): 5 dS (mmhols/cm) or less (as received)
    - c. PH range: 5.5 to 8.0 (as received)
    - d. Final carbon to nitrogen ratio: 20:1 or less.
    - e. Nutrient Content (dry weight basis): N 1% or above, P 1% or above, K 0.5% or above.
    - f. Bulk Density: 800 - 1,000 lbs/yd<sup>3</sup>
    - g. Moisture Content: 35% - 55%
- II. Certification of Compost Testing: The Contractor shall furnish to the City a signed statement certifying that the compost furnished is from the lot that has been tested.
- III. Amended Topsoil: Offsite, mechanically combined product.
- IV. Amended Topsoil: Components of the amended topsoil product (compost and topsoil) shall meet all previously outlined criteria for the individual components.
  1. The Contractor shall supply a sample of amended topsoil to the Colorado State University Soil Testing Laboratory for analysis a minimum of thirty (30) days prior to delivery of amended topsoil to the project site.
  2. The Contractor shall contact the Project Manager to inspect and approve all planting areas prior to delivery or placement of amended topsoil. The Contractor shall submit to the Project Manager a Certificate of Compliance from the CSU Testing Laboratory verifying testing levels.
  3. Provide analysis for the following:
    - a. Organic Matter Content: 3 - 15% (dry basis)
    - b. Soluble Salt Concentration (EC Paste Test): 2.7dS (mmhols/cm) or less (as received)
    - c. PH Range: 5.5 to 8.0 (as received)
    - d. Final carbon to nitrogen ratio: 20:1 or less.
    - e. Nutrient Content (dry weight basis): N 1% or above, P 1% or above, K 0.5% or above.
    - f. Moisture content: 35 to 55%
- V. Certification of Topsoil Testing: The Contractor shall furnish to the City a signed statement

certifying that the topsoil furnished is from the lot that has been tested.

#### 2.02 FERTILIZER:

- A. Before seeding, apply an inorganic mixture tilled thoroughly into the top six inches (6") of soil, unless otherwise stated:
  - 1. 1 lb. of Nitrogen (N) per one thousand (1,000) square feet.
  - 2. 2 lbs. Phosphorus (P205) per one-thousand (1,000) square feet.
  - 3. 1 lb. Sulfur (SO4-S) per one-thousand (1,000) square feet.

#### 2.03 SEED:

- A. Grass Seed: Fresh, clean, dry, new-crop seed conforming to all State and Federal regulations and complying with the Association of Official Seed Analysts', "Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Mixture: Seed mixture and application rate are indicated on the drawings. Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination. Materials furnished shall be free of prohibited noxious weeds and meet State and City standards for restricted noxious weeds.
- C. Proportions and Mixing: All seed shall be mixed by a wholesale seed supplier in the proportions-necessary to obtain the application rate specified.
- D. Labels: Seed and seed mixes shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the common, scientific and variety name(s) of the seed(s), the lot number, net weight, percent of weed seed content and the guaranteed percent of purity and germination.
- E. Certification of Seed Testing: The Contractor shall furnish to the City a signed statement certifying that the seed furnished is from the lot that has been tested and comply with the Colorado Seed Law.

#### 2.04 SOD:

- A. Turfgrass Sod: Certified Approved Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows, with not less than ninety-five (95) percent germination, not less than eighty-five (85) percent pure seed, and not more than one-half (1/2) percent weed seed:
  - 1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three improved cultivars.

#### 2.05 MULCHES:

- A. Hydro Mulch for seeding operations: See Hydro Mulch Spec Section.

#### 2.06 HERBICIDES:

- A. Herbicide: EPA registered and approved, of type utilized by City of Greeley Parks Department.



- B. Applicators must possess both a Colorado Department of Agriculture license and City of Greeley pesticide applicator's license.
- C. The Contractor making chemical applications must have a Qualified Supervisor on staff.

2.07 EROSION CONTROL NETTING, BLANKETS, MATS, FABRICS:

- A. Erosion control blankets, mats, of other commercial products for stabilizing disturbed areas may be required on certain projects. If so, the type, manufacturer, and installation method for these products will be agreed to prior to installation.

2.08 SQUEEGEE AGGREGATE

- A. Squeegee aggregate, as available from Pioneer Sand & Gravel, Crystal Landscape Supplies, or approved equivalent.
- B. Color: grey, tan and pink.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Verify that existing site conditions are as specified and indicated before beginning work under this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Work is to be performed by personnel thoroughly familiar with proper and accepted methods for soil preparation, herbicide applications, fertilizing, seeding, mulching, etc. Work is to be performed under the direct supervision of the Contractor's superintendent, who shall be thoroughly familiar with the provisions of these specifications.
- C. Damaged Earth: Inspect to verify that earth rendered unfit to receive planting due to concrete water, mortar, lime water or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Project Manager. Access roadways or compacted soil shall be ripped and rototilled to loosen soil.
- D. Unsatisfactory Conditions: Report in writing to the City.
- E. Acceptance: Beginning installation indicates acceptance of existing conditions by Contractor.

3.02 PREPARATION:

- F. Locate structures, sewer, water, irrigation, gas, electric, phone, cable TV, other pipelines or conduits and equipment prior to commencing work.
- G. Contractor will be responsible for proper repair to landscape, utilities, fences, walls, signs, pavements and other site improvements damaged by operations under this section.
- H. Contractor shall keep a log of pesticide applications performed throughout the duration of the project, detailing applications. Notes shall be submitted to Owner at the completion of project.
- I. Herbicides shall be applied using well maintained spraying equipment by individuals working for the Contractor who are appropriately licensed by the State or Federal agency having jurisdiction over such applications. It shall be the responsibility of the Contractor to be knowledgeable of any and all current laws and regulations pertaining to pesticide applications, and to advise the City immediately if any requests for applications made by the City are inappropriate as they pertain to these laws and regulations.
- J. Herbicides and other chemicals shall not be applied during periods when wind or other physical conditions cause the herbicides to be transported off site, or a distance of more than five (5') feet

from the immediate area where they are being applied. It shall be the responsibility of the Contractor to notify the Project Manager immediately if any weather or other physical conditions exist which would make application inappropriate.

- K. Herbicides and other chemicals shall be applied at rates as determined by the Contractor and the Project Manager.
  - 1. Bluegrass areas:
    - a. Existing vegetation, excluding trees and shrubs, in all areas designated to receive new bluegrass seed, is to be sprayed with a contact non-selective post emergent herbicide (Roundup), a minimum of one (1) week and a maximum of (3) weeks prior to the ripping/tilling process.
  - 2. Native areas:
    - a. New seeding areas: Existing vegetation, excluding trees and shrubs, in all areas designated to receive new native seed mixes, shall be sprayed with a contact non-selective post emergent herbicide (Roundup), a minimum of one (1) week and a maximum of (3) weeks prior to the ripping/tilling process.
    - b. Over seeded areas: Spot treatment with selective post emergent herbicides may be required to eliminate undesirable vegetation in some areas. Coordinate herbicide application with the Project Manager a minimum of two (2) weeks prior to the seeding operation.
  - 3. Reapply herbicide, if necessary, to insure complete kill of existing vegetation.
- L. Surface Grade: Remove existing grass, weeds, debris and rocks larger than one and one half-inches (1½") in areas designated to receive seed. Verify that rough grades have been established.
- M. Runoff: Take measures and furnish equipment, materials, and labor necessary to control the flow, drainage and accumulation of water on and off the site, as intended by the grading plans.
- N. Erosion Control: Take measures and furnish labor, materials, and equipment necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site throughout duration of work.

### 3.03 SOIL/SEED BED PREPARATION:

- A. General: Ripping and tilling operations shall be done in a direction which follows the natural contours of the land on slopes of 3:1 or less. Soils on slopes greater than three 3:1 will be prepared for planting in a manner specified by the City. Irregularities in the ground surface resulting from soil preparation operations shall be corrected and sloped to drain as intended by the grading plans.
- B. Ripping/Tilling:
  - 1. Soil shall be ripped or tilled to a minimum of eight inches (8"), with agricultural sub-soiler in areas to receive seed. This includes any areas compacted by construction traffic during the construction process, with four (4) passes in at least two (2) directions.
  - 2. In areas where extremely stiff materials, or if debris is encountered during ripping, re-adjust equipment to avoid bringing up chunks of un-tillable material.
  - 3. The soils shall be worked until it has become loose and friable and no clods greater than two inches (2") in diameter remain, unless directed otherwise by the Project Manager, prior to the addition of any soil amendments, seed, or mulch.
  - 4. Remove stones larger than one and one-half inches (1½") in any dimension and sticks, roots,

rubbish, and other extraneous matter.

5. Any required soil amendments (e.g. organic soil conditioners, fertilizer, ect.) Shall be uniformly spread on the surface of soil which has been prepared as stated above and at the rates specified in section 3.03; II and 3.03; III, below.

#### 3.04 SOIL AMENDMENTS:

- A. Blue Grass Areas: Evenly distribute composted material in the bluegrass seed areas at the following rates:
  1. Apply the compost at four (4) cubic yards per one thousand (1,000) square feet.
  2. Spreading the compost shall be accomplished with either a truck or trailer mounted spreader, capable of being adjusted to apply varying rates of material at a given speed.
- B. Native Seed Areas: Evenly distribute composted material in the native seed areas at the following rates:
  1. Apply the compost at two (2) cubic yards per one thousand (1,000) square feet.
  2. Spreading the compost shall be accomplished with either a truck or trailer mounted spreader, capable of being adjusted to apply varying rates of material at a given speed.
  3. In areas inaccessible with a truck or trailer mounted spreader, the compost can be delivered and spread with a tractor and/or by hand.
- C. Over Seeding Native Seed into existing vegetation:
  1. No compost will be required in these areas.
  2. Fertilizer shall be spread evenly on the surface of the soil immediately after seeding operations have been completed. Fertilizer shall be applied using standard application equipment at the rates specified.
- D. Fertilizer:
  1. See 2.01 and 2.02 above.
- E. Areas receiving organic soil amendments:
  1. After applying soil amendments and fertilizer, thoroughly till area to a depth of six inches (6") minimum by rototilling, plowing, harrowing, or disking until soil is well pulverized.
- F. Fill, compact and grade the site to within +/- 0.1' (1 3/16 ") of grades indicated and specified.

#### 3.05 FINE GRADING:

- A. Perform fine grading for areas prior to seeding: Perform as required to maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc. and as required to provide smooth well-contoured surface prior to proceeding.
- B. Prior to Acceptance of Grades: Hand-rake to a smooth even surface with a loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions. Remove debris, clods, rocks, vegetable matter, and any other objects that may interfere with planting or maintenance operations. Limit fine grading to areas that can be planted in the immediate future.
- C. Establish finish grades to within one-half inch (½") of grades indicated.
- D. Noxious weeds or parts thereof shall not be present in the surface grade prior to seeding.
- E. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow the surface to dry before planting. Do not create muddy soil.

- F. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Leave graded surface clean and free of trash and debris. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.06 SEEDING:

- A. The Contractor shall notify the Project Manager prior to seeding work.
- B. The Project Manager will be on site during seeding operations and will collect representative samples of the seed used on the project for possible later testing for contract compliance.
- C. Prepared areas, need to be firm, but not compacted, prior to seed application.
- D. Native Areas:
1. Seed the listed varieties in the areas designated on the drawings.
  2. All seed is to be drilled 0.25 inch to 0.50 inch into the soil at the specified PLS/acre rate listed in the Seed Mix Schedule, with a mechanical, power-drawn drill seeder. Rows shall be spaced not more than eight inches (8") apart.
  3. The Contractor shall drill equal quantities in two directions at right angles of each other.
  4. Seeding rates need to be increased 50% on slopes 6:1 or greater.
  5. Seeding rates need to be increased 100% for areas that are seeded by hand broadcasting.
  6. Seeding native grasses into existing vegetation, or areas that have not been ripped and tilled to a minimum of 6 inches require the use of a seeder with:
    - a. Double Disc openers with depth bands.
    - b. Native Grass Seed Box with agitator and picker wheels.
    - c. Press wheels.
    - d. In hard ground areas, the Project Manager may require the use of a, no till Coulter unit.
  7. A cultipacker seeder (Brillion, Trillion type) is acceptable to use in well prepared (fine and firm) seed bed applications.
    - a. The seeder should be equipped with seed boxes to handle the type of seed being planted.
    - b. Native grass seed would need a seed box with an agitator and picker wheels.
    - c. Seeding rates would need to be increased 50% with a cultipacker seeder since it is a broadcasting application.
- E. Broadcast Seeding: Some areas may be inaccessible to a drill. In these mutually agreeable areas, seed shall be uniformly broadcast at 2 times the specified rate. Seed is to be evenly distributed and sown in equal quantities, in two directions at right angles to each other. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Hand broadcasted seeded areas need to be raked in to provide a minimum of ¼" cover and a maximum of ½" cover.
- F. Hydro Mulch: apply Hydro Mulch to seeded areas. See Hydro Mulch Spec Section.
- G. Watering Newly Seeded Areas.
1. Bluegrass areas: Coordinate with Project Manager the irrigation controller settings to provide adequate moisture for seed germination, and to avoid erosion.
  2. Native areas:
    - a. Some native areas may have irrigation available, in which case follow the guidelines for Bluegrass areas above.
    - b. Native areas without irrigation:

- (i). Spring Planting: Plan the planting operation to start as soon as the soil can be worked and prior to the spring rainy season.
  - (ii). Fall Planting: Place seed prior to the first hard frost in the fall, but after dormancy begins for the varieties being planted.
- H. Companion Crops: Add the prescribed companion crop with the native seed mixes to be planted at the rate listed. If in doubt, coordinate with Project Manager.
- I. Erosion Protection:
  - 1. Slopes of 6:1 or less require no erosion protection.
  - 2. Protect seeded slopes exceeding 6:1 against erosion with jute or coir-fiber erosion-control mesh installed and stapled according to manufacturer's recommendations.
  - 3. Protect seeded slopes exceeding 4:1 against erosion with erosion-control blankets installed and stapled according to manufacturer's recommendations.

### 3.07 SODDING

- A. Lay sod within twenty-four (24) hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
  - 1. Lay sod across angle of slopes exceeding 1:3.
  - 2. Anchor sod on slopes exceeding 1:3 with wood pegs[ or steel staples] spaced as recommended by sod Supplier but not less than two (2) anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

### 3.08 TURF RENOVATION

- A. Renovate existing turf.
- B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Re-establish turf where settlement or washouts occur or where minor re-grading is required.
  - 2. Provide new topsoil as required.
- C. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil.
- D. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.
- E. Mow, dethatch, core aerate, and rake existing turf.
- F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- I. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top four (4) inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.
- J. Water newly planted areas and keep moist until new lawn is established.

**3.09 SEED MIXTURE SCHEDULE:**

- A. Provide certified grass-seed blends or mixes, proportioned by weight, as indicated on the drawings.

**3.10 NOTIFICATION AND INSPECTION:**

- A. Inspection: Provide notice to Owner requesting inspection at least seven (7) days prior to anticipated date of completion.
- B. Deficiencies: If deficiencies exist, the City shall specify such deficiencies to the Contractor who shall make satisfactory adjustments and will again notify the City for final inspection.

**3.11 CLEANING:**

- A. Cleaning: Remove and haul from the site all excess materials and debris generated during the construction process. Perform daily cleaning during installation of the work, and upon completion of the work. Clean paved and finished surfaces soiled as a result of work under this section. Clean out drainage inlet structures as required. Repair any and all damage.

**3.12 PROTECTION:**

- A. General: Provide and install barriers as required and as directed by the City to protect the seeded areas against damage from pedestrian and vehicular traffic until well established and accepted by the City. Provide any additional erosion control measures which are necessary for the successful establishment of grass areas.

**END OF SECTION**

**HYDRO MULCHING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes:
  - 1. Hydro Mulching.
- B. Related Sections:
  - 1. Seeding and Sodding.
  - 2. Landscaping.

**1.02 SUBMITTALS**

- A. Quality Control Submittals:
  - 1. Certificates: State, Federal and other inspection certificates shall accompany the invoice for materials showing source or origin. Submit to Owner prior to acceptance of material.
  - 2. Contractor shall submit specifications for both the hydro mulch and organic tackifier prior to application.

**1.03 QUALITY ASSURANCE**

- A. Source Quality Control.

**1.04 DELIVERY, STORAGE AND HANDLING**

- A. General: Comply with best management practices for delivery, storage and handling of material.

**1.05 PROJECT / SITE CONDITIONS**

- A. Existing Conditions:
  - 1. Grade will have been established and seed will be in place. Repairs to seedbed due to vehicle tracking or erosion must be repaired prior to mulching.
  - 2. Vehicular accessibility on site shall be as directed by Owner. Repair damage to prepared grounds and surfaces caused by vehicular movement during work under this section to original condition at no additional cost to Owner.
- B. Environmental Requirements:
  - 1. Do not apply hydro mulch when wind speed exceeds seven (7) miles per hour.

**PART 2 - PRODUCTS****2.01 MATERIALS**

- A. Mulch: Mulch all seeded areas, including those seeded over remaining vegetation, hydro mulch with Conwed 200 and an organic tackifier or approved substitute:
  - 1. Virgin wood cellulose fiber: May not contain any substance or fiber that may inhibit germination or growth of grass seeds and plants.
  - 2. Dye to appropriate color to allow proper metering of application.
  - 3. Fibers must have ability to become evenly dispersed and suspended when agitated in water.
  - 4. When sprayed uniformly on surface of soil, fibers shall form blotter - like ground cover which readily absorbs water and allows infiltration to underlying soil.
  - 5. Weight specifications shall refer only to air dry weight of fibers with a standard moisture content of ten (10) percent.
  - 6. Mulch material shall be supplied in containers not weighing over 100 pounds and showing air dry weight of fibers.
  - 7. Organic tackifier may be supplied with hydro mulch fibers or be added at a later time.
  - 8. Suppliers must certify that laboratory and field testing of product has been accomplished and that material meets all of the foregoing requirements for cellulose wood fiber mulch.

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. General - Verify that existing site conditions are as specified and indicated before beginning work under this section.
  - 1. Layout: Seeded areas will be mulched. Mulch placement shall not extend beyond seeded areas by more than five (5) feet.
  - 2. Grades: Verify that grades are as indicated and specified.
- B. Unsatisfactory Conditions: Report in writing to Owner's Representative.
- C. Beginning of installation means acceptance of existing conditions by this Contractor.

## 3.02 PREPARATION

- A. Protection:
  - 1. Be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this Section.
  - 2. Identify mulched areas requiring protection and erect barriers for proper protection and traffic control.
  - 3. Erosion control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind deposited materials at the site throughout the duration of work.

## 3.03 MULCHING

- A. Hydro Mulching:
  - 1. Mixing: Add cellulose fiber mulch after proportionate quantities of water and other accepted materials have been placed in slurry tank. Mix ingredients to form homogenous slurry.
  - 2. Spraying: Spray apply slurry mulch uniformly over seeded areas using control of mulch as metering agent. Apply at rate of 2500 pounds per acre plus organic tackifier at rate of 150 pounds per acre. Soil may not be visible through the hydro mulch upon completion of application.
  - 3. Hydro mulching: Do not apply in presence of free surface water resulting from rain, melting snow or irrigation.
- B. Hydraulic Mulching Equipment: Include pump capable of being operated at one hundred (100) gallons a minute and at 100 P.S.I., unless otherwise directed.
  - 1. Provide nozzle adaptable to hydraulic mulching requirements.
  - 2. Storage tanks must have means of calculating volume used or remaining in tank.
- C. Timing: Mulch designated areas immediately following seed placement. Mulch must be placed within forty-eight (48) hours following seeding operation. If sections of seed are placed, mulch should follow each phase of seeding.
- D. Quality Control: Repair or re-mulch areas improperly mulched or damaged by Contractor's negligence, in manner specified. Mulch removed by circumstances beyond the Contractor's control shall be repaired and re-mulched as ordered by Owner Representative. Compensation for re-mulch required by circumstances beyond Contractor's control shall be calculated per the Unit Price in the Bid Form.
- E. The Owner's Representative shall be notified twenty-four (24) hours prior to each application and will determine if coverage is according to specification.

## 3.04 NOTIFICATION OF INSPECTION

- A. Notification: Give notice requesting inspection by Owner's Representative at completion of mulching operation.
- B. Deficiencies: If deficiencies exist, Owner's Representative shall specify such deficiencies to the Contractor who shall make satisfactory adjustments and will again notify the Owner's Representative for final inspection.



## 3.05 CLEANING

- A. Cleaning: Remove material containers and other debris from site. Clean paved and finished surfaces soiled as a result of work under this Section in accordance with directions given by the Owner's Representative. Clean out drainage inlet structures. Remove any accumulated soil from the surface to adjacent paved areas or undisturbed grass areas.

## 3.06 PROTECTION

- A. General: Provide and install barriers as required and as directed by the Owner's Representative to protect mulched areas against damage from pedestrian and vehicular traffic until final acceptance. Contractor is responsible for malicious destruction of mulch caused by others.

**END OF SECTION**

**LANDSCAPE BOULDERS****PART 1 – GENERAL****1.01 SECTION INCLUDES**

A. The work of this section shall include excavation, grading and installation of site boulders placed at the locations shown on the Drawings. The materials to be used for the construction of such structures shall be as specified herein. Site Rock Work includes the following:

1. Landscape Boulders

**1.02 SUBMITTALS**

A. Submit three (3) samples of each stone type that represents the full range of colors/staining that can be expected. Photos may also be submitted.

**1.03 SOURCE LIMITATIONS**

A. Obtain each type of stone from a single quarry.

**PART 2 - PRODUCTS****2.01 MATERIALS**

A. Boulders:

1. Stone Type: Colorado Buff Sandstone
2. Approved Suppliers:
  - a. Arkins Park Stone Quarries, 970-663-1920
  - b. Tribble Stone, 303-444-1840
  - c. Or approved equivalent.
3. Boulder sizes shall be as indicated on the Drawings. Where plans do not specify specific sizes, sandstone boulder sizes shall range between 0.5 ton and 1.5 tons. An even number of the full ranges of sizes shall be provided (not all 0.5 ton).

**PART 3 - EXECUTION****3.01 SELECTION OF STONE**

A. Project Manager shall be contacted to participate in selection of boulders/stone at stone supplier's yard. If stone supplier's yard is not local, the Contractor shall submit photos of available stones/boulders for Owner's review/selection.

**3.02 HANDLING**

A. Handling of the stone/boulders shall be carried out in such a way that the stones/boulders are not damaged or scarred. Damage stones/boulders may be rejected by the Owner Representative.

**3.03 PLACEMENT**

A. Placement Boulders:

1. Place stone/boulders with flat side up and most attractive face (as determined by Owner's Representative) facing activity areas, unless otherwise noted or directed by the Owner's Representative.
2. Boulders shall be firmly seated and not wobble or move after installation.
3. Tolerance: Top of Boulder elevations shall be within 0.1 of the designed elevation.
4. Bury approximately 1/3 the height of the stone/boulder, unless otherwise notes.
6. Locations and quantity shall be as indicated in the Drawings. Final placement of stone/boulders shall be reviewed and approved on site by the Owner's Representative prior to placing paving, surfacing and landscaping in abutting areas

## 3.04 CLEAN UP

- A. Remove unneeded stone debris from the site.
- B. Clean dirt, debris, trash and other deleterious material from stone surfaces and surrounding areas.

**END OF SECTION**

**LANDSCAPING****PART 1 GENERAL****1.01 SCOPE**

- A. Furnish labor, materials, supplies, equipment, tools, and transportation, and perform operations in connection with and reasonably incidental to the complete installation of the plant material, and warranty as shown on the drawings, the installation details, and as specified herein. Items of work specifically included:
  - 1. Procurement of applicable licenses and permits.
  - 2. Coordination of Utility Locates ("Utility Notification Center").
  - 3. Procurement and installation of Plant Material.
  - 4. Maintenance period.
  - 5. Warranty.

**1.02 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.03 SUMMARY**

- A. This section includes the following:
  - 1. Planting of B&B and container trees and shrubs.
  - 2. Plant quality.
  - 3. Planting seasons.
  - 4. Topsoil and soil amendments.
  - 5. Mulches.
  - 6. Weed Barrier.
  - 7. Tree stakes and guys.
  - 8. Inspection and warranties.

**1.04 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract, and Division 1 Specification Sections. Direct submittals to the Project Manager and receive approval in writing before work commences.
- B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.
  - 1. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.
- C. Samples of each of the following:
  - 1. 5 lbs. of rock mulch for material required for project, in labeled and sealed plastic bag.
  - 2. 2 lbs. of organic compost required for project, in labeled and sealed plastic bag.

3. 2 lbs. of topsoil required for project, in labeled and sealed plastic bag.
  4. 2 lbs. of compost required for project, in labeled and sealed plastic bag.
  5. Weed barrier – 12" square physical sample
  6. Photographs of tree staking, tree guying and tree wrap materials required for project.
- D. Soil analysis from approved testing facility for topsoil and compost products. Test results must be less than 90 days old.
- E. Maintenance instructions: Recommended procedures to be established by Owner for maintenance of landscaping for one full year. Submit prior to completion of planting for review by Project Manager.
- F. Certification of Testing: The Contractor shall furnish to the City a signed statement certifying that the topsoil/compost product furnished is from the lot that has been tested.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this project and with a record of successful landscape establishment.
1. Installer's Field Supervision: Installer shall have a Certified Landscape Technician (CLT) as the supervisor, on the project site full-time when landscaping is in progress.
- B. Quality:
1. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock", and conform to the requirements of the Colorado Nursery Act.
  2. Plants will have well-formed buds with size normal for the species. Growth increments of shoots for the previous year shall be of a length that is consistent with normal growth for that season.
  3. Plants shall be free of harmful insects, mites, diseases and mechanical injuries to trunks and major scaffold branches.
  4. The plants supplied under these specifications shall consist of plants coming from propagating houses, beds, frames or nurseries. "Collected stock" will not be accepted unless specified or as approved substitute. Plants shall conform to the most current Colorado Standards for Nursery Stock, Colorado Department of Agriculture.
- C. Size:
1. Plants shall be of size(s) specified.
  2. Measure trees and shrubs according to ANSI Z60.1 "American Standard for Nursery Stock", with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
- D. Source Quality Control: Ship landscape materials with certificates of inspection as required by governing authorities. Comply with governing regulations applicable to landscape materials.
- E. Growing Area:
1. Provide trees and shrubs grown in one of the following areas:
    - a. Colorado Grown: Trees and shrubs grown in Colorado nursery fields for major portion of plant life.

- b. Out of State Container Grown: Plants from hardiness zones other than 1 through 5 which have been acclimatized to site conditions at time of planting.
  - c. Northern Grown: Trees and shrubs grown in nurseries for at least one year in USDA Hardiness Zones 1-5.
- F. Planting Season: Unless otherwise agreed by Project Manager, balled and burlapped and machine-dug trees shall be planted in one of two planting seasons within a calendar year, namely, when plants are dormant in early spring and early fall no later than the end of October. Either of these seasons shall comprise that period of time in spring or fall that favors the recovery of plants from transplanting and encourages that resumption of healthy growth at the planting site.
- G. Inspection: The Project Manager reserves the right to inspect trees and shrubs either at place of growth or at site before planting, for compliance with requirements for name, variety, size and quality. Plant material must be acceptable to Project Manager.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- B. Trees and Shrubs: Deliver freshly dug or delivered trees and shrubs. Do not prune before delivery, except as approved by Project Manager. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering (shade cloth) during delivery. Apply anti-desiccants (Wilt Proof or equal) to all plant material prior to leaving the nursery. Do not drop trees and shrubs during delivery.
- C. Handle balled and burlapped stock by the root ball.
- D. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, provide shade, and protect from weather and mechanical damage, and keep roots moist.
- 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
  - 2. Do not remove container grown stock from containers before time of planting.
  - 3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

#### 1.07 PROJECT CONDITIONS

- A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Project Manager before planting.
- C. Open Holes or Pits: No hole or pit shall remain open without safety devices to protect the Owner from liability for personal accidental injury.
- D. Preservation of Properties: The Contractor shall be responsible for the preservation of public or private property including: existing trees, shrubs, turf, fences, pavement and other site features. If direct or indirect damage or injury is done to public or private properties by or on account of acts, omissions, neglect or misconduct in the execution of the work, on the part of the Contractor,

such property shall be restored by the Contractor, at his expense. Restoration shall be to a condition similar or equal to that existing before such damage or injury in such other manner as may be acceptable to the Project Manager.

#### 1.08 COORDINATION AND SCHEDULING

- A. The landscape construction schedule is to be provided at the Pre-Construction meeting depicting the dates the various stages of the project will start and when they will be completed.
- B. Coordinate installation of planting materials during normal planting seasons for each type of plant material required, only when weather and soil conditions permit and are in accordance with locally accepted practices, and approved by the Project Manager.
- C. If planting of trees and shrubs occurs after turf installation, protect lawn areas and promptly repair damage to lawns resulting from planting operations. Insure irrigation system is operating to provide adequate water.
- D. Trees shall be planted in the same growing season in which they were dug. Fall dug trees will be allowed.
- E. If plant material is to be stored on site for more than 8 consecutive hours, submit a detailed staging and care plan.

#### 1.09 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Warrant the following living planting materials for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions, unusual for warranty period, or incidents such as damage due to vandalism, hail, fire, owner neglect, or other circumstances that are beyond Contractor's control.
  - 1. Trees
  - 2. Shrubs
  - 3. Perennials, Ornamental Grasses, Plugs, and Ground Covers
- C. Remove plants within seven (7) days of notification, replace dead planting materials within 10 days of notification from owner's representative unless required to plant in the succeeding planting season.
- D. Replace planting materials that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
- E. Plant material is to be warranted throughout the warranty period and shall be replaced with plants of the same size and variety.

#### 1.10 TREE AND SHRUB MAINTENANCE

- A. Maintain trees and shrubs by cultivating, watering, weeding, fertilizing, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects

and disease. Restore or replace damaged tree protection devices. Maintain trees and shrubs for the following period:

1. Maintenance Period: Contractor responsible for plant and landscape maintenance up until project is turned over to owner upon acknowledgment of final acceptance.

## PART 2 PRODUCTS

### 2.01 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, and conform to the requirements of the Colorado Nursery Act, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1, for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Project Manager, with a proportionate increase in size of roots or balls.
  1. Containers: Plants specified in containers shall be container grown as defined by the Colorado Nursery Act. Container grown stock will have a healthy vigorous root system, not overgrown, not rootbound, and no encircling roots. Containerized stock that has been transplanted up to the next container size will be well established in its new container.
  2. Balled and Burlapped: Plants specified as balled and burlapped (B&B), shall conform to or exceed the minimum sizes specified in the Colorado Nursery Act. No balled and burlapped plant shall be accepted if the ball is broken or the trunk loose in the ball or viable roots exposed. Root balls will be solid (not soft, spongy or excessively sandy) and free from large cracks or other damage to the ball.
- C. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- D. Plants that do not appear to conform to the Colorado Standards for Nursery Stock may be subject to official inspection by a representative of the Colorado Department of Agriculture. If any plant or plants are condemned by the Colorado Department of Agriculture, replacement with plants that conform to the Colorado Standards for Nursery Stock will be at the expense of the Contractor.

### 2.02 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1, for type of trees required.
  1. Branching Height:  $\frac{1}{2}$  of tree height.
- B. Small Flowering Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, and stem form as indicated on plan planting schedule.
- C. Provide balled and burlapped shade and flowering trees.

### 2.03 DECIDUOUS SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1, for type, shape, and height of shrub.



- B. Provide container-grown deciduous shrubs as indicated. Container-grown stock to meet ANSI Z60.1, limitations.

#### 2.04 CONIFEROUS EVERGREEN TREES AND SHRUBS

- A. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens of the following grade:
  - 1. Heavy Grade: "XX"
- B. Provide balled and burlapped coniferous evergreen trees conforming to ANSI Z60.1, no options for container grown plant materials allowed.
- C. Provide container-grown coniferous evergreen shrubs subject to meeting ANSI Z60.1, limitations for container stock.

#### 2.05 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 8, four percent (4%) organic material minimum, free of stones 1 inch or larger in any dimension, and other extraneous materials harmful to plant growth.
  - 1. Topsoil Source: Amend existing on-site soil excavated from tree pits to produce topsoil.

#### 2.06 SOIL AMENDMENTS

- A. Compost: One hundred percent (100%) humus rich organic matter. The compost shall be a well decomposed, stable, weed free organic matter source derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings, or source-separated or mixed solid waste. Product must be certified as fully composted at permitted solid waste processing facility. Product to be registered with the Colorado Department of Agriculture and approved for use on Colorado Certified Organic Farms by the Division of Plant Industry of the State of Colorado. Product shall contain no solid particle of greater than one-half inch ( $\frac{1}{2}$ " ) in length or diameter and be free from un-composted or non-stabilized wood bulking agents. Product shall contain no substances toxic to plants and shall be reasonably free (<1% by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.
- B. Provide analysis for the following:
  - 1. Organic Matter Content: 30 - 70% (Dry Basis)
  - 2. Soluble Salt Concentration: 5 dS (mmhols/cm) or less (As Received)
  - 3. PH range: 5.5 to 8.0 (As Received)
  - 4. Final carbon to nitrogen ratio: 20:1 or less.
  - 5. Nutrient Content (dry weight basis): N 1% or above, P 1% or above, K 0.5% or above.
  - 6. Moisture Content: 35% - 55%
- C. Certification of Compost Testing: The Contractor shall furnish to the City a signed statement certifying that the compost furnished is from the lot that has been tested.

#### 2.07 HERBICIDES

- A. Herbicides: Coordinate EPA registered and approved, of type utilized by City of Greeley Parks Department maintenance program.
- B. Applicators must possess City of Greeley pesticide applicator's license.

**2.08 WATER**

- A. Water Source: Potable water from existing locations on the site. Coordinate locations with Project Manager.

**2.09 MULCHES**

- A. Organic Mulch: Organic mulch, free from deleterious materials, noxious weed seed and all foreign matter harmful to plant life, suitable as a top dressing of trees and shrubs.
  - 1. "Coffee" color wood mulch: Submit sample for approval.

**2.11 WEED BARRIER**

- 1. Mirafi 140, Typar 3341, or Polyspun 300 or approved equivalent.

**2.10 STAKES AND GUYS**

- A. Upright and Guy Stakes: Steel "T" posts, six feet (6') in length. Two stakes per tree required.
- B. Guy and Tie Wire: ASTM A 641 (ASTM A 641M), Class I, galvanized-steel wire, 2-strand, twisted, 0.080 inch in diameter.
- C. Chafing Straps: Two inch (2") wide nylon straps with grommets at each end, cut to lengths required to protect tree trunks from damage.
  - 1. Use safety caps on all T-Posts.
  - 2. Standard surveyor's plastic flagging tape, white, 6 inches long.

**2.11 MISCELLANEOUS MATERIALS**

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's instructions.
- B. Tree Wrap: Nurseryman's standard crepe tree wrap tape not less than 4" wide, consisting of two layers of crinkled paper cemented together with bituminous material and with a stretch factor of 33%.

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Prior to excavation, underground utilities shall be identified by the proper authority.

**3.02 PREPARATION**

- A. General: Requirements for approval of placement of plant materials prior to installation to be set forth during a pre-construction conference in accordance with Division I Specifications Section.

- B. Lay out individual tree and shrub locations and areas for multiple plantings in accordance with the plan. Stake locations, outline areas, and secure Project Manager's acceptance before the start of planting work. Make minor adjustments as may be required.

### 3.03 PLANTING SOIL PREPARATION

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
- B. Mix 33% organic compost with 67% on-site topsoil as required at rates indicated. If additional backfill material is needed, it shall be of the same soil type as found on the planting site.
  - 1. For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.
  - 2. Excess material and or debris shall be removed from site and properly disposed of.

### 3.04 EXCAVATION FOR TREES AND SHRUBS

- A. Pits and Trenches: Tree planting pits may be excavated by hand or by mechanical means. Pits dug mechanically will have the resulting walls scarified to eliminate glazing. Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.
  - 1. Balled and Burlapped Trees: Excavate pit a minimum of two times as wide as ball diameter, with ball depth (per drawings) so that top of root ball is 1" above finish grade. The root ball shall be placed on firm, undisturbed soil in the planting pit to prevent settling.
  - 2. Container grown Trees and Shrubs: Excavate pit a minimum of two times container width, and depth per drawings.
- B. Obstructions: Notify Project Manager if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- C. Drainage: Notify Project Manager if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- D. Fill excavations with water and allow to percolate out, before placing and positioning trees and shrubs.

### 3.05 PLANTING TREES AND SHRUBS

- A. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before installation.
- B. Set balled and burlapped stock plumb, and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
  - 1. Place stock on undisturbed soil at bottom of planting pit.
  - 2. Wire baskets will be removed completely prior to completion of backfilling. All twine or plastic will be removed and the burlap will be removed from trunk and from the top 1/3 of the root ball. Do not use planting stock if ball is cracked or broken before or during planting operation.
  - 3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately ½ backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.
  - 4. Additional watering is required every two weeks, or as directed by the Project Manager, until final acceptance.

- C. Set container-grown stock plumb, and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
  - 1. All containers will be removed and root balls scarified. Carefully remove containers so as not to damage root balls.
  - 2. Place stock on undisturbed soil at bottom of planting pit.
  - 3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately  $\frac{1}{2}$  backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.
- D. Set collar one inch above adjacent finish grades, unless otherwise indicated.
  - 1. Do not cover top of root ball with backfill. A water retaining berm, sufficient to hold 10-15 gallons of water at one time, will be built and compacted just outside the edge of the planting pit.
  - 2. After backfilling and watering to settle all voids, all trees should be watered with a minimum of seven (7) gallons, and all shrubs with a minimum of two (2) gallons of root stimulant, 'Upstart' or equal, mixed at the manufactures recommended rate.
  - 3. Protect all trees with tree wrap as specified.

### 3.06 TREE GUYING AND STAKING

- A. Upright Staking and Tying: Use a minimum of two stakes of length required to penetrate at least 24 inches below finish grade and to extend at least 48 inches above grade. One stake will be placed on the northwest side of the tree and the other 180° opposite on the southeast side. Safety caps will be installed on all posts. Set vertical stakes in undisturbed soil to avoid penetrating balls or root masses. Support trees with two strands of tie wire attached to nylon tree straps at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Flag guy wire with standard surveyor's plastic flagging tape.

### 3.07 MULCHING

- A. Mulch trees inside of bermed tree wells and around shrubs as indicated.
- B. Install weed-control barriers before rock mulching according to Manufacturer's written instructions. Completely cover area to be rock mulched. Weed control barrier is not required under organic wood mulch.
  - 1. Edge and Seam Treatment: seams of fabric shall overlap a minimum of 6 inches. Edges and seams shall be secured in placed with pins at 4' maximum spacing.
- B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.
  - 1. Thickness: Four inches (4"), unless indicated otherwise on the drawings.

### 3.08 INSTALLATION OF MISCELLANEOUS MATERIALS

- A. Apply antidesiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.
  - 1. When deciduous trees or shrubs are moved in full-leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

**3.09 CLEANUP AND PROTECTION**

- A. During landscaping, store materials and equipment where directed.
- B. The City prohibits the tracking, dropping, or depositing of soils or any other materials onto City streets by or from a vehicle or machinery. Any inadvertent deposited material shall be removed by the end of business day.
- C. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.
- D. At the end of construction, all holes, ruts, settlements, and depressions resulting from the work will be filled and graded to match elevations of adjacent surfaces, and all areas disturbed by construction shall be restored to their original condition to the maximum extent practicable and as acceptable to the Project Manager.

**3.10 INSPECTION AND ACCEPTANCE**

- A. When the landscape work is complete, the Project Manager will, upon request, make an inspection to determine acceptability.
  - 1. The landscape work may be inspected for acceptance in parts as agreeable to the Project Manager, provided the work offered for inspection is complete, and that the area comprises one complete unit or area of substantial size.
- B. Where inspected landscape work does not comply with the requirements, replace rejected work and continue specified maintenance until reinspected by the Project Manager and found to be acceptable. Replace all such plantings at one time and within 10 working days of notifications whether for acceptance or warranty inspections. Remove rejected plants and materials promptly from the project site.

**3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Upon completion of work, clean adjacent streets and site paving of dirt and debris accumulation.
- B. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

**END OF SECTION**

**CEMENTITIOUS COATING FOR MANHOLE REHABILITATION****TRENCHLESS MANHOLE REHABILITATION  
CEMENTITIOUS COATING**

The City of Greeley, Water and Sewer Department is requesting bids for the trenchless rehabilitation of sanitary sewer manholes by use of a cementitious coating. This request for bid is product specific. It is the intent of the City of Greeley to engage a qualified and experienced professional company to complete the described work.

**1.00 PROJECT DESCRIPTION**

The proposed work will be completed at various locations in the City of Greeley. The selected bidder shall supply all necessary labor, equipment, and material to perform the work. This will include all preparatory work, application of coating to eliminate infiltration, root growth, prevent deterioration from sulfide, and provide a 50 year life to existing manholes.

The bid document includes a map of each manhole to be rehabilitated. This map includes streets, location of manhole in relation to the street and each manhole is identified with a project number.

**2.00 CONTACT / INQUIRES**

Inquiries concerning this bid shall be directed to Linda Ingram at (970)350-9325 or by email, [linda.ingram@greeleygov.com](mailto:linda.ingram@greeleygov.com).

**3.00 PRODUCTS**

Manhole liner/coating, patching, infiltration control, and grouting material will be one of the following.

Manhole liner/coating material:	Kerneos SewperCoat PG	Strong-Seal High Performance
	Mix	

Patching material:	Strong Seal QSR
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Infiltration control material:	Strong Seal Strong Plug
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Grouting material:	Strong Seal Grout 1000
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**4.00 SUBMITTALS**

Bidders must submit the following items with their proposal to be considered for award of this project. **Failure to include required item/s will automatically disqualify the bidder.**

4.01 Manufacturer's Specifications: Provide the manufacturer's specifications. These will include, but not be limited to, specifications of the materials (including chemical composition), mixing of materials, and application of materials, curing of materials, strength of materials, and all other pertinent information. Specifications must include weight of product bags and amount of water to be added per bag.

4.02 Project Price: Prices will include the cost per foot and a total for each manhole. This price will include all pertinent and incidental items such as traffic control, bypass pumping and mobilization.

**5.00 APPLICATION****5.01 Preparation:**

- Place covers over invert to prevent extraneous material from entering the sewer lines.
- All foreign material shall be removed from the manhole wall and bench using a high pressure water spray (minimum 4000 psi). Loose and protruding brick, mortar, and concrete shall be removed.
- All drop bowls shall be removed and anchor studs cut flush with the manhole wall. Drop bowls will be returned to The City of Greeley's Wastewater Collection Division to be reapplied by the City at a later date. Fill voids with quick setting patching mix using approved material. (Section 3.00)
- Active groundwater leaks will be stopped by using approved material. (Section 3.00)
- Where severe infiltration exists, drilling may be required in order to pressure grout using a cementitious grout or chemical grout. Chemical grouting material will be approved by the City of Greeley, prior to its use.

**5.02 Invert repair:**

- After all preparations have been completed, remove all loose material and high pressure wash wall again.
- Any bench, invert, or service line repairs shall be made at this time using a quick setting patching material.
- Invert repair shall be performed on all inverts with visible damage or where infiltration is present or when vacuum testing is specified. After blocking flow through manhole, and thoroughly cleaning invert, quick setting patch material (Section 3.00) shall be applied to the invert. The material shall be troweled uniformly onto the damaged invert at a minimum thickness of ½ inch at the invert extending out onto the bench of the manhole sufficiently to tie into the structural / structurally enhanced monolithic liner to be spray applied. The finished invert surfaces shall be smooth and free of ridges. Flow line grade will not be altered.
- Flow through the manhole will be restored only after repairs have set up completely.

**5.03 Mixing of Lining Materials:**

- For each bag of product, use the amount of water or water settings required per manufacturer's recommendations following mixing procedures noted on product bag and using the approved equipment for mixing and application.
- Prepared mix shall be discharged into a hopper and mixing shall continue in such a manner as to allow spraying continuously without interruption until each application is complete.

**5.04 Application to Walls:**

- Surface shall be clean and free of all foreign material and shall be damp without noticeable free water droplets or running water, but totally saturated just prior to application of material.

- Benches shall be covered to prevent lining material from getting into the sewer line.
- Material shall be hand sprayed and troweled. Methods not using hand sprayed application will not be considered. Material shall be spray applied at a minimum thickness of ½ inch and a maximum thickness of one (1) inch in one or more passes. The surface will then be troweled to relatively smooth finish, being careful not to over trowel.
- If approved by the City of Greeley, a brush finish may be applied to the troweled surface.
- Product manufacturer's recommendations shall be followed whenever more than 24 hours have elapsed between applications.
- **Do not coat the cast iron manhole frames or poly grade rings.**

#### 5.05 Bench Application:

- Application to benches shall take place immediately following wall application.
- Benches shall be hand spray applied to build to or maintain a one (1) inch per foot of slope from the wall to the channel. Sprayed material to be no less than ½ inch thickness.
- Wall bench intersection shall be rounded to a uniform radius the full circumference of the manhole.

#### 5.06 Curing:

- Prior to the application of any product, the contractor will submit to the City of Greeley the manufacturer's specification for curing. These specifications will be adhered to by the contractor and enforced by the City of Greeley project manager.

### 6.00 WORK HOURS

Working hours will be Monday through Friday, 7:00 am to 7:00 pm. No work will be performed on weekends or holidays. Any work out side of these days and hours will be approved by the City of Greeley prior to work taking place.

### 7.00 WEATHER

No application shall be made if ambient temperature is below 40 degrees F. No application shall be made to frozen surfaces or if freezing is expected to occur in the substrate within 24 hours after application.

Precautions shall be taken to keep the mix temperatures at time of application below 90 degrees F. Water temperature shall not exceed 80 degrees F. Chill with ice if necessary.

### 8.00 PUMPING, BYPASSING, PLUGGING

Prior to commencement of work, the selected contractor will submit for review a written plan with a map proposing methods of handling sewage flows in each individual manhole. All bypassed sewage flow shall be returned to the sanitary sewer system.

The use of flow-thru plugs will only be approved if the contractor demonstrates that the normal flow of sewage can be handled for the duration of the specific project it is intended to be used on. If the use of a flow-thru plug is approved, the contractor will check the upstream manhole a minimum of each hour while the plug is in place. This checking will continue 24 hours per day until the plug is removed.

### 9.00 FLOW CONTROL PRECAUTIONS

Precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property. The Contractor shall be liable for private property damages caused by sewer blockages resulting from the Contractor's activities or lack of action to prevent. In the event sewage



should spill, leak or be discharged to anywhere other than the sanitary sewer system, the contractor will notify the city of Greeley within the first hour of discovery. The Contractor shall be liable for triple punitive damages should the City be fined by any regulatory agency because of the Contractor's failure to control sewage flow.

#### **10.00 TESTING AND INSPECTION**

- Eight each two inch cubes of the liner product shall be cast each day or from every pallet of product used. Four of these shall be properly packaged, labeled, and returned to the manufacturer for compression strength testing as per ASTM C109 procedure. The remaining four cubes shall be delivered to the City of Greeley.
- The contractor shall provide the city with test results within seven (7) days of application of the tested product.
- No application of the liner product will take place before the inspector has visually inspected the areas to be applied. The contractor will perform further cleaning, patching, or preparation work required by this inspection.
- At completion of application, the owner's inspector will visually check for evidence of sagging, coverage and cure.
- The contractor shall provide and set up OSHA approved confined space entry equipment for the duration of the inspection.
- As required, the contractor shall set up and maintain bypass pumping for the duration of inspection.

#### **11.00 SAFETY**

- Traffic Control: The contractor shall be responsible for providing traffic control in accordance with all state and local regulations. Local regulations do require a 5 working day advanced notice for full road closures and a 72 hour notice is strongly recommended prior to construction.
- Confined Space Entry: The contractor will provide and use OSHA approved equipment and procedures when entering manholes.

#### **12.00 PUBLIC RELATIONS**

The public information and notification program shall, as a minimum, require the contractor to provide 24 hours advance notification of residences and businesses where work on any sanitary sewer manhole will interrupt normal activity. This notification shall be for such projects as manholes in easements behind residences, in front of driveways, and on sidewalks. The contractor will provide information as to the work to be performed, and when it will be started and completed. The information shall also include the contractor's person to contact and local telephone number. The contractor will also make personal contact on the day/s the work is to take place.

#### **13.00 WARRANTY**

The manufacturer and contractor shall warrant the product and workmanship for a period of two (2) years. This warranty will cover the replacement of all material/product and labor to make these replacements.

This warranty will also cover any liability for damage to private property caused by failure of product or poor workmanship.

**END OF SECTION**

**COLORED CONCRETE FOR SPLASH BLOCK****FOR PATTERNED CONCRETE AND MEDIAN EDGING****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Colored Concrete - for median splash apron and median paving, having the surface colored. The work is performed on the job site.

**1.2 DESCRIPTION – Colored concrete includes:**

- A. Materials: concrete, dry-shake color hardener, curing compound, release agent and sealer.
- B. Concrete placement and finish
- C. Color hardener and release agent placement
- D. Curing compound
- E. Sealer application

**1.3 SUBMITTALS**

- A. Submit Samples as required showing color, finish and sealer
- B. Color Chart
- C. Product data

**1.4 CONTRACTOR**

- A. A licensed, experienced colored concrete contractor shall install all median paving and edging. Shall provide a qualified foreman or supervisor who has a minimum of three years experience with colored concrete, and who has successfully completed at least five (5) colored concrete installations of high quality and similar in scope to that specified herein, and located within a 100 mile radius of the proposed project. Evidence the contractor is qualified to complete the project in a workmanlike manner as specified herein shall be submitted to, and approved by, the engineer.

**PART 2 PRODUCTS****2.1 CONCRETE**

- A. Mix Design
  - a. Concrete shall have a minimum of 4,000 psi (per ACI 318) or as required by local building codes or industry standards, whichever is higher
  - b. Portland Cement shall conform to ASTM C150, C595 or C1157 depending on soil conditions.
  - c. Aggregate shall conform to ASTM C33
  - d. Air entrainment shall conform to ASTM C260
  - e. No admixtures containing calcium chloride shall be permitted.
  - f. Fibers shall conform to ASTM Guidelines
  - g. Color Admixture - Concrete shall be colored with **Davis San Diego Buff**

**2.2 COLORING, TEXTURE AND SEALING MATERIALS**

- A. Color Hardener: The concrete shall be colored with the following Color Hardener color(s): Lithochrome Walnut or approved equal. The grade of the hardeners shall be: Regular Grade.
- B. Stamp Pattern – **“Small Canyon Stone”** style
- C. Release Agent: Powdered release agent shall be applied to all concrete surfaces to be textured: Color – **Walnut Brown**.

- D. Curing: All colored concrete slabs shall be cured with approved Cure and Seal.
- E. Sealer: All slabs shall be sealed in accordance with the manufacture's recommendations.

## PART 3 EXECUTION

### 3.1 MOCKUPS

- A. The Contractor shall cast a minimum of three (3) mockups of 6' x 6' full depth panels of colored concrete pavement to demonstrate typical texture, surface finish, color and standard of workmanship. Obtain Greeley Project Manager's approval or selection of mockups before starting construction. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work. Demolish and remove mockups when directed. Any acceptable mockups may become part of the completed Work if undisturbed at the time of Substantial Completion. The cost of the mockups shall be incidental to the colored concrete pavement.

### 3.2 INSTALLATION

- A. The area to receive colored concrete shall have the sub-grade prepared as required by City of Greeley standards.
- B. The formwork shall be installed in accordance with the drawings. Provide reinforcement as specified.
- C. Control joints and/or expansion joints shall be provided in accordance with the drawings and the guidelines established by the American Concrete Institute (ACI). As with any concrete slab, colored concrete usually contains construction joints, control joints and expansion joints, the contractor shall advise and work with the engineer to determine the best location for these joints to minimize the visibility of the joints and to minimize unsightly cracking.
- D. All concrete flatwork shall be performed under the direct supervision of a Craftsman holding the following certificate: American Concrete Institute (ACI) Concrete Flatwork Finisher and Technician (ACICFFT)
- E. A minimum of one certified Craftsman is required at each finishing operation.
- F. The concrete shall be placed and screeded to the finished grade, and floated to a uniform surface using standard finishing techniques.
- G. Color Hardener shall be applied evenly to the surface of the fresh concrete by the dry-shake method using a minimum of 60 pounds per 100 square feet. It shall be applied in two or more shakes, floated after each shake and troweled only after the final floating.
- H. Release Agent shall be applied evenly to the troweled surface prior to imprinting
- I. While the concrete is still in its plastic stage of set, the imprinting tools shall be applied to the surface.
- J. Approved Cure and Seal shall be applied in accordance with the manufacturer's recommendations immediately after completing the imprinting process for slabs only. Slabs typically do not require membrane or mechanical curing.
- K. After the initial curing period (and grouting operation, if applicable), the surface of the slab shall be sealed.

## PART 4 MEASUREMENT AND PAYMENT

- A. Forming, finishing and installing or constructing joint devices and fillers, furnishing and installing reinforcing steel (unless otherwise specified) miscellaneous embedded items, furnishing, placing, finishing and curing concrete. If required and not listed in the Bid schedule, excavation, base materials, backfill and compaction are to be considered incidental to this item.

**END OF SECTION**

**TRAFFIC SIGNAL**

CITY OF GREELEY  
STANDARD SPECIFICATION FOR

TRAFFIC SIGNAL MATERIALS AND INSTALLATION

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- A. General
- B. Trenching, Backfilling, and Restore
- C. Trenching and Backfill Only (No Restoration)
- D. Bored or Pushed conduit (Furnish and Install)
- E. Conduit (Furnish and Install)
- F. Potholing
- G. Pull Box (Install)
- H. Pull Box (Remove)
- I. Pull Box (Reset)
- J. Water Valve Pull Box (Install)

- K. Controller Foundation (Furnish and Install)
- L. Controller Foundation (Remove)
- M. Controller Step Pad (Furnish and Install)
- N. Controller (Install)
- O. Controller (Remove)
- P. Controller (Reset)
- Q. Mast Arm Pole or Combination Pole (Install)
- R. Mast Arm Pole or Combination Pole (Remove)
- S. Pedestal Pole (Install)
- T. Pedestal Pole (Remove)
- U. Strain Pole (Furnish and Install)
- V. Strain Pole (Remove)
- W. Span Wire for Strain Pole (Furnish and Install)
- X. Mast Arm (Install)
- Y. Mast Arm (Remove)
- Z. Mast Arm (Reset)
- AA. Traffic Signal Head (Install)
- BB. Traffic Signal Head (Remove)
- CC. Pedestrian Push-button Assembly (Install)
- DD. Pedestrian Push-button Assembly (Remove)
- EE. Pedestrian Instructional Sign (Install)
- FF. Saw cut Loop Detector (Furnish and Install)
- GG. Surface Applied Loop Detector (Furnish and Install)
- HH. Micro loop Detector (Install)
- II. Loop Detector Lead-In Wire, single pair (Furnish and Install)
- JJ. Loop Detector Lead-In Wire, Multi pair (furnish and Install)
- KK. Pedestrian Push-button Lead-In Wire (Furnish and Install)
- LL. Multi conductor (Furnish and Install)
- MM. Grounding and Bonding Wire (Furnish and Install)
- NN. Service Entrance Wire (Furnish and Install)
- OO. Opticom Sensor (Install)
- PP. Opticom Lead-In Wire (furnish and Install)
- QQ. LED Signal Indication (Install)
- RR. Video Detection Camera (Install)
- SS. Video Detection Cable (Install)

**TS-1 GENERAL**

These specifications for the provision of traffic signal and lighting installations are intended to provide a set of minimum standards that shall be followed when work is done for the City of Greeley. These standards, plans, and any special provisions shall apply to all materials supplied, methods and procedures of work to be followed, and other general minimum requirements that shall be complied with before work is accepted by the City of Greeley.

The City of Greeley has adopted the following as part of these standard specifications:

Standard Specifications for Road and Bridge Construction (current edition), Colorado Department of Transportation, and all amendments and revisions pertaining thereto.

Manual on Uniform Traffic Control Devices (current edition), Federal Highway Administration, and the Colorado Supplement thereto.

Design Criteria and Standard Specifications (current edition), City of Greeley.

The standard specifications outlined in this document are revisions and amendments to the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction. In situations where there is a conflict or question of interpretation, these specifications and any special provisions will prevail.

These specifications, the plans, any special provisions, and all supplemental documents are essential parts of a contract and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for the complete work. In case of a discrepancy, figured dimensions shall govern over scaled dimensions; plans shall govern over standard specifications; and special provisions shall govern over plans and standard specifications.

**TS-2 DEFINITIONS****CITY**

The City of Greeley, Colorado.

**CONTRACTOR**

The person, partnership or corporation that has signed a contract to perform work for the City.

**CABINET**

A complete electrical or solid-state mechanism for controlling the operation of traffic control signals, including the timer controller, and all auxiliary apparatus mounted in the cabinet.

**DETECTOR, LOOP**

A loop of wire imbedded in the roadway capable of actuating a detection unit when a vehicle passes within its magnetic field.

**DETECTOR, MICROLOOP**

A sealed probe buried beneath the roadway surface capable of actuating a detection unit when a vehicle passes within its magnetic field.

**CITY ENGINEER**

The City Engineer or his duly authorized representative.

**GRC**

Galvanized rigid conduit.

**INSTALLATION, THE**

The work completed, in place, and in operation.

**LENS**

A part of the optical unit that redirects the light coming from the reflector. It may be referred to as the redirecting cover glass or roundel.

**PVC - (POLYVINYL CHLORIDE)**

A strong, tough plastic based on resins made by the polymerization of Vinyl Chloride or co polymerization of Vinyl Chloride with minor amounts (not over 50 percent) of other unsaturated compounds, which is then fashioned into sheets, tubing pipe, conduit, containers, insulation, etc.

**PEDESTRIAN PUSH-BUTTON ASSEMBLY**

An assembly consisting of actuation ADA button, switch, housing or frame, and directional sign.

**PHASE**

A part of the total time cycle allocated to any traffic movements receiving the right-of-way simultaneously during one or more intervals.

**SIGNAL HEAD**

An assembly containing one or more signal faces, which may be, designated accordingly as one-way, two-way, three-way, four-way, etc. (a) Signal Section - An assembly containing a reflector, receptacle, lens, and door with the necessary enclosure and supporting parts; to be used with a light source for providing a single signal indication, which may be RED, YELLOW, GREEN OR ARROW, as necessary. (b) Signal Face - an assembly containing from one to five complete signal sections (normally red-yellow-green or arrows).

**SIGNAL INDICATION**

The illumination of a traffic signal lens or equivalent device or of a combination of several lenses or equivalent devices at the same time.

**SUPERINTENDENT**

The City Traffic Operations Manager or his duly authorized representative.

**TRAFFIC SIGNAL**

A power-operated traffic control device, not a sign, by which traffic is warned or is directed to take some specific action.

**TS-3 SCOPE OF WORK****A. General**

The work shall consist of the installation of materials and equipment to form complete and operational traffic signal and lighting installations at various locations in the City.

The installations shall be complete with all necessary accessories for proper operation. The disconnect devices; protective devices, and all other equipment shall be thoroughly coordinated to secure accordance with these specifications.

The contractor shall be responsible for all requests for locates from the start of the project and shall continue until the project is accepted as complete by the City of Greeley.

Traffic signal and lighting plans indicate the extent and general arrangement of the installation. If the Contractor deems any departures from the plans necessary, details of such departures and the reasons therefore shall be submitted immediately to the Superintendent for approval. No such departures shall be made prior to the written approval of the Superintendent.

Location of materials and equipment shall be as shown on the plans or as directed by the Superintendent.

A certified IMSA Level II Signal Electrician shall do all work within controller cabinets. The successful bidder shall provide a list of qualified employees to the Superintendent.

~~Loop detector repair and maintenance shall begin a maximum of 48 hours after the City gives a verbal Notice to Proceed.~~

**B. Materials to be Furnished by the City**

The City will not furnish traffic signal items as part of this project. The contractor shall furnish and install all traffic signal items based on the plans.

**C. Materials to be Furnished by the Contractor**

The Contractor shall supply all materials per the traffic signal design plans.

Unless otherwise indicated on the plans, specified in the special provisions, or directed by the Superintendent, all materials shall be new. Where existing installations are to be modified, existing material shall be incorporated into the revised system, salvaged, or abandoned, as indicated on the plans, specified in the special provisions, or as directed by the Superintendent.

**TS-4 CONTROL OF WORK**

**A. General**

Work shall not be performed in the roadway before 8:00 a.m. or after 4:00 p.m., unless the Superintendent grants permission.

The Contractor shall notify property owners, and give them sufficient time to move their vehicles, before a driveway is blocked.

Electrical equipment shall conform to the standards of the National Electrical Manufacturers Association. Material and work shall conform to the applicable requirements of the National Electrical Code and any local ordinance, which may apply.

**B. Traffic Control**

When the Contractor's operations create a condition hazardous to traffic or the public, the Contractor shall take the necessary precautions and provide adequate means to protect those who pass through or over the work, at no expense to the City. The City of Greeley has an agreement with Northern Colorado Traffic Control, 1712 First Avenue, Greeley, Colorado, 970-356-6881, to provide traffic control services. If you are interested in using them, they will perform the service at the rates covered by the agreement. If the Contractor shall appear to be negligent in providing such warning or protective measures, the Superintendent may direct attention to the existence of a hazard, and the Contractor at no expense to the City shall install any measures required to protect the public.

Traffic control plans shall be submitted to the Superintendent for approval before work in the public right of way may begin.

Signal turn-on/turn-off and flashing entry/exit shall be done only at the on-site direction of the Superintendent.

**C. Equipment List and Drawings**

If the Contractor is supplying equipment to the project, he shall submit to the Superintendent for approval, within five days following notification of work to perform, a list of equipment and material, which he proposes



to install. The list shall include all materials that are identified on the plans or in the specifications by the performance characteristics, or by other means when it is necessary or customary in the trade. The list shall be complete as to name of manufacturer, size, and catalog number of unit, and shall be supplemented by such other data as may be required, including detailed scale drawings and wiring diagrams of any non-standard or special equipment and of any proposed deviation from the plans. If requested to do so, the Contractor shall submit for approval sample articles of the materials proposed for use.

The above data shall be submitted to the Superintendent (in as many copies or complete sets as required by the Superintendent) for checking, correction, and approval. Upon completion of checking, correction, or approval, the Superintendent will submit a letter of transmittal to the Contractor indicating acceptance or rejection of, or changes required for acceptance of, the above data.

The contractor shall supply "as-built drawings@ upon completion of the work and prior to final payment.

#### **D. Cooperation between Contractors**

Street construction within the limits of the work may be under way by other Contractors during the period of the contract. The Contractor shall cooperate with any other Contractor under contract to the City or working under a utility agreement with the City. Coordination of work zone traffic control will be done by the city.

### **TS-5 EXCAVATING AND BACKFILLING**

#### **A. Excavating**

Blasting shall not be done within City limits.

When trenching, the trench shall be dug only as far in advance of the conduit as permitted by the Superintendent.

The trench bottom, regardless of whether it is existing, imported, or recompacted material, shall be shaped to provide a uniform and continuous bearing support for the conduit on solid and undisturbed material at every point between couplings. Couplings shall be provided for pipe. Excavations for conduit shall be two inches wider than the outside diameter of the conduit. Pipe shall not be installed in the trench until the sub grade preparation meets the above specifications, as determined by the Superintendent.

Surplus excavated material shall be removed and disposed of immediately by the Contractor. After each excavation is complete, the Contractor shall notify the Superintendent and under no circumstances shall any conduit or material be covered without inspection and approval.

#### **B. Backfilling**

Excavation in trenches shall be backfilled to the original ground surface or to such grades as specified or shown on the drawings. Backfilling shall begin as soon as practical after the pipe has been placed and shall be carried on as rapidly as is consistent with construction in the open trench work area.

Complete cleanup shall proceed directly behind the backfilling to facilitate the return to normal conditions. The Contractor shall have sufficient equipment on the job at all times to assure timely backfilling and cleanup.

Backfilling and compacting shall be done as thoroughly as possible to prevent after-settlement. Depositing of the backfill shall be done so the impact of falling material will not damage the conduit. Grading over and around the work shall be done as directed by the Superintendent.

Backfilling of the conduit trenches shall be done by placing aggregate base course material CDOT Specification, Class 6, tamping in lifts of not more than six inches, to the bottom surface of the structural

roadway material. The remaining portion of the excavation shall be backfilled with the same type of material used to construct the existing roadway surface.

Use of non-shrinking backfill material as outlined in City of Greeley Standards may be substituted for above.

When the trench excavation is within the right-of-ways of State or County highways, the backfilling of the trench, compaction of materials, sub-grade preparation, and surfacing shall be done in strict accordance with the requirements and specifications of the State or County Highway Department. Unless otherwise specified, this work shall be considered incidental to other portions of the contract.

The Contractor shall blade and compact the roadway after the trench has been backfilled, so it shall be passable to traffic at all times. The Contractor shall maintain the roadway in a condition acceptable to the Superintendent until final acceptance of the entire work by the City.

The Contractor shall remedy at no cost to the City any defects that appear in the backfill following completion and during the guarantee period.

### **C. Removing and Replacing Improvements**

When a part of a square or slab of existing concrete sidewalk is broken or damaged, the entire square or slab shall be removed and the sidewalk reconstructed as specified above. The outline of areas to be removed in Portland Cement concrete shall be outlined and shall be cut to a minimum depth of 12" with an abrasive-type saw prior to removing the material. Cut for the remainder of the required depth may be made by any method satisfactory to the Engineer. Saw cuts shall be neat and true with no shattering or chipping of concrete adjacent to or outside of the removal area.

Cuts in existing bituminous pavement shall be saw cut or cut with a sharp-edged wheel roller.

Removed bituminous and concrete materials shall be hauled from the site and disposed of by and at the expense of the Contractor, at a suitable disposal site provided by the Contractor.

Trenches in the roadway shall be patched within five calendar days. The Contractor shall be responsible for maintaining trenches on a daily basis until the final patch is in place. In the event the Contractor cannot comply within the allotted time frame, the City may employ a secondary contractor to install the necessary patch, and back charge the original Contractor for patch installation.

## **TS-6 CONDUIT**

### **A. General**

Conductors shall be run in conduit except when run in metal poles. A nylon pull line shall be left in each conduit run for future pulling of wires. Conduit shall be rigid PVC or galvanized rigid steel conforming to the plans, standard specifications, and/or the special provisions.

Electrical conduits running to the control cabinet shall enter from the bottom of the cabinet unless otherwise noted on the plans. Conduit runs shown on the plans are tentative as to routing and may be changed as directed by the Superintendent to avoid underground obstructions. In the event of any change from the location shown on the plans, accurate records shall be kept for as-built drawings, and necessary details submitted to the Superintendent before final payment is made.

### **B. PVC conduit**

PVC conduit shall be manufactured of high-impact PVC, and shall conform to industry standards and commercial standards No. CS-207-60. Each length of PVC conduit and back of the various PVC fittings (expansion joints, couplings, adapter, etc.) shall bear the label of Underwriter's Laboratories, Inc. The conduit shall be of the size or sizes shown on the plans or indicated in the special provisions. All PVC

conduits shall be schedule 40, except under any travel way HDPE SDR 11 shall be used. PVC conduit shall be used only for underground installations. Conduit used above ground shall be GRC.

A #8 AWG stranded copper conductor shall run continuously in all PVC conduits used for traffic signal circuits. This wire is used for bonding and grounding purposes.

A nylon pull line of not less than 500 lb. tensile strength shall run continuously in all conduits. Bare copper conductor and nylon pull line shall be supplied by the Contractor and shall be incidental to conduit installation.

### **C. Galvanized Rigid conduit**

Conduit and fittings shall be galvanized rigid steel and shall be uniformly and adequately zinc-coated by the hot-dipped process conforming to ASTM Designation A153. Joints shall be set up tight with squared ends. Fastenings shall be secured and of a type appropriate in design and dimensions for the particular application. Couplings, connectors, and fittings shall be approved types specifically designed and manufactured for the purpose. Fittings shall be installed to provide a good electrical grounding throughout the conduit system. Neither the interior nor the exterior of a six-inch sample cut from the center of a standard length of conduit, when tested in accordance with the applicable portion of ASTM Designation A239, shall show a fixed deposit of copper after four one-minute immersions in the standard copper sulphate solution. The interior of the rigid conduit shall have a galvanized coating. Each length shall bear the label of Underwriters' Laboratories, Inc., and shall conform to appropriate articles of the electrical code.

### **D. Conduit Installation**

Conduit under railroad tracks shall not be less than 42 inches below the bottom of the tie or as specified by railroad code. It shall be the responsibility of the Contractor to obtain clearance from the railroad before any work is done within the railroad right-of-way. The minimum size of conduit to be used will be shown on the plans or as required on the wire layout sheets. Conduit smaller than 3/4-inch electrical trade size shall not be used, unless otherwise specified, except that grounding jumpers at service points may be enclosed in 2-inch conduit.

Conduit installed for future use shall terminate in a pull box, and each conduit end shall also be capped. Each pull box (other than water valves) shall have a minimum of 6" of 3/4" rock and 4" clearance from the top of the conduit to the bottom of the lid.

### **E. PVC conduit Installation**

In bending PVC conduit, the following methods may be used.

1. A water bending process may be used consisting of a water-filled steel pipe four feet long, heated to the temperature that will render the PVC conduit pliable in approximately 30 seconds after insertion in the pipe. The conduit may then be bent to the desired angle and held in an appropriate jig for a cooling period of approximately 20 seconds.
2. The Contractor may use other methods of bending PVC conduit if the preceding method is found unsuitable because of climactic conditions, but only after demonstrating the proposed method to the Superintendent and receiving his approval.

Bends in PVC conduit shall be made and conform to all appropriate sections of the National Electrical Code or local codes governing bending radius, and number of bends allowed as applicable for rigid conduit.

Conduit bends, except factory bends, shall have a radius of not less than six times the inside diameter of the conduit. When factory bends are not used, conduit shall be bent without crimping or flattening using the longest radius practicable.

**F. Termination of conduit**

Galvanized rigid conduit terminations shall be fitted with insulating bushings to prevent chafing of wire on exposed edges. Threaded ends shall be protected with approved insulated metal ground bushings or insulated bushing material, and sealed by duct seal.

**G. Pull Boxes**

All pull boxes shall be polymer concrete type (or an approved equal) with size to be determined by the superintendent. Each pull box will have installed a 5/8" X 10' ground rod and all # 8 copper wires attached to the ground rod. All conduits shall enter the pull box from the bottom and sweep up. There shall be at least 4" clearance between the top of the conduit and the top of the box and no more than 6". Each box shall contain a minimum of 6" of 3/4" rock.

**TS-7 CONCRETE FOUNDATIONS****A. General**

Foundations shall be concrete conforming to City of Greeley Class "BZ" mix requirements.

After pouring the concrete, the anchor bolts shall be raised and lowered individually to eliminate any air pockets, and to allow proper alignment of the anchor bolts in the concrete prior to the setting of the concrete.

If the Contractor proposes any deviations in the pouring of foundations, the City Engineer prior to pouring of the concrete shall approve the deviations.

**B. Poles, Standards, and Pedestal Foundations**

Poles, standards, and pedestals shall not be erected until the foundation concrete has set at least seven days. Foundations for high-strain poles shall set a minimum of ten days. Equipment shall be plumbed or raked as required and directed by the Superintendent.

Foundations for poles shall normally be flush-top and shall be located as shown on the plans or as directed by the Superintendent. The maximum distance behind the curb for pole locations is desired. In locations where the roadway is not curbed, the top of the foundations shall be six inches plus or minus one-quarter inch above the grade of the edge of the pavement. Where foundations are located in the sidewalk, the foundation shall be two inches above the surface of the sidewalk. Expansion material shall be placed between the foundation and the sidewalk, with the top of the expansion material level with the sidewalk surface.

Poles that are to be painted, shall be washed with approved solvent, a two-part primer coat applied with an approved primer (Macro Poxxy 846) and two-part epoxy paint (Sherman Williams code B65ST304) Federal Green.

The provisions in the above paragraph are general descriptions for normal roadway conditions. In certain cases, special foundation requirements may be indicated on the plans or required by the City Engineer. For example: where heavy excavations, embankments, sloping (rip-rap) areas near the roadway, or unusual soil conditions are encountered.

**C. Controller Foundations**

Controller foundations shall be concrete conforming to City of Greeley Class "B" mix requirements. Foundations for traffic signal controller cabinets, when located in sidewalks, shall rise above the sidewalk surface as shown on the plans. Foundations may also be approved fiberglass when approved by the Superintendent.

The foundation shall be caulked with an asphalt or silicon caulk, or "Rubberneck" sealant prior to placing the cabinet on the foundation.

#### **TS-8 VEHICLE DETECTOR INSTALLATION**

Effective January 1, 2007 all new signal installations, all signal rebuilds and anytime a loop fails due to age or is damaged due to construction and/or maintenance being preformed in the public right, inductive vehicle detection (loops) will no longer be saw cut into the existing pavement surface, unless other methods of non-intrusive detection can not physically be installed. The existing loop or loops shall be replaced with a non-intrusive vehicle detection system (video detection).

~~If loops are approved as an alternate the following specifications shall apply. Loops shall be 6' X 30' preformed loops and placed in the lower lift or road base for asphalt roads or under the concrete for intersections that are being rebuilt in concrete.~~

~~As a last resort, (when lack of existing conduit or other extenuating circumstance prevents installing non-intrusive vehicle detection). Then inductive loops may be installed as follows:~~

~~Loops shall be 6' X 30' quadra-pole. The saw cut angle shall be no less than 135 degrees, measured at the inside of the loop. Corners may be drilled with a 1 2" core drill.~~

~~Saw cuts shall be 5/16" wide and a minimum of 2" deep.~~

~~During all cutting operations the City of Greeley Storm Water Policies shall be followed. This includes but is not necessarily limited to vacuuming up all water and debris. Blocking the storm water drains to prevent cutting material from entering the storm water system.~~

~~A 500 VDC meager shall be used to confirm insulation resistance of no less than 100 megohms prior to sealing the slots.~~

~~The sealant shall be at least one inch thick above the top conductor in the saw cut.~~

~~Each loop end shall be identified with tape rings, to indicate wire numbers 1 through 4. Each detector cable shall be clearly labeled in the controller cabinet, pull box and signal pole base, identifying phase relationship and approach leg, in accordance with the color coding described in these specifications.~~

~~14 gauge stranded IMSA 51-5 wire shall be used for loop detectors.~~

~~Loop sealant shall be of a type approved by the Superintendent.~~

~~18" to 24" of slack shall be provided in the pull box for each wire end, and for the continuous unspliced loop of wire made by extending wire #2 and #3 into the pull box.~~

~~Loop splices shall be sealed with 3M (or approved equal) DBY splice kits. Multiple loops per phase shall always be wired in series.~~

#### **TS-9 CABLE AND CONDUCTORS**

##### **A. General**

Cable and conductors shall be furnished by the Contractor, and conform to the applicable I.M.S.A. Specifications and to these specifications.

Multi conductor cable shall be copper and conform to IMSA Specification 19-1.

The individual conductors in Multi conductor cable shall be 14 gauge stranded copper wire.

Detector "Home Run" or lead-in cable and pedestrian push-button lead-in cable shall be IMSA 50-2, #16 stranded, and shall have polyethylene outer insulation.

Multiple twisted pair cable may be used as detector "Home Run" cable, and each pair shall be individually twisted and shielded #16 stranded conductors, shall have polyethylene outer insulation, and shall conform to IMSA Specification 50-2. The outer insulation of each pair shall be colored white/black, red/black, and green/black or numbered one (1), two (2), and three (3).

Opticom emergency priority equipment shall be wired with 3M cable designed specifically for this type of equipment.

## **B. Wiring Installation**

### **City of Greeley 19 – 21 Conductor Cable Wiring**

#### **MAIN STREET**

#### **SIDE STREET**

CONDUCTOR	INDICATION	CONDUCTOR	INDICATION
RED	= RED	RED/BLK	= RED
ORANGE	= YELLOW	ORANGE/BLK	= YELLOW
GREEN	= GREEN	GREEN/BLK	= GREEN
RED/WHT	= RED ARROW	BLACK	= RED ARROW
ORANGE/RED	= YELLOW ARROW	WHITE/BLK	= YELLOW ARROW
GREEN/WHT	= GREEN ARROW	BLUE	= GREEN ARROW
BLACK/WHT	= DON'T WALK	BLACK/RED	= DON'T WALK
BLUE/WHT	= WALK	BLUE/RED	= WALK
WHITE	= SIGNAL NEUTRAL	BLUE/BLK	= SPARE
WHITE/RED	= PED NEUTRAL	RED/GRN	= SPARE
ORANGE/GRN	= SPARE		

#### **CABLE COLOR (TAPE) CODES**

NORTHBOUND=	RED	LEFT TURN	= WHITE
SOUTHBOUND=	GREEN	PEDESTRIAN	= YELLOW
EASTBOUND =	ORANGE	RIGHT TURN	= GRAY
WESTBOUND =	BLUE		

Separate conduits for low voltage and high voltage conductors shall be provided in all signal installations. High voltage conductors shall be run in conduits separate from low voltage actuation lead-ins and telephone interconnect.

Separate Multi conductor cables shall be provided for each signal phase. Each mast arm mounted signal face shall be wired separately back to the pole base. The signal face farthest from the pole shall always be wired to accept a five-section signal face, whether that face is installed or not.

Unused conductors in each cable shall be folded back on the cable and securely taped.

Loop detector lead-in, and Opticom lead-in cables shall not be spliced.

Connections to signal heads, pushbuttons, and traffic controllers shall be secured to the screw type terminals in the traffic signal heads, pedestrian pushbuttons, and the traffic controller. The connectors shall

be of the spade tongue type and shall be affixed to the conductors using a tool designed specifically for the connection of the connectors to the conductors.

Sheath for detectors shall not be grounded.

The wiring for each mast arm mounted signal head shall be taped with the appropriate number of bands, color coded by direction, to indicate signal head number, with the head furthest from the pole being number one.

### **Seven conductor cable wiring**

<b>CONDUCTOR COLOR</b>	<b>INDICATION</b>	<b>TAPE COLOR</b>
<u>Northbound Through Vehicles:</u>		
Green	Green	Red
Orange	Yellow	Red
Red	Red	Red
<u>Northbound Left Turns:</u>		
BLUE	Green Arrow	Red + White
WHITE/BLK	Yellow Arrow	Red + White
Red	Red Arrow	Red + White
<u>Northbound Right Turns:</u>		
Green	Green Arrow	Red + Gray
Orange	Yellow Arrow	Red + Gray
Red	Red Arrow	Red + Gray
<u>Northbound Pedestrians:</u>		
Blue	Walk	Red + Yellow
Black	Don't Walk	Red + Yellow
<u>Southbound Through Vehicles:</u>		
Green	Green	Green
Orange	Yellow	Green
Red	Red	Green
<u>Southbound Left Turns:</u>		
Green	Green Arrow	Green + White
Orange	Yellow Arrow	Green + White
Red	Red Arrow	Green + White
<u>Southbound Right Turns:</u>		
Green	Green Arrow	Green + Gray
Orange	Yellow Arrow	Green + Gray
Red	Red Arrow	Green + Gray
<u>Southbound Pedestrians:</u>		
Blue	Walk	Green + Yellow
Black	Don't Walk	Green + Yellow
<u>Eastbound Through Vehicles:</u>		
Green	Green	Orange
Orange	Yellow	Orange
Red	Red	Orange

CONDUCTOR COLOR	INDICATION	TAPE COLOR
<u>Eastbound Left Turns:</u>		
Green	Green Arrow	Orange + White
Orange	Yellow Arrow	Orange + White
Red	Red Arrow	Orange + White
<u>Eastbound Right Turns:</u>		
Green	Green Arrow	Orange + Gray
Orange	Yellow Arrow	Orange + Gray
Red	Red Arrow	Orange + Gray
<u>Eastbound Pedestrians:</u>		
Blue	Walk	Orange + Yellow
Black	Don't Walk	Orange + Yellow
<u>Westbound Through Vehicles:</u>		
Green	Green	Blue
Orange	Yellow	Blue
Red	Red	Blue
<u>Westbound Left Turns:</u>		
Green	Green Arrow	Blue + White
Orange	Yellow Arrow	Blue + White
Red	Red Arrow	Blue + White
<u>Westbound Right Turns:</u>		
Green	Green Arrow	Blue + Gray
Orange	Yellow Arrow	Blue + Gray
Red	Red Arrow	Blue + Gray
<u>Westbound Pedestrians:</u>		
Blue	Walk	Blue + Yellow
Black	Don't Walk	Blue + Yellow
<u>Other:</u>		
White	Common Signal	
White/Black	Unused or Common Ped	

Opticom lead-in shall be color coded Purple.

The Contractor shall install two single conductor #6 AWG wire from the controller to the service connection pull box or service pole, leaving three extra feet of wire in the pull box.

## TS-10 SERVICE SYSTEMS

### A. General

Service points shown on the plans are approximate only. The exact location will be determined in the field by the Contractor, the Superintendent, and Xcel Energy Company.

Xcel Energy Company will make the electrical service connections. The City shall be responsible for coordinating the service connection with Xcel Energy Company.



**B. Service Pole**

Conduit shall be strapped to the pole with rigid two-hole straps with #8 or #9 12" wood screws, or as shown on the plans. Plumber's tape, wire nails, or other means of fastening conduit shall not be used. In locations where it is necessary, conduits, covers, and gaskets shall be furnished and installed by the Contractor.

Conduit used in the service installation above ground shall be GRC of the size specified on the plans or special provisions. In areas where the GRC is coupled to PVC conduit used for the underground portion of the service run, the joining of the two conduits shall take place 18 inches underground utilizing a GRC factory elbow.

The conduit shall be securely bonded to the service pole when deemed necessary by the Superintendent, and shall also be bonded in a like manner to the service pole ground system.

**TS-11 METHOD OF MEASUREMENT AND BASIS OF PAYMENT****A. General**

Separate Purchase Orders may be issued for individual work projects. All invoices by the Contractor for work done shall be itemized by work item and location, and shall reference the applicable Purchase Order.

Items listed as **Furnish and Install** shall mean that the Contractor shall furnish and install the item, and shall furnish all other materials, equipment, and labor to complete the item.

~~Items listed, as **Install** shall mean that the Contractor shall install the item, which will be furnished by the City at a point designated by the Superintendent. The Contractor shall be responsible for making arrangements with the Superintendent twenty-four hours in advance to pick up the item. The Contractor shall furnish all other materials, equipment, and labor to complete the item.~~

Items listed as **Remove** shall mean that the Contractor shall remove the item and return it to the City at the Municipal Service Center, 1300 AA@ Street, exercising care not to damage or lose the removed item. The Contractor shall furnish all materials, equipment, and labor to complete the item.

Items listed, as **Reset** shall mean that the Contractor shall remove the item and install it in its relocated position. The Contractor shall furnish all other materials, equipment, and labor to complete the item.

Items listed as **Replace** shall mean that the Contractor shall remove the existing item and return it to the City at the Municipal Service Center, exercising care not to damage or lose the removed item. The Contractor shall install in its place a similar but different item, as shown in the plans. The Contractor shall furnish all other materials, equipment, and labor to complete the item.

**B. Trench, Backfill, and Restore**

Trenching and backfilling shall not be paid for separately but included in the price of the conduit. Price and payment shall include all materials, equipment, and labor to remove and dispose of spoils and improvements, furnish and install backfill material, and replace and restore removed improvements.

**C. Trench and Backfill Only, No Restoration**

~~Trenching and backfilling will be paid for at the contract unit price per linear foot, measured from end point to end point. Price and payment shall include all materials, equipment, and labor to remove and dispose of spoils and improvements, and furnish and install backfill material. Restoration in this instance shall be coordinated and done by City crews, at City expense.~~

**D. Bored or Pushed Conduit (Furnish and Install)**

Bored or pushed conduit will be paid for at the contract unit price per linear foot, measured from end point to end point. Price and payment shall include furnishing and installing conduit as shown on the plans or as directed by the Superintendent.

**E. Conduit (Furnish and Install)**

Conduit installation will be paid for at the contract unit prices per linear foot. Prices and payment shall include furnishing and installing as shown on the plans or as directed by the Superintendent.

**F. Pot Holing (Remove and Restore)**

All potholes in concrete or asphalt shall be restored per MEGPEC Item 18.3.7 (special provision) that states Pot Holes "shall be filled with flow fill up to the bottom of the existing pavement. The rest of the hole shall be filled to within one quarter (1/4) inch of the finished grade with a non-shrink grout."

**G. Pull Box (Furnish and Install)**

Pull box installation will be paid for at the contract unit price per each. Price and payment shall include installation as shown on the plans or as directed by the Superintendent. Pull boxes shall be Quazite pull boxes with dimensions as specified in the plans.

**H. ~~Pull Box (Remove)~~**

~~Pull box removals will be paid for at the contract unit price per each. Price and payment shall include removing the pull box, backfilling the hole, and restoring the surface.~~

**I. ~~Pull Box (Reset)~~**

~~Pull box resets will be paid for at the contract unit price per each. Price and payment shall include removing the pull box, adjusting the elevation, reinstalling the pull box, and restoring the surface.~~

**J. ~~Water Valve Pull Box (Install)~~**

~~Water valve pull box shall be of cast iron (body and cover); installations will be paid for at the contract unit price per each. Price and payment shall include installation as shown on the plans and per City of Greeley Design Criteria and Construction Specifications Standards detail S-33.~~

**K. Cabinet Foundation (Furnish and Install)**

Cabinet foundations will be paid for at the contract unit price per each. Price and payment shall include forming the foundation, furnishing and placing the ground rod, placing the anchor bolts, and furnishing and pouring the concrete. Cabinet foundation may be of the fiberglass type at the discretion of the Superintendent.

**L. ~~Cabinet Foundation (Remove)~~**

~~Cabinet foundation removals will be paid for at the contract unit price per each. Price and payment shall include removing the foundation and step pad, backfilling the hole, and restoring the surface.~~

**M. Cabinet Step Pad (Furnish and Install)**

Cabinet step pads will be paid for at the contract unit price per each. Price and payment shall include a 36" x 36" x 4" concrete pad.

**N. Cabinet (Furnish and Install)**

Cabinet (332D CDOT spec) will be paid for at the contract unit price per each including the cost of the traffic signal controller and UPS unit. Price and payment shall include mounting the cabinet on the base and making all connections to render the cabinet fully operable. The traffic controller shall be a 170 ATC Coldfire Controller with 750 Intersection Control Software. The cabinet shall contain a Clary UPS unit and generator connector.

**O. Cabinet (Remove)**

~~Cabinet removals will be paid for at the contract unit price per each. Price and payment shall include removing the controller from its mounting, and removing all disconnect equipment at the service point.~~

**P. Cabinet (Reset)**

~~Cabinet resets will be paid for at the contract unit price per each. Price and payment shall include removing the controller from its existing foundation, removing the existing foundation and step pad, backfilling the hole, restoring the surface, furnishing and installing a replacement foundation, installing the controller on the replacement foundation, and making all connections to render the reset controller fully operable.~~

**Q. Mast Arm Pole or Combination Pole (Furnish and Install)**

Mast arm pole or combination mast arm and street light pole installations will be paid for at the contract unit price per each. Price and payment shall include furnishing and installing either a precast or field-poured foundation in conformance with current City of Greeley Standards or Colorado Department of Transportation Standards, the traffic signal pole and associated mast arm as shown on the plans.

**R. Mast Arm Pole or Combination Pole (Remove)**

~~Combination pole or mast arm pole removals will be paid for at the contract unit price per each. Price and payment shall include the following: remove the pole from the foundation, completely remove the foundation, backfill the hole, and restore the surface.~~

**S. Pedestal Pole (Furnish and Install)**

Pedestal pole installations will be paid for at the contract unit prices per each for each size listed. Prices and payment shall include furnishing and installing a concrete foundation with two 2-inch conduits, furnishing and installing the ground rod, and installing the pole as shown on the plans.

**T. Pedestal Pole (Remove)**

~~Pedestal pole removals will be paid for at the contract unit price per each. Price and payment shall include removing the pole from the foundation, completely removing the foundation, backfilling the hole, and restoring the surface.~~

**U. Strain Pole (Furnish and Install)**

~~Strain pole installations will be paid for at the contract unit price per each. Price and payment shall include furnishing and installing either a precast or field-poured foundation in conformance with current Colorado Department of Transportation Standards, furnishing and installing the pole, and furnishing and installing stabilizing cable and all other materials to complete the installation.~~

**V. Strain Pole (Remove)**

~~Strain pole removals will be paid for at the contract unit price per each. Price and payment shall include removing all span wires, completely removing the strain pole from the ground without cutting, completely removing the concrete foundation from the pole and ground, backfilling the hole, and restoring the surface.~~

**W. Span Wire for Strain Pole (Furnish and Install)**

~~Span wire will be paid for at the contract unit price per linear foot. Price and payment shall include furnishing and installing span wire in conformance with current Colorado Department of Transportation Standards.~~

**X. Mast Arm (Install)**

~~Mast arm installations will be paid for at the contract unit prices per each for each size listed. Prices and payment shall include mounting each mast arm and any attached signage as shown on the plans. All signage shall be provided by the City, and shall be mounted in place by the contractor at the time the mast arm becomes operational. A nylon pull rope shall run continuously from the mast arm end signal head to the hand hole.~~

**Y. Mast Arm (Remove)**

~~Mast arm removals will be paid for at the contract unit price per each. Price and payment shall include the removal of any existing signage.~~

**Z. Mast Arm (Reset)**

~~Mast arm resets will be paid for at the contract unit price per each. Price and payment shall include making all connections to render the reset mast arm fully operable, and reattaching all signage.~~

**AA. Traffic Signal Head (Furnish and Install)**

Traffic signal head installations will be paid for at the contract unit price per each. Price and payment shall include making sure all hardware in and out of the head is tight, assembling and attaching all mounting hardware, mounting the signal head as shown on the plans (including back plate), furnishing and installing the cable to the pole base hand hole, and all splices and connections to render the traffic signal head fully operable. Signal heads shall be mounted 18' from the bottom of the signal head to pavement crown (left most head) when installed on the mast arm, the remaining heads on the arm to be level with this head. Side of pole signal heads to be 10' from the bottom of the head to grade.

Pedestrian signal heads to be 8' from the bottom of the head to grade. Side of Pole Signals shall be mounted using 3/4" Band-it. Holes to facilitate wiring of signal and pedestrian heads are to be drilled and shall be a minimum of 3/4" in diameter. All holes will be deburred by filing with rat-tail file. Traffic signal heads shall be McCain traffic signal heads.

**BB. Traffic Signal Head (Remove)**

Traffic signal head removals will be paid for at the contract unit price per each.

**CC. Pedestrian Push-button Assembly (Furnish and Install)**

Push-button assembly installations will be paid for at the contract unit price per each. Price and payment shall include furnishing, mounting the push-button assembly and making all connections to render the push-button fully operable. Buttons shall be mounted 38" from the bottom of the base. Mounting of the assembly shall be by drilling and tapping 1/4" X 20 holes and the hole for wiring shall be drilled a minimum of 3/4" diameter. Pedestrian push buttons shall be Polara 2 wire iCCU Rack Mount Central Control Unit 330 type push buttons.

**DD. Pedestrian Push-button Assembly (Remove)**

~~Push-button assembly removals will be paid for at the contract unit price per each.~~

**EE. Pedestrian Instructional Sign (Furnish and Install)**

~~Pedestrian instructional sign shall not be paid for separately but included in the cost of the pedestrian push button. Price and payment shall include the following: drill and tap holes for 5/16" screws provided with the sign, and mount 9" x 12" sign, as shown on the plans.~~

**FF. Saw cut Loop Detector (Furnish and Install)**

~~Loop detectors will be paid for at the contract unit price per linear foot of Saw cut. Price and payment shall include the following: Saw cut the pavement, furnish and install the wire, and furnish and install a Saw cut sealant approved by the Supervisor.~~

**GG. Surface Applied Loop Detector (Furnish and Install)**

~~Loop detectors will be paid for at the contract unit price per linear foot of loop design. Price and payment shall include furnishing all materials necessary to place, secure, and seal the wire.~~

**HH. Micro loop Detector (Install)**

~~Micro loop detector installation will be paid for at the contract unit price per each. Price and payment shall include drilling the installation hole, installing the Micro loop, and sealing the hole.~~

**II. Loop Detector Lead-In Wire, One-Pair (Furnish and Install)**

~~Loop detector lead-in wire will be paid for at the contract unit price per linear foot from the splice point nearest the detector to the controller. Price and payment shall include furnishing and installing the wire, furnishing and installing a "3M DBY" seal kit and connecting to the controller.~~

**JJ. Loop Detector Lead-In Wire, Multi-Pair (Furnish and Install)**

~~Loop detector lead-in wire will be paid for at the contract unit price per linear foot from the splice point nearest the detector to the controller. Price and payment shall include furnishing and installing the wire; furnishing and installing a "3M DBY" splice kit and connecting to the controller.~~

**KK. Pedestrian Push-button Lead-In Wire (Furnish and Install)**

~~Pedestrian push-button lead-in wire will be paid for at the contract unit price per linear foot, measured from the termination at the push-button assembly to the controller termination. Price and payment shall include making all connections to render the item fully operable. All wiring shall be paid for as a lump sum under the Wiring item.~~

**LL. Multi Conductor (Furnish and Install)**

~~Multi conductor will be paid for at the contract unit price per linear foot, measured from the controller to the final hand hole splice prior. (Multi conductor from the final hand hole splice to the signal head is included in signal head installation unit pricing.) Price and payment shall include making all connections to render the item fully operable. All wiring shall be paid for as a lump sum under the Wiring item.~~

**MM. Grounding and Bonding Wire (Furnish and Install)**

# 8 AWG CU stranded wire will be paid for at the contract unit price per linear foot, measured from pull box to pull box and multiplied times the number of conduits. All wiring shall be paid for as a lump sum under the Wiring item.

**NN. Service Entrance Wire (Furnish and Install)**

One each black and white # 6 AWG CU stranded will be paid for at the contract unit price per linear foot, measured from the Utility termination point to the cabinet. All wiring shall be paid for as a lump sum under the Wiring item.

**OO. Fire Preemption Unit and Timer (Furnish and Install)**

Fire Preemption Unit and Timer installations will be paid for at the contract unit price per each. Price and payment shall include making all connections and configurations to render the item fully operable. The unit and timer shall use Global Traffic Technologies 722 dual-channel detectors and 764 Phase Selector card. The cost of the item shall also include troubleshooting services for 30 days after the traffic signal is operational.

**PP. Fire Preemption Unit Lead-In Wire (Furnish and Install)**

Fire Preemption unit lead-in wire shall not be paid for separately but shall be included in the cost of the Fire Preemption Unit and Timer. Price and payment shall include furnishing and installing the wire and making all terminations necessary to make the Fire Preemption Unit fully operable. All fire preemption unit lead-in wire shall be continuous and unspliced.

**QQ. LED Signal Indication (Furnish and Install)**

LED signal indication will be paid for at the contract unit price per each. Price and payment shall include removing the incandescent lamp and reflector if necessary, and installing the LED assembly.

**RR. Intersection Detection System (Radar) (Furnish and Install)**

Intersection detection system (Radar) installations will be paid for at the contract unit price per each. Price and payment shall include making all connections and configurations to render the item fully operable. The system shall be Wavetronix SmartSensor Matrix radar detection. The cost of the item shall also include troubleshooting services for 30 days after the traffic signal is operational.

**SS. Radar Detection Cabling (Furnish and Install)**

Video detection cables will not be paid for separately but shall be included in the cost of the Intersection Detection System (Radar). Price and payment shall include installing the wire as shown on the plans or as directed by the Superintendent.

**TT. Communication Radio (Furnish and Install)**

Communication Radio installations will be paid for at the contract unit price per each. Price and payment shall include making all connections to render the item fully operable. The communication radio shall be a Encom 5.8 GHz Broadband radio and antenna.

**END OF SECTION**

**TRAFFIC SIGNAL CONTROLLER CABINET****REVISION OF SECTION 614  
TRAFFIC SIGNAL CONTROLLER CABINET**

This item will use the CDOT Standard Specifications for Road and Bridge Construction Section 614 and is hereby revised for this project as follows:

Section 614 of the Standard Specifications is hereby revised for projects as follows:

Subsection 614.08 shall include the following:

**Traffic Signal Materials**

(b) *Traffic Signal Controllers – General.* The traffic signal controller shall be a McCain 170 ATC ColdFire controller with 750 Intersection Control software.

(c) *Controller Cabinets.* The controller cabinet assembly shall consist of a 332D cabinet, controller, Clary UPS, backup generator connection, and all necessary auxiliary equipment to provide the operation shown on the plans. The cabinet shall be natural aluminum with anchor bolts in accordance with the FHWA-IP-78-16 specification. The input files shall meet the requirements of the split input file below. Unless otherwise specified in the Contract, the cabinet shall include the following:

<i>Quantity</i>	<i>Item</i>
1 ea.	McCain 170 ATC ColdFire controller with 750 control software
2 ea.	Internal (front/back) fluorescent lamps
4 ea.	Corbin Locks
4 ea.	Fan Assemblies
1 ea.	PDA #2 2/206-L Power Supply
2 ea.	Standard Split Input File
4 ea.	Model 430 Transfer Relays
2 ea.	Model 204 2-Circuit Flasher (cube type, 25 AMP output)
12 ea.	Model 200 Load Switch (cube type, 25 AMP output)
3 ea.	Model 242 DC Isolators
1 ea.	Model 2010ECL Monitor with absence of red monitoring.
1 ea.	New York 330 Pull-out Drawer Assembly
1 ea.	Auxiliary Detector Termination Panel Assembly
1 ea.	Transient Voltage Surge Suppression System
1 ea.	Output file with Terminal Strip
4 ea.	Anchor Bolts
6 ea.	Model 222 Loop Amplifiers
1 ea.	Traffic UPS (see Specifications below)

Additional provisions for the 332D cabinet shall include:

- 2 each Split Input File
- 1 each Additional New York Pull-out drawer Assembly
- 1 each Traffic UPS (see Specifications below)
- Cabinet dimensions: 67" H X 49" W X 30" D
- Cabinet shall have four (4) doors (2 full size front and 2 full size back) and Corbin #2 Locks.
- Door Stops: 90 degree (+/- 10 degree) each door top and 90 degree and 180 degree (+/- 10 degree) each door bottom
- The left side of the 332D cabinet assembly shall have shelves assembled to the EIA rack assembly to house additional equipment such as, but not limited to, Video Detection, Standby Uninterrupted Power supply and communication equipment.

The cabinet shall have a natural aluminum finish.

The output file shall have a terminal strip capable of a minimum of eight phases.

Surge suppression for the field wiring shall be installed on the back of the output file. This shall include devices for a 9-position 5-mm panel and plug. Through panel part #071024 and 9-position plug parts # 1778056. Each plug shall have six 50 joule, 150 V movistors, or as a covered sealed unit.

The power distribution assembly shall be the PDA No. 2. The PDA No. 2 shall have field circuit breakers 1–6 to provide 15 amperes of operating AC current to the field load switches. If one of the field breakers is set off, the indicating switch shall place power on the MC coil and FTR coils causing a flashing operation. All cabinets shall have a shield over the circuit breakers to protect from accidentally being turned off. The shield will be such that the technician will still be able to view and reset the switch without removing the shield.

*Red Monitoring.* A 20-conductor cable assembly for monitoring the red outputs of all signal load switches shall be provided and mounted to the back-panel assembly. The cable shall be routed to the front of the assembly and be plugged into the connector on the front of the conflict monitor.

A means of selecting the active red monitor channel shall be provided on the rear of the monitor panel. Selections shall be accomplished by means of a two position jumper (shunt) with the center position wired to a red monitor input and select of 115 VAC to the right and red load switch output to the left. Moving the jumper to the right will provide continuous red input and override, while moving the jumper to the left will attach the monitor channel to the corresponding load switch output.

The jumper assembly shall be accessible while the intersection is in operation. Means shall be provided to prevent shock to personnel operating jumper selection devices.

A minimum of 12 selections is required, eight phase selections and four overlap selections shall be provided with jumper selections.

Red monitoring disable control shall be provided within the red monitor cable assembly. Pin six on TB02 shall connect to a 24 VDC relay coil. This relay is designated RM control relay. The normally closed contacts shall provide 115 VAC to the red monitor select line and pin 17 on the monitor cable. When a logic ground signal is applied to TB02-6 the RM relay shall energize and open the cable. The relay power will be derived from the cabinet 24 VDC cabinet power supply.

*Transient protection.* Electrical characteristics of the device that will be used for series transient protection on the 332, 332D and 336S cabinet systems shall include tests run using a Velonex 587 surge generator and Tektronix oscilloscope type 2430 or equivalent hardware. Using ANSI/IEEE.062.41-1980 waveforms for normal mode and common mode ring wave and impulse tests, each unit shall comply with the following minimum characteristics:

- (1) Clamping level 400V peak normal mode and 500V peak common mode. Trace photos and other test related information will be available upon request.
- (2) EMI/EFI noise rejection derived via standardized 50 ohm insertion loss tests shall have amplitude of at least –20dB over a minimum spectrum from 50 kHz with a –40dB being the most desirable.
- (3) Diagnostics indicators shall clearly display the status of the suppression circuit. The indication shall warn of the loss of protection.
- (4) Transient energy suppression shall be in excess of 250 joules.
- (5) Rated voltage is 120 VAC with rated output current minimum 10 amperes single-phase operation.



*Split Input File.* The split input file shall be an SF 170 that will operate in the 332, 332D or the 336S cabinet.

The split input file shall use the same form factors as the present (older) input file and shall be completely interchangeable with these older input files except as follows.

The input file shall use a split 22-pin connector (2 rows of 22 pins), which provide for 44 unique contacts, rather than the 22 double contacts as provided by the former input file. This design shall interface electrically with the older 2 and 4 channel devices available under the 170 and NEMA TS1 specifications as well as the newer 2 and 4 channel devices as specified in the TS2 NEMA specifications.

The input file shall be divided into two partitions. The first partition shall include the first eight slots from the left; the second partition shall include the next six slots. All 14 slots shall be able to be tied to one common communications drop if desired.

The serial/TTL Transmit and receive pairs shall be wired across the back panel. TXO, DXO, and Ground0 serve the first eight slots; TX1, DX1 and Ground1 serve the next six slots. Back plane addressing is automatically assigned in the rear of the input file, such that:

Slot 1 = Address 0

Slot 2 = Address 1. . . Slot 8 = Address 7 (all three lines low)

Addressing from the front of any input device shall override the back plane addressing.

Serial connections shall use a standard quick lock connection.

Beau 5.08-mm pluggable PCB terminal Block & Header (Eurostyle) shall be used for all field termination points on the back of the input file. There shall be 3 headers soldered and fastened to the input file PCB for each slot assignment. Three (3) terminal blocks shall plug into the headers of each slot assignment. Two of the blocks shall have 5 termination points and the third shall have 4 termination points. The 4-position plug shall terminate inputs from the 57-pin Amp connector. The 5 position plugs shall terminate all field terminal connections from field wiring. Channel 1 shall be on one 5-position plug and channel 2 on the other 5-position plug. Each five-position plug shall daisy chain the loop input to allow for more than one twisted pair connection point. The plugs shall be configured and attached to the header in the following manner:

<i>SP</i>	<i>Spare</i>
<i>SP</i>	<i>Spare</i>
<i>F</i>	<i>Channel 1 output</i>
<i>W</i>	<i>Channel 2 output</i>

<i>D</i>	<i>Channel 1 Loop</i>
<i>E</i>	
<i>D</i>	<i>Channel 1 Loop</i>
<i>E</i>	
<i>L</i>	<i>Equipment Gnd.</i>

<i>J</i>	<i>Channel 2 Loop</i>
<i>K</i>	
<i>J</i>	<i>Channel 2 Loop</i>
<i>K</i>	
<i>L</i>	<i>Equipment Gnd.</i>

A strain release bar shall be added and fastened with thumbscrews for tie wrapping input circuits from the field loops. The strain release bar shall be in a horizontal plain located at the bottom of the input file and mounted in such a way as to not interfere with the Amp connector mounting or field input wiring.

Surge suppression for the field wiring shall be installed on the back of the input file. Each plug shall have a 50 joule, 150 V movistors, or as a covered sealed unit.

Uninterrupted Power Supply (UPS) - The 332D shall have a Clary UPS as specified below rack mounted in the left cabinet.

#### 1.0 Operation

- A. The Traffic UPS shall be capable of producing – simultaneously -- fully regenerated, conditioned and true sine wave, standby and continuous AC outputs.
- B. Suggested operating mode for respective outputs during power failure: Continuous output provided for signal controllers and modems; Standby output provided for signals in flash mode operation (optional delay timer available for short-term battery run under full cycling operation).
- C. Up to the maximum rating, the Traffic UPS shall be capable of running any combination of signal heads, whether Incandescent, LED or Neon, by any manufacturer, regardless of power factor, without overdriving the poorer power factor LED heads which may cause early degradation, low luminosity or early signal failure.
- D. Upon loss of utility power the Traffic UPS shall insert battery power into the system via a supplied Power Interface Module (PIM). In case of UPS failure and/or battery depletion, the PIM will ensure that the UPS will drop out and, upon return of utility power, the traffic control system will default to normal operating mode.
- E. The Power Interface Module shall enable removal and replacement of the Traffic UPS without shutting down the traffic control system (i.e. “hot swap” capability). Connectors shall be equipped with a “safety interlock” feature.
- F. For 170 or “California” style cabinets, upon loss of power the Traffic UPS shall actuate the existing Flash Transfer Relays (FTRs) and Mercury Contactor (MC) to force the traffic control system into Flash Mode operation.
- G. Existing Flasher Modules and Flash Transfer Relays shall be utilized.
- H. To facilitate emergency crews and police activities, the Traffic UPS shall be compatible with police panel functions (i.e. “Signals OFF” switch must kill power to the field wiring even when on UPS/Battery power).
- I. The Traffic UPS shall not duplicate or take over flash operation or flash transfer relay functions.
- J. The Traffic UPS shall be capable of providing continuous, fully conditioned, regulated, sinusoidal (AC) power to selected devices such as signal controllers, modems, communications hubs, NTCIP adapters and video equipment.

#### 2.0 Description

The Traffic UPS shall consist of three major components, the Electronics Module, the Power Interface Module, and the Battery System.

The Electronics Module shall consist of the following:

- A. True sine wave, high frequency inverter utilizing IGBT technology,
- B. 3-stage, temperature compensated, battery charger,
- C. For connection from the Electronics Module to the Power Interface Module and Battery System, dedicated harnesses shall be provided with quick-release, keyed, circular connectors and braided nylon sleeving over all conductors,
- D. local and remote control of UPS functions,
- E. local and remote communications capabilities,
- F. and be capable of accepting an NTCIP-ready adapter or a Wireless broadband Radio modem.
- G. Separate Power Interface Module (PIM) for inserting power safely and reliably.

#### 2.1 Mounting/ Configuration

- 2.1.1 NEMA Style: mounting method shall be shelf-mount or wall-mount.

- 2.1.2 170 Style: mounting method shall be 19" rack-mount. Shelf angles or rails, typically supplied by others, are available as optional accessories.
- 2.1.3 External: A separate, stand-alone, pad-mounted, outdoor (NEMA 3R) enclosure shall be available should there be inadequate room in the signal cabinet or should the consulting/traffic engineer prefer independent, external mounting.
- 2.2 Battery System
- 2.2.1 The battery shall be comprised of extreme temperature, deep cycle, AGM/VRLA (Absorbed Glass Mat/ Valve Regulated Lead Acid) batteries that have been field proven and tested by the U.S. military.
- 2.2.2 The battery system shall consist of one or more strings (typically 4 or 6 batteries per string) of extreme temperature, deep cycle, AGM/VRLA (Absorbed Glass Mat/ Valve Regulated Lead Acid) batteries such as Clary Outpost™ batteries or equivalent.
- 2.2.3 Batteries shall be certified to operate at extreme temperatures from  $-40^{\circ}\text{C}$  to  $+74^{\circ}\text{C}$ .
- 2.2.4 The batteries shall be provided with appropriate interconnect wiring and a corrosion-resistant mounting trays and/or brackets appropriate for the cabinet into which they will be installed.
- 2.2.5 The interconnect cable shall be protected with abrasion-resistant nylon sheathing.
- 2.2.6 The interconnect cable shall connect to the base module via a quick-release circular connector.
- 2.2.7 For purposes of safety and proper operation, the circular battery connector shall have interlocking pins to prevent turn-on if batteries are not connected, and to shut off the UPS should the batteries be disconnected.
- 2.2.8 Battery construction shall include heavy-duty, inter-cell connections for low-impedance between cells, and heavy-duty plates to withstand shock and vibration.
- 2.2.9 The top cover shall use tongue and groove construction and shall be epoxied to the battery case for maximum strength and durability.
- 2.2.10 An optional lifting handle shall be available on most battery models.
- 3.0 Electrical Specifications
- 3.1 Input Specification
- |                           |                                |
|---------------------------|--------------------------------|
| Nominal Input Voltage     | 120 VAC, Single Phase          |
| Input Voltage Range       | 85 VAC to 140 VAC              |
| Input Frequency           | 50 or 60 Hz (+/- 5%)           |
| Input Configuration       | 3 Wire (Hot, Neutral & Ground) |
| Input Current (Max. draw) | 7.2 amps, Power-Factor         |
| Corrected                 |                                |
| Input Protection          | Input Fuse (12 amps)           |
- 3.2 Output Specification
- |                           |   |
|---------------------------|---|
| Nominal Output Voltage    | 120 VAC, Single Phase   |
| Power Rating              | 1 kVA (1000VA/700W)   |
| Output Voltage Regulation | +/- 2% for 100% step load change and from High battery to Low battery condition |
| Output Frequency          | 50 or 60 Hz (+/- 5%)  |
| Output Configuration      | Keyed, circular connectors and duplex receptacle                                |
| Output Wave Form          | True Sinewave   |
| Overload capability       | 110% for 10 minutes<br>200% for ½ second  |
| Fault clearing            | Current limit and automatic shutdown  |
| Short circuit protection  | Current limit and automatic shutdown  |
| Efficiency                | 85% at full load  |
| Load Power Factor         | .7 lagging through unity to .7 leading  |

## 4.0 Physical Specifications, UPS Electronics Module

## 4.1 Dimensions:

Rack-mount: Width = 19", Depth = 12", Height = 3.5" (2U)

Shelf-mount: Width = 19", Depth = 12", Height = 3.5"

Wall-mount/Unistrut Rail mount: Width = 6.9", Depth = 9.5", Height = 16"

Separate Power-Interface Module = Width = 6", Depth = 2.8", Height = 9"

## 4.2 Weight: UPS: 20 lbs., Shipping weight: 25 lbs.

## 5.0 Environmental Specifications

5.1 The UPS shall meet or exceed NEMA temperature standards from  $-40^{\circ}\text{C}$  to  $+74^{\circ}\text{C}$ .

5.2 The UPS shall be certified and field proven to meet or exceed NEMA temperature standards. A certificate of compliance shall be made available upon request.

## 6.0 Battery Specifications

6.1 The battery system shall be certified and field proven to meet or exceed NEMA temperature standards from  $-40^{\circ}\text{C}$  to  $+74^{\circ}\text{C}$ .

6.2 Ampere-Hour ratings (see table 1)

6.3 Hydrogen gas emissions: must meet Mil-Spec #MIL-B-8565J

6.4 Dimensions: (see table 1)

6.5 Weights: (see table 1)

Table 1.

		Estimated Runtime (assumes $77^{\circ}\text{F}$ / $25^{\circ}\text{C}$ , to 1.75 volts per cell).			Unit Weight	Overall Dimensions Per Battery Inches(cm.)		
	Volts/A-hrs.	200 Watts	400 Watts	800 Watts	Lbs. (Kg.)	Length L	Width W	Height H
	12 VDC/ 16 A-h	3.5 Hrs.	1.73 Hrs.	52 Min.	14.7 (6.7)	7.27 (18.46)	3.11 (7.89)	6.67 (16.93)
	12 VDC/ 31 A-h	8.8 Hrs.	3.8 Hrs.	1.8 Hrs.	23 (10.5)	7.68 (19.51)	5.15 (13.08)	7.22 (18.34)
	12 VDC/ 39 A-h	11.3 Hrs.	5.5 Hrs.	2.3 Hrs.	29 (13.2)	7.68 (19.51)	5.15 (13.08)	8.50 (21.59)
	12 VDC/ 48 A-h	13.7 Hrs.	6.7 Hrs.	2.9 Hrs.	32 (14.5)	9.41 (23.90)	5.22 (13.26)	9.35 (23.75)

\*OP72X battery sets include **six (6)** batteries per set. Wired in series, each set provides 72 VDC.

## 7.0 Communications, Controls &amp; Diagnostics

7.1 Alarm Function Monitoring: The traffic UPS shall come standard with a DB-9F connector with open collectors (40 V @ 20 mA) indicating:

7.1.1 Loss of Utility Power,

7.1.2 Inverter Failure, and

7.1.3 Low Battery.

7.2 An RS232 Interface shall be provided via a DB-9F connector allowing full, interactive, remote computer monitoring and control of the UPS functions.

7.3 Front Panel controls: Power ON, Cold (DC) Start, Alarm Silence, Battery Test, Bypass Breaker, and DC/Battery Breaker.

#### 8.0 Reliability

8.1 Calculated MTBF is 100,000 hours based on component ratings.

8.2 When Bypass and Power Interface Module are included, system MTBF increases to 150,000 hours.

#### 9.0 Options

9.1 Battery Tray to hold six (6) OP72A batteries, up to four (4) OP72B or OP72C batteries, and up to three (3) OP72D batteries. Tray is 19" wide for use in 170 type cabinets and mounts on standard RETMA rails.

9.2 Swing-out Battery Box, mounts on right rail inside back door of 170 type cabinets. Box is designed to hold six (6) OP72A batteries, up to four (4) OP72B or OP72C batteries, and up to three (3) OP72D batteries.

9.3 Adjustable Delay-timer to provide up to 10 hours of full cycling while on battery before switching to flash mode (only available where 100% low-power/LED signals and ped heads are used). Batteries must be sized properly to fully utilize this feature.

9.4 Service pedestal-mounting option.

9.5 One-shot ground pulse to trigger External Start upon return of AC power.

9.6 Dial-out modem for wireless or land line communication

9.7 Enhanced battery charger provides accelerated charging capacity (contact factory for details and proper application).

#### 10.0 Serviceability & Maintainability

10.1 MTTR (Mean-Time-To-Replace or Repair)

10.1.1 Electronics: 15 minutes or less

10.1.2 Battery System: 15 minutes or less

#### 11.0 Warranty

Standard warranty terms cover entire Traffic UPS including battery. Terms are one-year parts and labor with labor F.O.B. factory.

All of the above components provided on the project, excluding the signal monitor unit, shall be on the Colorado Qualified Products listing.

### METHOD OF MEASUREMENT

All labor, materials, and equipment necessary for the Traffic Signal Controller Cabinet will be measured by the number of cabinets installed.

### BASIS OF PAYMENT

Payment will be under:

#### Pay Item

Traffic Signal Controller Cabinet

#### Pay Unit

Each

Payment will be full compensation for all labor, materials and equipment required to complete the work.

### END OF SECTION

**IRRIGATION**CITY OF GREELEY  
BASELINE IRRIGATION SPECIFICATION

## SECTION 02810 – IRRIGATION

PART 1 - GENERAL

## 1.01. SCOPE:

Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein. Items of work specifically included are:

- I. Procurement of all applicable licenses, permits, and fees.
- II. Coordination of Utility Locates ("Utility Notification Center").
- III. Connection of electrical power supply to the irrigation control system.
- IV. Sleeving for irrigation pipe and wire.
- V. Preparation of Record Drawings.
- VI. Spring start-up and winterization.
- VII. Maintenance period.

## 1.02. WORK NOT INCLUDED:

Items of work specifically excluded or covered under other sections are:

- I. Provision of electrical power supply to the irrigation control system.
- II. Provision for water to the site (water meter).

## 1.03. SUBMITTALS:

- I. The Contractor must submit to the Owner's Representative one PDF copy of all submittals to the Owner's Representative within 10 working days from the date of Notice to Proceed. Provide table of contents and index sheet. Provide sections that are indexed for different components and labeled with the specification section number and the name of the component. Submittals must be made for all the components on the material list. Indicate which items are being supplied on the catalog cut sheets when multiple items are shown on one sheet. Submittal package must be complete prior to being reviewed by the Owner's Representative. Incomplete submittals will be returned without review.
- II. Materials List: Include sleeving, pipe, fittings, mainline components, sprinkler, drip irrigation components, control system components, shop drawings and all other components shown on the drawings and installation details or described herein. Components such as pipe sealant, wire, wire connectors, ID tags, etc. must be included. Quantities of materials need not be included.
- III. Manufacturers' Data: Submit manufacturers' catalog cuts, specifications, and operating instructions for equipment shown on the materials list.

- IV. Shop Drawings: Submit shop drawings called for in the installation details. Show products required for proper installation, their relative locations, and critical dimensions. Note modifications to the installation detail.
- V. The following items are required to receive Baseline's installation verification and warranty verification: Baseline's Controller and Communications. Prior to final acceptance of the project, the contractor shall be responsible for contacting and coordinating installation verification for any and all of the aforementioned products required by and installed on this project. Prior to starting work on this project, the contractor shall contact an authorized Baseline Distributer, and conduct an on-site meeting with the Baseline representative and a City representative to coordinate all required verification services in a timely manner, to include Radio Site Survey and equipment needs. The contractor shall provide documentation of this meeting to the City of Greeley. Prior to final acceptance of the work, the contractor shall provide proof of installation verification of all required equipment by the authorized Baseline representative to the City of Greeley.

1.04. RULES AND REGULATIONS:

- I. Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws and regulations of the governing authorities.
- II. When the contract documents call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.
- III. If quantities are provided either in these specifications or on the drawings, these quantities are provided for information only, it is the Contractor's responsibility to determine the actual quantities of all material, equipment, and supplies required by the project and to complete an independent estimate of quantities and wastage.

1.05. QUALITY ASSURANCE:

- I. Engage an experienced Installer who has completed irrigation work similar in material, design, and extent to that indicated for this project and with a record of successful irrigation installations.
- II. Installer's Field Supervision: Field supervision shall be on site, full time during installation. Field supervisor shall have at least 5 years experience in 2 wire installation.

1.06. TESTING:

- I. Notify the Owner's Representative three days in advance of testing.
- II. Pipelines jointed with rubber gaskets or threaded connections may be subjected to a pressure test at any time after partial completion of backfill. Pipelines jointed with solvent-welded PVC joints shall be allowed to cure at least 24 hours before testing.
- III. Subsections of mainline pipe may be tested independently, subject to the review of the Owner's Representative.
- IV. Furnish clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests. Pressure gauge resolution must be suitable for recording losses less than 5 psi.
- V. All costs, including travel expenses for site visits by the Project Manager, for any reinspection that may be required due to non-compliance with the Construction Documents shall be the sole responsibility of the Contractor.

## VI. Hydrostatic Pressure Test (Solvent Weld Mainline Pipe):

- A. Subject mainline pipe to a hydrostatic pressure equal to 140 PSI for two hours. Test with mainline components installed.
- B. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
- C. Expose all remote control valves their riser pipe and service tee fittings.
- D. Purge air from mainline pipe before test. Attach pressure gauge to mainline pipe in test section.
- E. Observe pressure loss on pressure gauge. If pressure loss is greater than 5 PSI, identify reason for pressure loss. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until pressure loss is equal to or less than 5 PSI.
- F. Visually inspect irrigation pipe for leakage and replace defective pipe, fittings, joint, valve, or appurtenance. Repeat test until pipe passes test.
- G. Cement or caulking to seal leaks is prohibited.

## VII. Volumetric Leakage Test:

- A. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
- B. Purge air from pipeline before test.
- C. Subject mainline pipe to 140 PSI for two hours. Maintain constant pressure.
- D. Provide all necessary pumps, bypass piping, storage tanks, meters, 3-inch test gauge, supply piping, and fittings in order to properly perform testing.
- E. Testing pump must provide a continuous 140-PSI to the mainline. Allowable deviation in test pressure is 5-PSI during test period. Restore test pressure to 140-PSI at end of test.
- F. Water added to mainline pipe must be measured volumetrically to nearest 0.10 gallons.
- G. Use the following table to determine maximum allowable volume lost during test:

Leakage Allowable (Gallons per (100 Joints) / Hour)

Pipe Size (INCHES)	Test Pressure (PSI)								
	60	70	80	90	100	110	120	130	140
2 ½"	0.39	0.42	0.45	0.48	0.51	0.53	0.56	0.58	0.61
3"	0.48	0.51	0.55	0.58	0.62	0.65	0.68	0.70	0.73
4"	0.62	0.66	0.71	0.75	0.80	0.84	0.87	0.91	0.94
6"	0.90	0.97	1.04	1.11	1.18	1.23	1.29	1.34	1.40

## VIII. Operational Test:

- A. Activate each remote control valve in sequence from controller. The Owner's Representative will visually observe operation, water application patterns, and leakage.
- B. Replace defective remote control valve, solenoid, wiring, or appurtenance to correct operational deficiencies.
- C. Replace, adjust, or move water emission devices to correct operational or coverage deficiencies.
- D. Replace defective pipe, fitting, joint, valve, sprinkler, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.
- E. Repeat test(s) until each lateral passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to the Owner.



## IX. Control System Acceptance Test:

- A. Upon completion of construction, City of Greeley Parks Department Representatives will administer a System Acceptance Test.
- B. Following construction completion and a Review by the Project Manager, an evaluation period will begin. After 30 days of continuous service without major system problems, the system will be accepted and the guarantee/warranty period will begin. If at any time during the 30-day evaluation period, a major system problem occurs, the source of the problem will be determined and corrected and the 30-day evaluation period will start again. Equipment will not be accepted until such time as the System Acceptance Test is passed.
- C. If successful completion of the System Acceptance Test is not attained within 90 days following commencement of the evaluation period, the Project Manager has the option to request replacement of equipment, terminate the order, or portions thereof, or continue with the System Acceptance Test. These options will remain in effect until such time as a successful completion of the System Acceptance Test.
- D. Final payment will be made after successful completion of the System Acceptance Test.

## X. Control System Grounding:

- A. Test for proper grounding of control system per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
- B. Replace defective wire, grounding rod, or appurtenances. Repeat the test until the manufacturer's guidelines are met.

## 1.07. CONSTRUCTION REVIEW:

The purpose of on-site reviews by the Owner's Representative is to periodically observe the work in progress, the Contractor's interpretation of the construction documents, and to address questions with regard to the installation.

- I. Scheduled reviews such as those for irrigation system layout or testing must be scheduled with the Project Manager as required by these specifications.
- II. Impromptu reviews may occur at any time during the project.
- III. A review will occur at the completion of the irrigation system installation and Project Record Drawing submittal.

## 1.08. COORDINATION AND SCHEDULING:

The irrigation construction schedule is to be provided at the Pre-Construction meeting depicting the dates the various stages of the project will start and when they will be completed.

## 1.09. GUARANTEE/WARRANTY AND REPLACEMENT:

The purpose of this guarantee/warranty is to insure that the Owner receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner.

- I. For a period of one year from commencement of the formal maintenance period, guarantee/warranty irrigation materials, equipment, and workmanship against defects. Fill and repair depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by a defective item. Make repairs within seven days of notification from the Owner's Representative.
- II. Contract documents govern replacements identically as with new work. Make replacements at no additional cost to the contract price.

- III. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

## PART 2 - MATERIALS

### 2.01. QUALITY:

Use materials that are new and without flaws or defects of any type, and which are the best of their class and kind.

### 2.02. SUBSTITUTIONS:

- I. Alternative equipment must be approved by the Engineer prior to bidding. The Contractor is responsible for making any changes to the design to accommodate alternative equipment.
- II. Pipe sizes referenced in the construction documents are minimum sizes. Any changes to pipe sizes must be approved by Engineer prior to construction.

### 2.03. SLEEVING:

- I. Install a separate sleeve beneath paved areas to route each run of irrigation pipe or wiring bundle.
- II. Sleeving material beneath pedestrian pavements shall be PVC Class 200 pipe with solvent welded joints.
- III. Sleeving beneath drives and streets shall be PVC Class 200 pipe with solvent welded joints.
- IV. Sleeving diameter: equal to twice that of the pipe or wiring bundle.
- V. All sleeving located under concrete, pavement or other hard surfacing shall be notched on both sides to mark the sleeve location.

### 2.04. COPPER TRACING WIRE:

- I. Use American Wire Gauge (AWG) No. 12-1 solid copper, 600 volt, Type UF or PE cable, UL approved for direct underground burial.
- II. Color: Tracing wire must be of color different from that of any active two wire cable, control wire, or common wire. Wire color shall be continuous over entire length.
- III. Splices: Use 3M DBR/Y-6 wire connector with waterproof sealant.

### 2.05. PIPE AND FITTINGS:

- I. Mainline Pipe and Fittings:
  - A. Use rigid, un-plasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end suitable for solvent welding.
  - B. Use Class 200, SDR-21, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 200 in the case of small nominal diameters that are not manufactured in Class 200.
  - C. Use solvent weld pipe for mainline pipe with a nominal diameter less than 3-inches or where a pipe connection occurs in a sleeve. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.
- II. Lateral Pipe and Fittings:

- A. Use rigid, un-plasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B. ASTM Standard D1784, with an integral belled end suitable for solvent welding.
- B. Use Class 200, SDR-21, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241.
- C. Use solvent weld pipe for lateral pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of a type approved by the pipe manufacturer.

### III. Specialized Pipe and Fittings:

- A. Low Density Polyethylene Hose:
  - 1. Use pipe specifically intended for use as a flexible swing joint.  
Inside diameter: 0.490\_+0.010 inch.  
Wall thickness: 0.100+0.010 inch.  
Color: Black.
  - 2. Use spiral barbed fittings supplied by the same manufacturer as the hose.
- B. Assemblies calling for flanged connections shall utilize stainless steel studs and nuts and rubber gaskets.
- C. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 and 40 threaded fittings and Spears pre-manufactured swing-joint assemblies. Use PVC Schedule 80 nipples.
- D. Joint sealant: Use non-hardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by the pipe fitting and valve manufacturers. Where directed by valve manufacturers, use thread tape for threaded connections at valves instead of thread paste.
- E. Copper Pipe: Use Type "K" rigid pipe conforming to ASTM Standard B88. Use wrought copper or cast bronze fittings, soldered, flared mechanical, or treaded joint per installation details or local code. Use a 95-percent tin and 5-percent antimony solder.
- F. Pressure Supply Lines (downstream of backflow prevention units) – HDPE, DR11.

### IV. Joint Restraint Harness:

- A. Use a joint restraint harnesses wherever joints are not positively restrained by flanged fittings, threaded fittings, and/or thrust blocks.
- B. Use a joint restraint harness with transition fittings between metal and PVC pipe, where weak trench banks do not allow the use of thrust blocks, or where extra support is required to retain a fitting or joint.
- C. Use bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials that are zinc plated or galvanized.
- D. Use on pipe greater than or equal to 3-inch diameter or any diameter rubber gasket pipe.

### 2.06. MAINLINE COMPONENTS:

- I. Flow Sensor Assembly: As presented in the installation details.
- II. Isolation Gate Valve Assembly: As presented in the installation details. Acceptable manufacturers are American AVK, Clow, Kennedy, Mueller, Matco, Nibco, or Waterous.
- III. Quick Coupling Valve Assembly: As presented in the installation details.

- IV. Air Vacuum Relief Valve Assembly: as presented in the details. Provide a continuous action combination air vacuum relief valve with an operating pressure rating of 150 PSI. Acceptable manufactures are Bermad, Crispin, Fresno, or Waterman.

2.07. SPRINKLER IRRIGATION COMPONENTS:

- I. Remote Control Valve (RCV) Assembly for Sprinkler Laterals: as presented in the installation details. Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Use standard Christy I.D. tags with hot-stamped black letters on a yellow background. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly. Provide PRS-Dial pressure regulators for all spray nozzles when inlet pressure exceeds 15 psi of desired outlet pressure. Install 2-wire decoder on each control valve.
- II. Sprinkler Assembly: As presented in the drawings and installation details.
- III. Sprinkler Pressure Test Kit: Provide Rain Bird PHG assembly, and Rain Bird Pitot Tube (part no. 41017), for use in pressure adjustment for spray and rotors sprinklers.

2.08. DRIP IRRIGATION COMPONENTS:

- I. Remote Control Valve (RCV) /assembly for Drip Laterals.
- A. As presented in drawing and installation details.
- II. Inline Drip Tubing:
- A. Tubing: Use UV resistant polyethylene drip tubing with integral pressure compensating drip emitters. Emitter spacing as noted in drawings and installation details. Use emitters that are pressure compensating from 8 to 70 PSI. Use tubing with O.D. of 0.660", and I.D. of 0.560". Use tubing stakes or landscape fabric staples to hold above-ground pipe in place.
- B. Blank Drip Tubing: Use UV resistant polyethylene blank tubing for supply and exhaust manifolds with flows less than five (5) GPM, and start connections between manifolds and drip tubing. Use PVC insert line fittings compatible with inline drip tubing. Compression fittings will not be allowed. Use blank tubing from same manufacture as inline drip tubing.
- C. Flush Valve Assembly: As presented in drawings and installation details.

2.09. CONTROL SYSTEM COMPONENTS:

- I. Automatic Controller (2-Wire) - Size and type shown on Drawings; mounted as detailed.
- A. Single Station Decoders (2-Wire) - Size and type shown on Drawings; mounted as detailed.
1. Install decoders and wire per manufacture recommendations and requirements.
2. Grounding for all decoders and 2-wire cable, to be per manufactures recommendations and requirements. Minimum one grounding assembly per every 600' of wire and at all ends of the wire runs.
- II. Baseline Controller Assembly: All incidental parts which are not specified herein and are necessary to complete the system shall be furnished and installed as though such parts were shown on plans or specified. All systems shall be in satisfactory operation at the time of completion. Contractor is responsible to meet with designated City of Greeley Parks Division staff as well as authorized Baseline Technical Services Staff to determine appropriate communication path from the below options BEFORE PACKAGE SYSTEM IS TO BE ORDERED. Contractor is also required to provide designated City of Greeley Parks Division Staff with a final Package System sales order from an authorized Baseline dealer for

approval BEFORE ordering of system occurs. (refer to supplemental Baseline Specification section).

- A. Lightning protection: Connect to building ground.
- B. Wire markers: Pre-numbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
- C. Power Wire:
  - 1. Electric wire from the power source to satellite control unit shall be solid or stranded copper, Type UF single conductor cable or multi-conductor with ground cable, UL approved for direct underground burial. Power wires shall be black, white, and green in color. The Contractor is responsible for verifying that the power wire sizes are compatible and adequate for the control system being used.
  - 2. Splices: Use 3M 82-A series connectors.
  - 3. Conduit: PVC Schedule 40.
  - 4. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW"
- D. Control Wire:
  - 1. Low Voltage:
    - a. Electrical Control Wire - UFUL approved No. 12/12 (2-wire Paige #7072Dor Regency Maxi Wire 14/2 or 12/2 or as per manufactures requirements) direct burial copper wire to operate system as designed.
    - b. If multiple controllers are utilized, refer to wire routing plan for individual wire runs.
    - c. Control Wire connections and splices shall be made with 3M DBRy-6 direct bury splice.
    - d. Loop five (5) feet minimum of 2-wire cable into all valve boxes.
    - e. If multiple controllers are utilized, each controller shall have it's own 2-wire cable run. Controllers cannot be connected with the same 2-wire run and each must be independently color coded.
  - 2. Warning tape: Insert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

2.10. OTHER COMPONENTS SUPPLIED BY CONTRACTOR:

- I. Tools and Spare Parts: Provide operating keys, servicing tools, spare parts and other items indicated in the General Notes of the drawings.
- II. Other Materials: Provide other materials or equipment shown on the drawings or installation details that are part of the irrigation system, even though such items may not have been referenced in these specifications.

PART 3 - EXECUTION

3.01. INSPECTIONS AND REVIEWS:

- I. Site Inspections:
  - A. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities to the Owner's Representative prior to beginning work.
  - B. Beginning work of this section implies acceptance of existing conditions.
- II. Utility Locates ("Utility Notification Center of Colorado"):

- A. Arrange for and coordinate with local authorities the location of all underground utilities.
- B. Repair any underground utilities damaged during construction. Make repairs at no additional cost to the contract price.
- C. Irrigation System Layout Review: Irrigation system layout review will occur after the staking has been completed. Notify the Owner's Representative one week in advance of review. Modifications will be identified by the Owner's Representative at this review.

3.02. LAYOUT OF WORK:

- I. Stake out the irrigation system. Items staked include: back flow device, sprinklers, mainline and lateral pipe, control valves, quick coupling valves, controller, and isolation valves.
- II. Install all mainline pipe and mainline components inside of project property lines.

3.03. EXCAVATION, TRENCHING, AND BACKFILLING:

- I. Excavate to permit the pipes to be laid at the intended elevations and to permit work space for installing connections and fittings.
- II. Minimum cover (distance from top of pipe or control wire to finish grade):
  - A. 24-inches over mainline pipe and over electrical conduit.
  - B. 28-inches over control wire.
  - C. 18-inches over lateral pipe to sprinklers.
- III. Maintain at least 15-feet clearance from the centerline of any tree.
- IV. PVC lateral pipes may be pulled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling. Minimum burial depths equal minimum cover listed above.
- V. Backfill only after lines have been reviewed and tested.
- VI. Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, vegetable matter, and stones larger than 2-inches in maximum dimension. Remove material not suitable for backfill. Backfill placed next to pipe shall be free of sharp objects that may damage the pipe.
- VII. Backfill unsleeved pipe in either of the following manners:
  - A. Backfill and puddle the lower half of the trench. Allow to dry 24 hours. Backfill the remainder of the trench in 6-inch layers. Compact to density of surrounding soil.
  - B. Backfill the trench by depositing the backfill material equally on both sides of the pipe in 6-inch layers and compacting to the density of surrounding soil.
- VIII. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698-78. Use of water for compaction around sleeves, "puddling", will not be permitted.
- IX. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.
- X. Where utilities conflict with irrigation trenching and pipe work, contact the Owner's Representative for trench depth adjustments.

3.04. SLEEVING AND BORING:

- I. Install sleeving at a depth that permits the encased pipe or wiring to remain at the specified burial depth.
- II. Extend sleeve ends six inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes.

- III. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring. Hand excavating under sidewalks and hardscapes will not be allowed.

3.05. INSTALLATION OF COPPER TRACING WIRE:

- I. Install tracing wire as shown in the details.
- II. Tape to top centerline of pipe as shown in the details with adhesive tape or plastic tie straps so that the wire remains in place during embedding and backfilling.
- III. Bring tracing wire to the surface in all mainline component valve boxes as shown in the details.

3.06. ASSEMBLING PIPE AND FITTINGS:

I. General:

- A. Keep pipe free from dirt and pipe scale Cut pipe ends square and debur. Clean pipe ends.
- B. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.
- C. Trenches may be curved to change direction or avoid obstructions within the limits of the curvature of the pipe. Minimum radius of curvature and offset will be based on manufactures recommendations. Installer will be required to provide chart of allowable deflection with pipe submittals. No deflection will be allowed at a pipe joint.

II. Mainline Pipe and Fittings:

- A. Use only strap-type friction wrenches for threaded plastic pipe.
- B. PVC Rubber-Gasket Pipe:
  - 1. Use pipe lubricant. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
  - 2. Ductile iron fittings shall not be struck with a metallic tool. Cushion blows with a wood block or similar shock absorber.
- C. PVC Solvent Weld Pipe:
  - 1. Use primer and solvent cement. Join pipe in a manner recommended by the manufacturer and in accordance with accepted industry practices.
  - 2. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
  - 3. Snake pipe from side to side within the trench.
- D. Fittings: The use of cross type fittings is not permitted. Do not strike ductile iron fittings with metallic tools. Cushion blows with wood block or similar shock absorber

III. Lateral Pipe and Fittings:

- A. Use only strap-type friction wrenches for threaded plastic pipe.
- B. PVC Solvent Weld Pipe:
  - 1. Use primer and solvent cement. Join pipe in the manner recommended by the manufacturer and in accordance with accepted industry practices.
  - 2. Cure for 30 minutes before handling and 24 hours before allowing water in the pipe.
  - 3. Snake pipe from side to side within the trench.
- C. Fittings: The use of cross type fittings is not permitted.

IV. Specialized Pipe and Fittings:

- A. Low Density Polyethylene Hose: Install per manufacturer's recommendations.
  - B. Flanged connections: Install stainless steel studs and nuts and rubber gaskets per manufacturer's recommendations.
  - C. PVC Threaded Connections:
    - 1. Use only factory-formed threads. Field-cut threads are not permitted.
    - 2. Use only non-hardening, nontoxic thread sealant.
    - 3. When connection is plastic-to-metal, the plastic component shall have male threads and the metal component shall have female threads.
  - D. Make metal-to-metal, threaded connections with non-hardening, nontoxic pipe sealant applied to the male threads only.
  - E. Copper Pipe:
    - 1. Use flux and solder. Join pipe in manner recommended by manufacturer and in accordance with local codes and accepted industry practices.
    - 2. Solder so that continuous bead shows around the joint circumference.
- 3.07. INSTALLATION OF MAINLINE COMPONENTS:
- I. Master Valve Assembly: Install where indicated on the drawings.
  - II. Flow Sensor Assembly: Install where indicated on the drawings according to manufacturer's installation guidelines.
  - III. Isolation Gate Valve Assembly:
    - A. Install where indicated on the drawings.
    - B. Locate at least 12-inches from and align with adjacent walls or edges of paved areas.
  - IV. Quick Coupling Valve Assembly: Install where indicated on the drawings.
- 3.08. INSTALLATION OF SPRINKLER IRRIGATION COMPONENTS:
- I. Remote Control Valve (RCV) Assembly for Sprinkler Laterals:
    - A. Flush mainline before installation of RCV assembly.
    - B. Install where indicated on the drawings. Connect control wires to remote control valve wires using 3M DBY-6 or DBR-6 waterproof connectors. Install connectors per the manufacturer's recommendations.
    - C. Install only one RCV to a valve box. Locate valve box at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Arrange grouped valve boxes in rectangular patterns. Allow at least 12-inches between valve boxes.
    - D. Attach ID tag with controller station number to control wiring.
    - E. Install 2-wire decoder, per manufacture standards and recommendations.
    - F. Brand valve box lid with appropriate station number for each remote control valve. Branding device must create letters a minimum of 3-inches in height and 0.2-inches deep in lid.
  - II. Sprinkler Assembly:
    - A. Flush lateral pipe before installing sprinkler assembly.
    - B. Install per the installation details at locations shown on the drawings.
    - C. Locate rotary sprinklers 6-inches from adjacent walls, fences, or edges of paved areas.
    - D. Locate spray sprinklers 3-inches from adjacent walls, fences, or edges of paved areas.
    - E. Install sprinklers perpendicular to the finish grade.



F. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.

G. Adjust the radius of throw of each sprinkler for best performance.

III. Sprinkler Pressure Test Kit (if applicable):

- A. Use a Pitot tube and pressure gauge at the worst-case rotor sprinkler assembly, from the respective remote control valve. Adjust PRS-Dial at each rotor remote control valve, to provide the design operating pressure at the worst-case rotor sprinkler head. Typically the worst-case sprinkler is the sprinkler furthest from the remote control valve. Complete pressure adjustment for every rotor remote control valve.
- B. Using pressure gauge and necessary fittings, place pressure gauge on worst-case spray sprinkler, from the respective remote control valve. Adjust PRS-Dial at each spray remote control valve to provide an operating pressure of 30 PSI at the worst-case spray sprinkler head. Typically the worst-case sprinkler is the sprinkler furthest from the remote control valve. Complete pressure adjustment for each spray remote control valve.
- C. Turn over Pitot tube and pressure gauge to the City of Greeley at completion of construction.

3.09. INSTALLATION OF DRIP IRRIGATION COMPONENTS:

I. Remote Control Valve (RCV) Assembly for Drip Laterals:

- A. Flush mainline pipe before installing RCV assembly.
- B. Locate as shown on drawings. Connect control wires to remote control valve wires using wire connectors and waterproof sealant. Provide 3M DBRY-6 or DBR-6 connectors and sealant per manufacturer's recommendations.
- C. Install only one RCV per valve box. Locate at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Align grouped valve boxes in uniform patterns. Allow at least 12-inches between valve boxes. Brand controller letter and station number on valve box lid in 2-inch high letters.
- D. Arrange grouped valve boxes in rectangular patterns.

II. Inline Drip Tubing: Install inline drip tubing components in strict accordance with tubing manufacturer's details, guidelines, and recommendations.

III. Flush Valve Assembly: Provide at end of each dripper line grid as show and directed on drawings and installation details. Install at least 12-inches from and align with adjacent walls or edges of paved areas. Brand "FV" on valve box lid in 2-inch high letters.

3.10. INSTALLATION OF CONTROL SYSTEM COMPONENTS:

I. Satellite Controller Assemblies:

- A. The location of the Controller Assemblies as depicted on the drawings is approximate; the Project Manager will determine the exact site location during sprinkler layout review.
- B. Assemble controller assembly, sensors, and appurtenance controller enclosure per authorized manufacturer representative recommendation and shop drawings. Provide pre-fabrication and testing of controller assembly by authorized Baseline distributor representative prior to installation in field. Provide installation observation and wire connections in field by manufacturer's personnel or trained distributor personnel.
- C. Provide combination switch/GFCI outlet in accordance with local codes inside satellite controller assembly enclosure.
- D. Provide electrical service connection for Controller Assemblies under direction and observation of manufactures' personnel or trained distributor personnel. Utilize existing

electrical source. Provide primary surge protection arrestors on incoming power lines in accordance with control system manufacturer recommendations.

E. Lightning protection: Connect to building ground.

F. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with the identification number (see drawings) of the remote control valve to which the control wire is connected.

G. Connect control wires to the corresponding controller terminal.

II. Power Wire:

A. Install with a minimum number of field splices. If a power wire must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate all splices in a separate 12-inch standard valve box. Coil 2 feet of wire in valve box.

B. All power wire shall be laid in trenches. The use of a vibratory plow is not permitted.

C. Green wire shall be used as the ground wire from power source to all satellites.

D. Carefully backfill around power wire to avoid damage to wire insulation or wire connectors.

E. Unless noted on plans, install wire 2"-6" below mainline pipe.

F. Encase wire not installed with PVC mainline pipe in electrical conduit with a continuous run of warning tape placed in the backfill, 6-inches above the wiring.

III. 2- Wire cable:

A. Provide a 24-inch excess length of 2-wire cable in an 8-inch diameter loop at each 90-degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 5' length of 2-wire cable within each remote control valve box.

B. If a 2-wire cable must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in a valve box that contains an irrigation valve assembly, or in a separate 12-inch standard valve box. Use same procedure for connection to valves as for in-line splices.

C. Unless noted on plans, install wire 2"-6" below PVC mainline pipe.

D. Protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill six inches above the wiring.

3.11. INSTALLATION OF OTHER COMPONENTS:

I. Tools and Spare Parts: Prior to the Review at completion of construction, supply to the Owner operating keys, servicing tools, spare parts, and any other items indicated in the General Notes on the drawings.

II. Other Materials: Install other materials or equipment shown on the drawings or installation details that are part of the irrigation system, even though such items may not have been referenced in these specifications.

3.12. PROJECT RECORD DRAWINGS:

I. The Contractor is responsible for documenting changes to the design. Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until as-built information is recorded.

II. Record pipe and wiring network alterations. Record work that is installed differently than shown on the construction drawings. Record accurate reference dimensions, measured from

at least two permanent reference points, of each irrigation system valve, each backflow prevention device, each controller or control unit, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within a valve box.

- III. Prior to construction completion, obtain from the Owner's Representative an AutoCAD data file for this project. Using CAD, duplicate information contained on the project drawings maintained on site. Label each sheet "Record Drawing". Data delivered should conform to the current coordinate system used by the City of Greeley which is HARN NAD83 Stateplane US Survey Feet Northern Colorado projection. Vertical values should be captured in NAVD 88. Reference control point data can be obtained via the City of Greeley's web site within the GIS page or by contacting the GIS division at 970-350-9300.
- IV. Turn over the "Record Drawings" to the Owner's Representative. Completion of the Record Drawings will be a prerequisite for the Review at the completion of the irrigation system installation.
- V. Installer will be required to turn over a list of valves and corresponding decoder numbers installed in field.

3.13. WINTERIZATION AND SPRING START-UP:

- I. Winterize the irrigation system in the fall after the installation, and start-up the irrigation system the following spring. Repair any damage caused in improper winterization at no additional cost to the Owner. Coordinate the winterization and start-up with the landscape maintenance personnel.

3.14. MAINTENANCE:

- I. Upon completion of construction and Review by the Owner's Representative, maintain irrigation system for a duration of 30 calendar days. Make periodic examinations and adjustments to irrigation system components so as to achieve the most desirable application of water.
- II. Following completion of the Contractor's maintenance period, the Owner will be responsible for maintaining the system in working order during the remainder of the guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after the landscape maintenance operation.

3.15. CLEANUP:

- I. Upon completion of work, remove from the site all machinery, tools, excess materials, and rubbish.

**END OF SECTION**

**IRRIGATION CONTROLLER**

CITY OF GREELEY

IRRIGATION CONTROLLER SPECIFICATION

**Baseline Specification**

All irrigation controllers and online web management platform will be as manufactured by Baseline Control Systems. Controllers will be Base Station 3200 painted steel wall mounts and/or stainless-steel pedestals.

**BaseManager Online Management System**

Real-time internet connectivity that works on any web enabled device. With the ability to run any number of controllers across two controller platforms, using one interface.

Map-based user interface utilizing Bing maps with interactive map icons, giving the user the ability to turn zones on and off with user defined runtime, learn flow on a single station, chart zone activity, view what programs the zone is in and its associated runtime, test electrical circuit providing an AC voltage at the solenoid, amp draw, voltage drop reading along the two-wire path, and custom notes. Ability to geo locate zones, master valves, moisture sensors, flow meters, hydrometers, event switches, temperature sensors, and custom markers on map interface through mobile access. Interactive map icons must be color coded with 11 different colors displaying current status of that device. Colors for zone icon activity status and program status must transcend the entire control platform from controller face plate, to mobile phone access, internet and or self-hosted management platform. System can be configured to send alerts and messages via text message and email.

All sensor status and activity must be available in all access points from controller, to mobile phone, and web platform access. System must be able to interface with a rain switch in a manner that allows for user defined start, stop and pause conditions. Weather Access and weather-based schedules programmed on a by zone basis in watering schedule, with the ability to combine timed runtimes, weather-based runtimes and soil moisture-based runtimes in the same program. Allowing for a combination of weather-based or soil moisture activated runtimes on the same zones, depending on specific needs.

Allow the ability to customize zone names, sensor names, and program names and populate those customized descriptions throughout the entire platform from controller face plate, to mobile phone access, internet and or self-hosted management platform.

Requires the ability to manage controller access between users, giving users access to specific controllers, while other users have access to the same controllers or different controllers.

Basemanager must be available as a cloud-based service provided by Baseline Systems, as a subscription-based access platform or a self-hosted server or virtual machine server-based platform.

Minimum security protocol requirements: AES256-bit encryption along with the TLS1.2 protocol.

**Baseline Communication Methods**

All controllers must have the capability of utilizing all of the following methods of communication. Cellular (minimum of 4G), Ethernet, 900Mhz Ethernet Radio, Wi-Fi, and Two-Wire as a true two-way communication path. Must have the ability to connect to the online central without the use of a cellular modem device. Also, must be able to utilize 900Mhz Ethernet radio to connect multiple controllers to the internet through a single controller Ethernet and/or Cellular access point. Controller supports up to 8 available addresses for TCP/IP-based connections. These addresses are used to connect the following performance components: Flow station, SubStation, and Munro Pump Station.

### **Baseline Controller and Two-Wire Specification**

Wall mount controllers will be in powder coated steel or 304 grade stainless steel cabinets. Pedestal mount controllers will be in 304 grade stainless steel flip top pedestals mounts. Wall mount controller dimensions are: 15.5" x 12.38" x 6.4", 16-gauge powder coated steel or stainless steel. Pedestal mount enclosure dimensions are: 17.38" x 36.25" x 12.63" 16-gauge stainless steel. Controller display will meet the following minimum requirements: Built in full color display with High contrast 3.5-inch TFT LCD screen, resolution is 320x240 at 65,536 colors, screen brightness of 200 lumens for easy viewing in direct sunlight. Controllers must have a built in Ethernet port and be capable of running two-wire and conventional wire out of the same controller. With a zone count of up to 200 stations per controller in any combination of conventional and decoder stations, not exceeding the 200 stations. Controllers must utilize true two-way communication on the two-wire path. Controller is capable of operating non-irrigation zones with ease. Controller allows for operation of 15 concurrent zones and a up to 99 concurrent zones through the use of SubStations. Allows for the ability to back up and restore all programming and historical data with any USB flash drive. Controller will store all program and history information in its non-volatile memory. Controller will allow for the establishment of 3 levels of 4-digit PIN password protection: operator, programmer, and administrator.

Programming Features are as follows: All controllers must provide up to 99 automatic programs, with 8 programmable start times, allowing 1-15 concurrent zone to operate in each program, as long as it does not exceed the hydraulic and electrical limitations of the system. Controller will be able to utilize weather-based schedules, moisture sensor-based schedules and traditional runtime-based schedules, and will allow for all three of these methods to be utilized in the same program. Other programming features must include: Water source prioritization, program prioritization, and intelligent water rationing. The controller allows a program to be started by the following options: Start time, moisture percent, temperature value, event switch contacts open or closed, pressure sensor readings.

Each controller must be able to read and manage up to 8 master valves and 8 flow sensors and utilize pressure readings to stabilize flow. Every controller will have the ability to monitor up to 25 soil moisture sensors. Pressure sensors can be used to create start, stop or pause conditions based on a user defined pressure reading. Controller will search for and identify all devices connected to the two-wire path and lists them according to device type and serial number.

Messaging and Alerts: Provides real-time soil moisture measurements and watering feedback to the user, alerts and alarms are self-diagnosed and displayed on the screen. Displays on-screen historical-run-time chart that includes time watered for the last 6 days of program, and a historical water use chart showing actual water used for the last 6 days by flow meter. Displays a 6-day scalable soil moisture history graph with integrated run-time bar chart. Displays high flow alerts, low flow alerts, pause messages and conditions, rain delays, wire faults, and other operating conditions.

Decoders will have built in diagnostic LED indicator lights that tell you at a glance the device is working. Two-wire must utilize true two-way communication on the two-wire path. Requires smart two-way communication allowing you to assign any decoder to a zone or function from the controller after the decoder has been installed in the field. Multi-station decoders can be assigned any station number in any order.

Available devices for two-wire include but are not limited to the following: Single station decoder, two station decoder, four station decoder, master valve decoder, dc latching decoder, event decoder, pump start switching decoder, flow decoder, pause decoder and coach's button, and pressure sensor decoder. Controller must be able to identify every two-wire device connected to the two-wire path and must be able to list them in the controller. Controller is capable of re-addressing any station decoder to a new station number while leaving it installed in the field, by re-assigning the devices serial number to a new station number.

All decoders will be fully sealed, submersion-proof, and approved for direct bury, and will carry a standard 5-year warranty out of the box.

Acceptable wire and wire connectors for two-wire path: Paige P7072D or Regency 14/2 and 12/2 Maxi Wire, connectors will be DBR/Y-6. Other wire and wire connectors may be approved as an equal but must be submitted to owner prior to installation, and owner makes all final decisions on all specifications.

### **Controller and Two-Wire Path Grounding and Surge Protection Specification**

All installations should conform to manufacturer's instructions and must meet or exceed the American Society of Irrigation Consultants (ASIC) Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines (<http://www.asic.org>).

**Grounding Electrodes** In all cases where it does not conflict with appropriate grounding grid design for the site in question, grounding electrodes (such as rods or plates) referred to in this specification must conform to the following standards.

**Grounding Rods:**

- All grounding rods must be bare copper of 5/8" diameter or greater and a minimum of 8' length or longer.
- Grounding rods must be located at a minimum distance to assure that the two-wire path is outside of the electrode sphere of influence for the grounding rod. For an 8' grounding rod, this means that the grounding rod must be connected at least 8' away from the two-wire path, at a right angle to the two-wire path. See the BL-LA01 Surge Arrestor Installation Guide for details on connecting the grounding rod to the device or surge arrestor.
- Install all grounding rods in a 10-inch round valve box to facilitate the use of a clamp-on ground resistance tester. If you use a smaller box, you will not be able to clamp the tester around the ground rod or the conductor.
- Drive grounding rods into the ground to a minimum of 8' in a vertical or oblique position. The angle of the rod relative to the vertical must be no more than 45°.

**Grounding Plates:**

- All grounding plates must be a minimum of 5 square feet, as outlined in ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines.
- Grounding plates must be located a distance equal to the diagonal measurement (the distance from one corner of the grounding plate to the opposite corner) of the grounding plate from the two-wire path. The longest side of the grounding plate must run parallel to the two-wire path.
- Install grounding plates in a horizontal position a minimum of 30" below ground level and below the frost line. Position the plate flat at the bottom of the trench.

Consult the ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines for correct minimum recommended distances for different grounding rod or grounding plate sizes and grounding grid designs.

**Connections to Grounding Rods & Plates:**

All connections to grounding rods/plates must conform to ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines and must consist of either a CADWELD type or screw clamp type of connection. CADWELD or equivalent connections are preferred. All clamps must be suitable for direct burial or exothermic weld. The resistance reading on this connection should be less than 1milliohm.

Any wire extensions required to connect from a grounding rod to a surge arrestor or enclosure ground lug must be 6-gauge bare copper wire and must not have any sharp bends, coils, or kinks. Wire extensions connected to surge arrestors must use a split bolt connector, CADWELD connector, or screw clamp connector where the bare copper ground wire meets the green grounding wire from the surge arrestor. Never use solder to make connections in the grounding system because it will melt during a lightning discharge.

**Grounding Options:**

While the best option for grounding irrigation equipment is a direct physical connection to the earth, there are times when this is impossible or impractical. The following options are available for special cases. All other requirements in Baseline's Grounding Specifications apply.

- **Controller Enclosure:** When direct physical connection to the earth is not possible, the irrigation controller's enclosure ground can be connected to the building ground. However, DO NOT connect

the two-wire surge arrestor ground to the building ground. The ground on an electrical receptacle (outlet) is not allowed, and is not sufficient.

- Irrigation System on a Green Roof or Green Wall: When grounding the irrigation system on a green roof or green wall, the irrigation controller's enclosure ground can be connected to the building ground, and it is acceptable to connect the green wire from each surge arrestor to the building system ground.

#### Two-wire Grounding with Surge Arrestors:

The surge arrestor is a critical part of the surge protection scheme for the two-wire path. Surge arrestors attach directly to the two-wire path and help dissipate electricity generated by nearby lightning strikes and other electromagnetic events. While two-wire components have optical isolators and other surge arresting features, the surge arrestor provides an extra measure of protection.

**IMPORTANT:** Surge arrestors are required for proper operation and for warranty coverage.

#### Installation of Surge Arrestors:

- Connects directly to the red and black wires
- Attaches to grounding rod via the green wire
- Install in a valve box
- Surge arrestors must be connected to bare copper ground wires using split bolt connectors, CADWELD connectors, or screw clamp connectors suitable for direct burial (no wire nuts of any kind are supported for grounding wires).

#### Two-Wire Grounding Installation:

Two-wire supports a large number and variety of wiring configurations. As more wires are connected to a piece of electronic equipment, more lightning energy enters the equipment, and a more substantial grounding grid must be used. Consult the Baseline Two-Wire Specification for more details. The two-wire must have properly installed surge arrestors as outlined in the Baseline Surge Arrestor Install Guide and elsewhere in this document. Surge arrestors must be installed as outlined below:

- The first surge arrestor on the two-wire path must be within 25' of the controller. This grounding point must be separate from the irrigation controller's enclosure grounding point.
- Place a surge arrestor every 600' on the two-wire path. Each surge arrestor protects a 300-foot radius of the two-wire path.
- In lightning prone regions, consider grounding every 300' rather than going out to the maximum distance.
- There must be a surge arrestor at the end of the two-wire that is the maximum distance from the controller or if looped at the point of maximum distance from the controller.
- Any branch of the two-wire that exceeds 50' must have a surge arrestor at the end.
- On an uninterrupted run of more than 600', it is acceptable to have a surge arrestor at each end.  
Note: On any wire run with no splices, do not cut the wire to install a surge arrestor, just place one at the end.

#### Controllers in Steel Wall Mount Enclosures:

The following applies to all controllers, controller extensions, add on components, in steel wall mount enclosures. If the controller is on or within an existing building, the unit must be grounded as outlined below: The ground lug, located in the interior in the lower right region of the enclosure, must be connected directly to the building ground using a bare copper wire of 6 AWG or larger, as outlined in article 250 of the National Electric Code (NEC), so that a single point of connection with the building ground is achieved. If the controller is mounted at a remote location more than 25' away from the building or grounded AC power source, the unit must be grounded as outlined below: A bare copper grounding wire of 6 AWG or larger must be connected from the ground lug to an appropriate grounding rod as outlined in the previous sections of this document.

**Controllers in Stainless Steel Enclosures:**

If the controller is within 25' of an existing building, and is connected to the AC power system within that building, the unit must be grounded as outlined below: The ground lug, located in the interior on the back panel in the lower-left corner under the AC power box in the pedestal enclosure, must be connected directly to the building ground using a bare copper wire of 6 AWG or larger, as outlined in article 250 of the National Electric Code (NEC), so that a single point of connection with the building ground is achieved. If the controller is mounted at a remote location more than 25' away from a building or grounded AC power source, the unit must be grounded as outlined below: A bare copper grounding wire of 6 AWG or larger must be connected from the ground lug to an appropriate grounding rod as outlined in the previous sections, and in conformance with the ASIC Earth Grounding Electronic Equipment in Irrigation Systems—Guidelines.

**IMPORTANT:** All clamps used to connect the 6 AWG wire to the grounding electrode must be suitable for direct burial or exothermic weld.

**Baseline Extended Ten Warranty**

All Baseline manufacturer specifications must be adhered to including all grounding specifications for the controller and or the two-wire path. Once the controller has been installed the contractor is required to have Authorized Baseline Technical Service Representative perform the Baseline Extended Warranty testing. All equipment must meet or exceed the testing standards set forth by Baseline Systems. Controllers must be grounded to 10 ohms or less. After you have installed your grounding system on the two-wire path, Baseline requires that you measure the ground resistance in order to prove that each grounding point meets Baseline's specifications. Resistance readings of 5 to 10 ohms are desirable, and a reading of no more than 25 ohms is required. An Authorized Baseline Technical Service Representative will measure the ground resistance and will perform all other necessary testing, inspections and will submit all paperwork to Baseline for approval.

The Baseline Extended Ten Year Warranty Testing should be specified as follows:

**AUTHORIZED BASELINE EXTENDED WARRANTY CERTIFICATION TECHNICIAN TO PERFORM GROUNDING OHMS TEST AT CONTROLLERS AND ALONG TWO-WIRE PATH GROUNDING RODS. CONTROLLERS MUST BE GROUNDED TO 10 OHMS OR LESS, AND TWO-WIRE GROUNDING RODS (5-10 OHMS DESIRABLE) MUST BE 25 OHMS OR LESS. INCLUDES ALL FIELD INSPECTIONS AND SUBMISSION TO BASELINE FOR APPROVAL.**

**Important:** Consult Baseline's Two-Wire Technical Specification and the Surge Arrestor & Grounding Specification for details on surge protection installation. Failure to install surge protection hardware to specification will void surge protection coverage under this warranty.

**THIS WARRANTY IS LIMITED SOLELY TO BASELINE EQUIPMENT, AND DOES NOT WARRANT AGAINST DAMAGE CAUSED BY LIGHTNING OR OTHER POWER SURGES TO NON-BASELINE EQUIPMENT, WIRING, LANDSCAPE, OR FACILITIES. THIS WARRANTY DOES NOT COVER ANY EFFECTS TO LANDSCAPE OR PROPERTY DUE TO BASELINE EQUIPMENT'S OPERATION OR FAILURE TO OPERATE FOLLOWING A SURGE OR LIGHTNING STRIKE, NOR DOES IT COVER LABOR COSTS ASSOCIATED WITH TROUBLESHOOTING OR REPAIRS.**

**END OF SECTION**





**35<sup>TH</sup> AVENUE UTILITY PROJECT PHASE 1  
PROJECT SPECIAL SPECIFICATIONS**

<u>SECTION</u>	<u>TITLE</u>
02240	Dewatering
02275	Riprap and Riprap Bedding
02960	Temporary Sanitary Sewer Bypass Pumping
11285	Slide Gates

**CITY OF GREELEY CONSTRUCTION SPECIFICATIONS - VOLUME III (POTABLE WATER  
DISTRIBUTION, SANITARY SEWER COLLECTION, AND NON-POTABLE IRRIGATION SYSTEMS)**

<u>SECTION</u>	<u>TITLE</u>
01713	Water Distribution System Testing
01715	Sewer and Manhole Testing
02315	Excavation and Fill
02445	Casing Pipe – Borings and Encasements
02510	Water Utility Distribution Piping
02511	Disinfection of Water Utility Distribution
02513	Polyvinyl Chloride (PVC) Pressure Pipe
02514	Water Service Lines, Meters, and Appurtenances
02515	Water Utility Distribution Valves
02516	Water Utility Distribution Fire Hydrants
02530	Sanitary Utility Sewerage Piping
02533	Polyvinyl Chloride (PVC) Non-Pressure Pipe
02535	Sanitary Utility Sewerage Manholes, Frames, and Covers
03300	Cast-In-Place Concrete
03400	Precast Concrete
15140	Non-Potable Irrigation System



**35<sup>TH</sup> AVENUE UTILITY PROJECT PHASE 1  
PROJECT SPECIAL SPECIFICATIONS**

The following Specification Sections have been prepared by me or under my direct supervision:

<u>SECTION</u>	<u>TITLE</u>
02240	Dewatering
02275	Riprap and Riprap Bedding
02960	Temporary Sanitary Sewer Bypass Pumping
11285	Slide Gates



SECTION 02240  
DEWATERING

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF WORK**

- A. Provide all material, equipment, and labor to install and maintain all pumps, piping, drains, well points, and other facilities required to effectively control, collect, and dispose of groundwater or surface water to permit safe and proper completion of the Work. Use appropriate equipment and methods for dewatering based on existing site conditions.
- B. Maintain the foundations and other portions of the Work free from water as required for constructing each part of the Work.
- C. Comply with all applicable environmental protection laws and requirements in operation of the dewatering system.
- D. Remove all components of the dewatering system after it is no longer required.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01330: Submittals.
- B. Dewatering Plan: Submit a Dewatering Plan prepared by a qualified dewatering specialist, with experience in design, installation, and operation of dewatering installations. The Dewatering Plan shall be prepared by a Licensed Professional Engineer in the State of Colorado and include the following:
  - 1. **Details regarding the anticipated types and locations of various dewatering facilities, and design calculations required substantiating the Dewatering Plan.**
  - 2. **Superintendence plan and schedule, indicating who will be responsible for observing the dewatering system and the proposed schedule describing when personnel will be on site to observe and maintain the system.**
  - 3. **Coordination with other work including schedule, dewatering and diversion methods and operations, erosion and sediment control measures, equipment, and location and elevation of pumps, pipes, and any other features planned for use in the dewatering plan**

4. **Final recommendations for dewatering.**
5. **If the Contractor purchases, rents, installs, or mobilizes to the site any elements of the dewatering system before approval of the dewatering submittal, the Contractor does so at its own risk, and will not be due any additional compensation from the Owner if such elements are not subsequently used for the work.**
6. **Approval of the dewatering system proposed by the Contractor will only be with respect to the basic principles of the methods the Contractor intends to employ. Approval does not relieve the Contractor of full responsibility for adequacy of the dewatering system.**

### 1.3 DEFINITIONS

#### A. Definitions

1. **Dewatering: Removing water by single or multiple stage wellpoints, deep wells, ejector wells or sumps, as approved based on the Contractor's submittals.**
2. **Hydrostatic Groundwater Level: The groundwater level at any location during construction and before dewatering.**
3. **Sump: A depression excavated or constructed, from which water is pumped as part of dewatering.**

### 1.4 AVAILABLE DATA

- A. Logs of test borings and groundwater observations at the time of drilling are included on the Drawings and Baseline Report.
- B. The Contractor may refer to the boring and test pit logs on the Drawings, but shall draw their own conclusions as to the applicability of the information contained therein. The Contractor may choose to perform additional investigations to develop their dewatering plan. It is the Contractor's responsibility to evaluate site subsurface conditions with respect to required dewatering facilities.
- C. The subsurface conditions and groundwater observations from the test pits and borings apply only to the locations of the test pits and borings and at the time of

the explorations and measurements. The subsurface conditions at the site may be different at the time of construction as compared to when observations were made and recorded, and the groundwater level can be expected to fluctuate. These factors should be appropriately considered in developing the Contractor's Dewatering Plan.

## **1.5 QUALITY ASSURANCE AND QUALITY CONTROL**

- A. Dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

## **PART 2- PRODUCTS**

### **2.1 DEWATERING SYSTEM**

- A. The dewatering system shall be single- or multiple-stage wellpoints, deep wells, ejector wells, or sumps used for dewatering and which fulfill the dewatering requirements specified in this Section. The materials and construction of the dewatering wells will be selected by the Contractor and the Contractors' dewatering specialist.

## **PART 3- EXECUTION**

### **3.1 GENERAL**

- A. Design, furnish, install, maintain, and operate a dewatering system that prevents loss of fines, boiling, quick conditions, or softening of foundation strata and maintain stability of bottom of excavations so that every phase of the work can be performed in a dry, safe, and stable environment. Operate dewatering systems such that excavation bottoms are firm, suitably dry, and free from standing water at all times.
- B. Locate elements of the dewatering system such that interference with excavation and construction activity is minimized. Locations are subject to approval by the Engineer.
- C. At all times during construction, provide ample means and devices to remove promptly, and dispose of properly, all water entering excavations and keep the bottoms of excavations firm and free of standing water until structures to be built thereon are completed and/or backfill to be placed therein is placed. Conduct pumping and dewatering operations such that no disturbance to foundation subgrade materials or to fill materials supporting any other work will result. Discharged water shall be piped to an approved area.
- D. Install silt barriers or other discharge control measures at dewatering discharge locations, to control and prevent siltation. Provide suitable discharge controls in

accordance with applicable federal, state, and local permit regulations, and Section 01570: Sediment and Erosion Control. Do not allow dewatering discharge to cause siltation or other negative environmental impact on natural waterways or other property.

### 3.2 INSTALLATION AND OPERATION

- A. Operate the dewatering system to lower water levels as required and then operate continuously 24 hours per day, 7 days per week until all facilities and structures affected by the dewatering have been satisfactorily constructed, including placement of fill materials.
- B. Maintain groundwater levels low enough to fulfill the requirements of this Section and do not allow the water level to rise until constructed facilities are complete, so that the water can be allowed to rise without damaging facilities, their foundations, or surrounding areas and structures.
- C. Provide superintendence in accordance with the approved plan during all periods of dewatering. Superintendence means providing qualified Contractor personnel knowledgeable in operation and maintenance of dewatering system(s). The Contractor is responsible for any damage resulting from failure to maintain the dewatering system.
- D. Provide complete standby equipment and power sources available for immediate operation as may be required, to adequately maintain the dewatering on a continuous basis in the event that all or any part of the dewatering system becomes inadequate or fails. Provide an automatic switchover system to the standby power source to ensure uninterrupted power supply to pumps in an emergency. Spare pumps shall be automatically engaged if primary pumps fail for any reason.
- E. When the dewatering system does not meet the specified requirements, and as a consequence, loosening or disturbance of the foundations strata, instability of the slopes, or damage to the foundations or structures occurs, the Contractor is responsible for supplying all materials and labor and performing all work for restoring foundation soils, slopes, foundations, and structures, to the satisfaction of the Engineer, and at no additional cost to the Owner.
- F. When failure to provide adequate dewatering and drainage causes disturbance of the soils below design foundation or excavation grade, provide adequate dewatering and excavate and re-fill the disturbed areas with approved, properly compacted fill material. Such work shall be at the Contractor's expense and at no additional cost to the Owner.



### 3.3 REMOVAL

- A. Obtain written approval from the Engineer before discontinuing operation of any portion of the dewatering system(s).
- B. Remove all elements of the dewatering system(s) from the site at the completion of dewatering work.

SECTION 02275  
RIPRAP AND RIPRAP BEDDING

**PART 4- GENERAL**

**4.1 SECTION INCLUDES**

- A. Furnish all labor, equipment, and materials necessary for placing boulders, riprap, riprap bedding, and grouting in conformance with the Construction Drawings and Specifications.

**4.2 RELATED SECTIONS**

- A. Section 02240—Dewatering.

**4.3 REFERENCES**

- A. Where reference is made to any standard, the version in affect at the time of bid opening shall apply.
- B. Colorado Department of Transportation
  - 1. **Standard Specifications for Road and Bridge Construction.**

**4.4 SUBMITTALS**

- A. Submit under provisions of Section 01300.
- B. Certification: Submit certification stating both source of stone and that materials for all types of riprap will meet requirements of this Section.
- C. Product Data: Descriptions of all materials to be provided under this Section. In addition, provide sample of angular stone.
- D. Riprap Bedding
  - 1. **Gradation test results for each type of riprap bedding shall be submitted.**

**PART 5- PRODUCTS**

**5.1 MATERIALS**

- A. Riprap Bedding

1. **Imported bed course material for slope protection, or riprap filter blanket, shall be a porous free draining material consisting of sand, gravel, crushed stone or other approved free draining material. This material shall meet the following gradation requirements:**

GRADATION FOR GRANULAR BEDDING

Sieve Size	% by Weight Passing
	<b>Type I</b>
3/8"	100
#4	95-100
#16	45-80
#50	10-30
#100	2-10
#200	0-2

B. Riprap

1. **Imported riprap stone shall be rough, fractured to sub angular, and have a specific gravity of at least 2.65. Riprap shall consist of individual angular rock fragments which shall be unweathered, dense, hard, sound, and resistant to abrasion; shall be free from cracks, seams, and other defects that would tend to unduly increase their destruction by water and frost action. Boulder and riprap stones shall be nearly cubical as possible, with neither breadth nor thickness of a single stone less than one-third of its length. Thus, slab type stones, flaking rock, rounded stones, asphalt, broken concrete, concrete slabs, or other materials not classified as rock will not be allowed for use as boulders or riprap material. Riprap shall be clean, free of fines, and shall meet the following requirements:**

## CLASSIFICATION AND GRADATION OF RIPRAP

<b>Riprap Designation</b>	<b>% Smaller Than Given Size by Weight</b>	<b>Intermediate Rock Dimension (inches)</b>	<b>D50* (inches)</b>
Type VL	70 – 100 50 – 70 35 – 50 2 – 10	12 9 6 2	6
Type L	70 – 100 50 – 70 35 – 50 2 – 10	15 12 9 3	9
Type M	70 – 100 50 – 70 35 – 50 2 – 10	21 18 12 4	12
Type VH	100 50 – 70 35 – 50 2 – 10	42 33 24 9	24

\* D50 = Median Particle size.

## C. Void-Filled Riprap

- Where “Void-Filled Riprap” is designated on the Drawings, riprap shall be mixed with the materials and associated portions listed in the table below:

## MIX REQUIREMENTS FOR TYPE VL AND L VOID-FILLED RIPRAP

<b>Approx. Proportions (Loader Buckets)</b>	<b>Material Type</b>	<b>Material Description</b>
<b>6</b>	<b>Riprap</b>	<b>Type VL or L</b>
<b>1</b>	<b>Void-fill material</b>	<b>2- to 4-inch diameter cobble (round washed river rock that is well-graded, 100% passing 6-inch sieve, 35-50% passing 3-inch sieve, 5-20% passing 2-inch sieve).</b>
<b>1</b>	<b>Void-fill material</b>	<b>4-inch minus pit run surge (round river rock and sand, well graded, 90-100% passing 4-inch sieve, 70-80% passing 1.5-inch sieve,</b>

		<b>40-60% passing 3/8-inch sieve, 10-30% passing #16 sieve).</b>
<b>1</b>	<b>Void-fill material</b>	<b>Riprap bedding material.</b>
<b>½ to 1</b>	<b>Void-fill material</b>	<b>Native topsoil.</b>
<b>Top Layer</b>	<b>Top dressing</b>	<b>Additional 4- to 12-inch diameter cobbles (round washed river rock that is well graded, 80-100% passing 12-inch sieve, 35-50% passing 6-inch sieve, 5-20% passing 4-inch sieve) shall be mixed in on the surface of exposed sections of void-filled riprap (covering approximately 15% of the surface) prior to compaction of the void-filled riprap. Cobbles shall be fully embedded into the mass of the void-filled riprap.</b>

## **PART 6 - EXECUTION**

### **6.1 GENERAL**

- A. No riprap bedding or riprap shall be placed until the subgrade has been prepared, dewatered and properly compacted, or otherwise prepared in accordance with the provisions of the Specifications and as specified on the Drawings. No material shall be placed until the subgrade has been checked and approved by the Engineer in writing.

### **6.2 PLACEMENT OF RIPRAP BEDDING**

- A. All riprap bedding shall be placed uniformly under all placed riprap material, including replenished riprap materials, to a minimum thickness of 6 inches, and shall not account for the minimum thickness of riprap as shown on the Drawings. Uniform spreading of all riprap bedding shall be done using approved devices and machinery. Excessive rutting of the finished bedding surface shall be avoided. Riprap bedding shall be kept clean and free of other soils. If the riprap bedding is contaminated with other soils or deleterious material, it shall be removed and

replaced by the Contractor immediately. Where compaction is required, the bedding shall be compacted to 65% relative density (ASTM D4253).

### 6.3 RIPRAP PLACEMENT

- A. Riprap shall be placed with a maximum drop height of 3 feet to reduce segregation of particle sizes. Placing in layers or by dumping into chutes or similar methods which may cause segregation are specifically prohibited. The riprap shall be placed, in one preparation, to the line, grade, and thickness as shown on the drawings, without undue displacement of the granular filter bedding underneath.
- B. Riprap shall be placed to grade in a manner to ensure that the larger rock fragments are uniformly distributed and the smaller rock fragments serve to fill the spaces between the larger rock fragments in such a manner as will result in a well-keyed, densely placed, uniform layer of riprap of the specified thickness. Consolidation of the riprap by backhoe or other means will be necessary to ensure interlocking of rock fragments. Placed riprap shall be uniform and free from bulges, humps, or cavities. Hand placing will be required only to the extent necessary to secure the results specified above.
- C. The entire mass of riprap shall be placed on either channel slope or bottom so as to be in conformance with the required gradation mixture and to line, grade, and thickness shown on the Drawings.
- D. Riprap shall be placed to full course thickness at one operation and in such a manner as to avoid displacing the underlying bedding material. Placing of riprap in layers, or by dumping into chutes, or by similar methods shall not be permitted.
- E. All material used for riprap protection for channel slope or bottom shall be placed and distributed such that there shall be no large accumulations of either the larger or smaller sizes of stone. Some hand placement may be required to achieve this distribution.
- F. The basic procedure shall result in larger materials flush to the top surface with faces and shapes arranged to minimize voids, and smaller material below and between larger materials.
- G. Surface grade shall be a plane or as indicated, but projections above or depressions under the finished design grade by more than ten percent (10%) of the rock layer thickness shall not be allowed.
- H. Smaller rock shall be securely locked between the larger stone. It is essential that the material between the larger stones not be loose or easily displaced by flow or by vandalism.

- I. The stone shall be consolidated by the bucket of the backhoe or other means that will cause interlocking of the material.
- J. All rock is to be placed in a dewatered condition beginning at the toe of the slope or other lowest point.
- K. Contractor shall maintain the riprap protection until accepted. Any material displaced for any reason shall be replaced to the lines and grades shown on the Drawings at no additional cost to Owner. If the bedding materials are removed or disturbed, such material shall be replaced prior to replacing the displaced riprap.

#### 6.4 VOID-FILLED RIPRAP PLACEMENT

- A. The Engineer shall observe mixing and placing of the void-filled riprap material.
- B. Approved individual component materials of void-filled riprap mix shall be delivered to site in separate marked stockpiles. Mixing shall be accomplished using a front-end loader or other approved means to add the specified number of "loader buckets" of each material to a mixing stockpile. Ensure that each loader bucket comprises an approximately equal volume. If the loader operator is only able to fill the bucket partially full with large riprap (due to the force required to push the bucket into the pile), but uses full buckets of finer material, the mix proportions will not be correct. Avoid picking up excessive amounts of native soil from the subgrade under the stockpiled materials during the loader bucket mixing operations. The Engineer may reduce or eliminate the volume of topsoil added to the mixture based on the amount of native soil was incorporated during the bucket mixing operation.
- C. Once all the materials have been added to the mixing stockpile in the specified proportions, thoroughly mix the pile using a loader, large track hoe excavator, or other approved means to fill the voids of the riprap without displacing the riprap or creating pockets of finer material absent of riprap.
- D. Segregation of materials shall be minimized when hauling from the stockpile to the installation location. Remixing shall occur as necessary to correct for any segregation as the material is placed.
- E. The loose material shall be placed in a single lift of sufficient height such that final grade will be achieved upon compaction. Additional mixing with a track excavator shall be required after initial placement to ensure that the void-filled riprap is thoroughly mixed and no segregation or excessive amount of smaller void-fill material is present on the surface. The mixing and placement process shall result in larger riprap (D50 size or larger) flush to the top surface with faces and shapes arranged to minimize voids, and smaller material between and below larger materials.

- F. If the top of the compacted material is below final grade, placement of only the smaller void-fill materials to achieve final grade will not be permitted. Additional void-filled riprap shall be added and the entire section mixed with a track excavator to eliminate the presence of smaller void-fill material on the surface.
- G. Avoid segregation of materials and remix any section where the combined material consists primarily of the void-fill materials. The density and interlocking nature of riprap in the mixed material shall essentially be the same as if the riprap was placed without filling the voids. This requires care and persistence on the part of the Contractor to install the work correctly.
- H. At the direction of the Engineer, a 50:50 mixture of pit run and riprap bedding material shall be sprinkled on the surface of the void-filled riprap and washed-in with water using a high pressure hose to fill-in small voids. This shall be done just prior to compaction of the void-filled riprap.
- I. If specified as part of the cobble mix, the top dressing of cobbles shall also be mixed in on the surface of exposed sections of void-filled riprap material prior to compaction of the riprap material.
- J. Compaction of the void-filled riprap shall be performed by running over the void-filled riprap with a large, heavy duty track excavator or dozer. The moisture content of the mixture shall be at optimum conditions prior to compaction and water shall be added, as necessary, at the direction of the Engineer. Compaction of void-filled riprap shall be reviewed and approved by the Engineer.
- K. Where indicated on the Drawings, a surface layer of 4 to 6 inches moist topsoil shall be placed over the void-filled riprap. The topsoil surface layer shall be compacted to approximately 85% of maximum density and within two percentage points of optimum moisture in accordance with ASTM D698. Topsoil shall be added to any areas that settle.
- L. Contractor shall install a test section of at least 100 square feet of void-filled riprap for the review and approval of the Engineer prior to installation of the remaining void filled-riprap.
- M. Elevation tolerance for the void-filled riprap shall be 0.10 feet. Thickness of void-filled riprap shall be no less than thickness shown and no more than 2-inches greater than the thickness shown.

## 6.5 TOLERANCES

- A. Thickness: Minus 10 percent to plus 20 percent as shown on Drawings.



SECTION 02960  
TEMPORARY SANITARY SEWER BYPASS PUMPING

**PART 7 - GENERAL**

**7.1 SECTION INCLUDES**

- A. Temporary sanitary sewer bypass pumping to maintain sanitary sewer service during construction.

**7.2 RELATED SECTIONS:**

- A. All Sections.

**7.3 SUBMITTALS**

- A. Submittals shall conform to requirements of Section 01300 – Submittal Procedures.
- B. Submit Temporary Sanitary Sewer Bypass Plan for review by the Engineer and Owner prior to start of any fieldwork. A Professional Engineer licensed by the State of Colorado shall sign the Plan. The Plan shall include the following:

1. **Names and qualifications of equipment suppliers and installation subcontractors. The Contractor shall document at least 5 years of experience and verifiable history of projects requiring bypass pumping.**
2. **A description of the proposed temporary bypass systems indicating arrangement, location, capacities of system components, installation details and criteria, and operation and maintenance procedures. This description shall also include the following information:**
  - a. ***Bypass pumping phasing plan with exhibits and descriptions for each phase, including a schedule for installation and maintenance of bypass pumping system, and staging areas for pumps.***
  - b. ***Bypass pump sizes, capacity, number of each size to be onsite, and power requirements.***
  - c. ***Size, length, material, location, and method of installation for suction and discharge piping.***

- d. ***Standby power generator size and location.***
  - e. ***Method of noise control for each pump and/or generator.***
  - f. ***Design calculations demonstrating adequacy of the proposed systems for intended applications. Calculations shall include flow and head calculations including friction loss for the length and type of pipe and static head.***
  - g. ***Bypass pump curve(s) showing pump operating range.***
  - h. ***Daily operations of the pump(s) and the maintenance of the pump(s) during the non-working hours.***
  - i. ***Calculation of available time between pump failure and flooding, backups, etc.***
- 3. **Diagrams indicating the location of all system components, including, but not limited to, pumps, pipes, catch points, and discharge points. Include road crossing details.**
  - 4. **Name and telephone number for the Sewer Flow Control Supervisor who is to be on call 24 hours per day while pumps are in operation.**

#### 7.4 ENVIRONMENTAL REQUIREMENTS

- A. Comply with Colorado Department of Public Health and Environment (CDPHE) guidelines.

### **PART 8 - PRODUCTS**

#### 8.1 EQUIPMENT AND MATERIALS

- A. Contractor shall provide all labor, materials, and equipment necessary to provide adequate sanitary sewer bypass during construction of the Project without causing damage to public or private property or allowing unauthorized discharges of sanitary sewer flows.
- B. The Contractor is responsible for determining the capacity of the sanitary sewer bypass system. The Contractor shall consider the "full pipe" capacity of the sewer system being bypassed when determining the capacity of the bypass system. Based on City of Greeley modeling data, the peak hourly flow rate is expected to be approximately 1,550 GPM through the 18-inch diameter pipe, and the peak hourly

flow rate is expected to be approximately 176 GPM through the 12-inch diameter pipe. Equipment and materials to provide this range of flow capacity are at the option and risk of Contractor.

- C. Temporary Bypass Pumping System: All bypass pumping system materials shall be suitable for contact with domestic sanitary sewage. The bypass pumping system shall include the following components:
1. **Bypass pump(s) with sufficient capacity to bypass sanitary sewer flows without causing damage to public or private property.**
  2. **Backup pump(s) on site to provide 100% redundancy; backup pumps shall be isolated from the primary system by a valve.**
  3. **Bypass pumping control system.**
  4. **Bypass pumping system failure alarm(s).**
  5. **Discharge piping with leak-free joints.**
- D. Temporary Pumps: Pumps utilized in the bypass pumping system shall be self-priming and non-clog type capable of passing a non-compressible four-inch (4") sphere, designed for pumping domestic sewage containing solids and stringy materials. Pumps shall not require the use of foot valves or vacuum pumps in the priming system. All pumps used must be constructed to allow dry running for long periods of time to account for the cyclical nature of effluent flows. The pumps may be electric, or diesel powered. Engine exhaust shall be invisible, without objectionable fumes, smoke, oil mist, or carbon particles. Provide equipment of sufficient capacity to handle peak flow rates.
- E. Discharge and suction piping sizing shall be determined according to flow calculations and system operating calculations.
- F. High Density Polyethylene (HDPE): Piping shall be homogenous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, or other deleterious faults. Pipe shall be assembled and joined on site using coupling, flanges, or butt-fusion method to provide leak proof joints. Thread or solvent joints are not acceptable. Pipe fusion shall be carried out by personnel certified as fusion technicians by manufacturer of HDPE pipe and/or fusing equipment. Butt-fusion joints shall be true alignment and uniform roll-back beads resulting from use of proper temperature and pressure.

- G. Flexible Hoses and Associated Couplings and Connectors: Flexible hose and couplings shall be abrasive resistant and suitable for the intended services (i.e., fire hoses are not permitted). They shall be rated for external and internal loads anticipated including test pressure. External load design shall incorporate anticipated traffic loadings, including traffic impact loading where applicable. When subjected to traffic loading, the system shall be composed of traffic ramps and covers maintaining an H-20 loading requirement while in use or as directed by the Engineer.
- H. All rigid or hard piping shall be constructed with positive restrained joints.
- I. Under no circumstance will aluminum irrigation type piping or glued PVC pipe be allowed.
- J. Unmanned Bypass Pumping: All unmanned bypass pumping operations shall be fitted with an auto-dialer feature to monitor the operation of the pump and notify the Contractor in the event of a pump failure or overflow situation.
- K. Noise Control: Bypass pumping system components shall not have excessive noise levels and shall be restricted to a maximum of seventy decibels (70 dB) at a distance of 100 feet. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum.

## **PART 9 - EXECUTION**

### **9.1 TEMPORARY BYPASS PUMPING**

- A. Sanitary sewer bypass shall be completed in such a manner that there is no damage to public or private property. Repair and reparations for damage caused by or associated with sanitary sewer flows are the sole responsibility of the Contractor to fix, repair, clean and make whole.
- B. Sewage Spills: Violations of any state or federal laws caused by sewage spills shall be the sole responsibility of the Contractor. Should any liquid or solid matter from the sewer collection system be spilled, discharged, leaked, or otherwise deposited to the open environment as a result of the bypass operations, Contractor shall be responsible for all cleanup and disinfection of the affected area and all associated costs. The Contractor shall also be responsible for notifying the Owner, sewer system operating personnel, and appropriate regulatory agencies and performing all required cleanup operations at no additional cost to the Owner.
- C. Install, operate, and maintain temporary bypass systems in accordance with the Temporary Bypass Plan. Notify Engineer in writing of any changes made to accommodate field conditions and changes to the Work. Provide revised drawings and calculations with such notification.

- D. In the event of accidental spill or overflow, immediately stop the overflow and take action to clean up and disinfect spillage. Promptly notify Engineer so that required reporting can be made to the Colorado Department of Public Health and the Environment (CDPHE).
- E. Flow shall not be transferred to any new or modified facilities until the Owner has inspected and accepted the work.

## 9.2 FIELD QUALITY CONTROL AND MAINTENANCE

- A. Testing: Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The Owner will be given 24 hours' notice prior to testing.
- B. Inspection: Contractor shall inspect bypass pumping system every two hours to ensure that the system is working properly.
- C. Maintenance Service: Contractor shall ensure that the temporary pumping system is properly maintained.
- D. A Sewer Flow Control Supervisor is required to be on call 24 hours per day and be physically located within 30 minutes of the project site at all times while the pumps are in operation. The Sewer Flow Control Supervisor shall be knowledgeable in the operation of the sanitary sewer bypass system and shall have the authority to purchase replacement parts as needed to repair the sanitary sewer bypass system.
- E. Extra Materials:
  - 1. **Spare parts for pumps and piping shall be kept on site as required.**
  - 2. **Adequate hoisting equipment for each pump and accessories shall be maintained on the site.**

## 9.3 PREPARATION

- A. Precautions:
  - 1. **Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate their bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner. All costs associated**

**with relocating utilities and obtaining approvals shall be the responsibility of the Contractor.**

2. **During all bypass pumping operation, the Contractor shall protect the pumping station and main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for any physical damage to the pump station and mains and all local sewer lines caused by human or mechanical failure.**

B. Notifications:

1. **Contractor shall notify property owners, residents, and business managers in writing prior to plugging, bypassing, or otherwise affecting a sewer service. This notification shall be provided a minimum of 72 hours in advance, but no more than 144 hours in advance prior to plugging or bypassing a sewer service. Contractor shall not plug a sewer service for more than 4 hours without providing additional accommodations.**

#### 9.4 INSTALLATION AND REMOVAL

- A. Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide suction conduit.
- B. Plugging or blocking of sewage flows shall incorporate primary and secondary plugging devices. When plugging or blocking is no longer needed for performance and acceptance of Work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging, or causing other major disturbances downstream.
- C. When working inside a manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements for working in the presence of sewer gases, combustible oxygen-deficient atmospheres, and confined spaces.
- D. The installation of bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets, sidewalks, and on shoulders or the roads. When the bypass pipeline crosses local streets and private driveways, where roadway ramps cannot be used, the Contractor must place the bypass line in trenches and cover with temporary pavement or plates.

- E. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Owner, the Contractor shall remove all piping, restore all property to pre-construction condition, and restore all pavement and roadways. The Contractor is responsible for obtaining any approvals for placement of temporary pipelines from local agencies.

SECTION 11285  
SLIDE GATES

**PART 10      - GENERAL**

**10.1      SECTION INCLUDES**

- A.      Furnish all materials and services necessary for the slide gate system as shown on the Contract Drawings and as specified in accordance with provisions of the Contract Documents, and completely coordinated with work of all other trades. Although such work is not specifically shown or specified, furnish all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure and complete installation.
- B.      Furnish all materials and services necessary for the installation of the handwheel on the dissipation structure.

**10.2      RELATED SECTIONS**

- A.      Section 03300—Cast-In-Place Concrete

**10.3      REFERENCES**

- A.      Where reference is made to any standard, the version in affect at the time of bid opening shall apply.
- B.      American Society for Testing and Materials International (ASTM):
  - 1.      **A36: Standard Specification for Carbon Structural Steel**
  - 2.      **A126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings**
  - 3.      **A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod**
- C.      American National Standards Institute / American Water Works Association (ANSI/AWWA):
  - 1.      **C560: Cast-Iron Slide Gates**
- D.      The Society for Protective Coatings/National Association of Corrosion Engineers (SSPC/NACE):
  - 1.      **SSPC SP 10/NACE No. 2 – Near-White Blast Cleaning**



#### 10.4 SUBMITTALS

A. General:

1. **Submit under provisions of Section 01330—Submittals.**
2. **Prior to manufacturing any of the components for the installation of the slide gate and appurtenances, detailed shop drawings shall be submitted to the Engineer for approval.**
3. **Manufacturer drawings shall be certified as meeting ANSI/AWWA C560 Standards for dimensions, construction, and materials used for all parts of the slide gate and manual slide-gate actuator mechanism.**

#### 10.5 SYSTEM WARRANTY

- A. Defects in material or workmanship of new system components shall be repaired or replaced at no cost to the Owner for a period of two (2) years from date of final completion as determined by the Engineer and Owner.

### PART 11 - MATERIALS

#### 11.1 GENERAL

- A. The slide gate shall be installed on the outlet end of the non-potable water pipe at the dissipation structure.
- B. The slide gate shall be designed for totally submerged silty conditions.
- C. The slide gate handwheel shall be installed on the dissipation structure at the top of the ditch in accordance with the Drawings.
- D. The slide gate shall be rated for 20 feet of seating head and 10 feet of unseating head.
- E. The slide gate operator shall be lockable.

#### 11.2 SLIDE GATE MATERIALS

- A. Seat – Cast Iron – ASTM A126, Class B
- B. Slide – Cast Iron – ASTM A126, Class B
- C. Cross Bar – Cast Iron – ASTM A126, Class B

- D. Cross Bar Bolt & Nut – Steel, Plated – ASTM A307, A164
- E. Wedge – Cast Iron – ASTM A126, Class B
- F. Wedge Fasteners – Steel, Plated – ASTM A307, A164
- G. Side Angle – Steel, Galvanized – ASTM A36
- H. Stem Support – Steel, Galvanized – ASTM A36
- I. Head Bar – Steel, Galvanized – ASTM A36
- J. Head Bar Fasteners – Steel, Plated – ASTM A307, A164
- K. Stem – Steel – ASTM A108, Grade 1045
- L. Keeper – Cast Iron – ASTM A126, Class B
- M. Keeper Bolts & Nuts – Steel, Plated – ASTM A307, A164
- N. Lift Nut – Brass – ASTM B584, Alloy 844
- O. Stop Nut – Brass – ASTM B16
- P. Handwheel – Cast Iron – ASTM A126, Class B
- Q. Handwheel Set Screw – Steel, Plated – ASTM A307, A164
- R. Stem Supt., Bolts/Nuts – Steel, Plated – ASTM A307, A164

### 11.3 Manufacturers

- A. Series 6400 as manufactured by Fresno Gates.
- B. Series C-20 as manufactured by Waterman USA.
- C. Approved equal.

## PART 12 - EXECUTION

### 12.1 TESTING

- A. Field Leakage Test:
  - 1. **A field leakage test shall be performed by the Contractor after installation of the slide gate.**

2. **The manufacturer shall be notified of the test in sufficient time to enable manufacturer to have a representative present for that test.**
3. **After all adjustments have been made and the mechanisms properly lubricated, each gate slide shall be run through three complete cycles as a final check on proper operation before starting the leakage test.**
4. **Seating and unseating heads shall be measured from the top surface of the water to the center of the gate.**
5. **At the design seating head, the leakage shall not exceed 0.1 gpm per foot of seating perimeter.**

**B. Manufacturer's Representative:**

1. **The system manufacturer shall provide a field representative for a minimum of one (1) day of field time as required to inspect, test, or approve all aspects of the installation.**

**35<sup>TH</sup> AVENUE UTILITY PROJECT PHASE 1**  
**CITY OF GREELEY CONSTRUCTION SPECIFICATIONS - VOLUME III (POTABLE WATER**  
**DISTRIBUTION, SANITARY SEWER COLLECTION, AND NON-POTABLE IRRIGATION SYSTEMS)**

<u>SECTION</u>	<u>TITLE</u>
01713	Water Distribution System Testing
01715	Sewer and Manhole Testing
02315	Excavation and Fill
02445	Casing Pipe – Borings and Encasements
02510	Water Utility Distribution Piping
02511	Disinfection of Water Utility Distribution
02513	Polyvinyl Chloride (PVC) Pressure Pipe
02514	Water Service Lines, Meters, and Appurtenances
02515	Water Utility Distribution Valves
02516	Water Utility Distribution Fire Hydrants
02530	Sanitary Utility Sewerage Piping
02533	Polyvinyl Chloride (PVC) Non-Pressure Pipe
02535	Sanitary Utility Sewerage Manholes, Frames, and Covers
03300	Cast-In-Place Concrete
03400	Precast Concrete
15140	Non-Potable Irrigation System

SECTION 01713  
WATER DISTRIBUTION SYSTEM TESTING

**PART 13**      – GENERAL

**13.1**    SCOPE

- A.      This section addresses the hydrostatic testing of potable water distribution and non-potable irrigation lines.
- B.      The Contractor is responsible for the hydrostatic testing of water lines.

**13.2**    SUBMITTALS

- A.      Testing Plan: Submit prior to testing and include the following:
  - 1.      **Testing dates.**
  - 2.      **Piping systems and section(s) to be tested.**
  - 3.      **Test type.**
  - 4.      **Method of isolation.**
  - 5.      **Calculation of maximum allowable leakage for piping section(s) to be tested.**
- B.      Certifications of Calibration for testing equipment, including pressure gauges, that are no more than 6 months old from date of use.
- C.      Certified Test Report.

**PART 14**      – PRODUCTS

**14.1**    PRESSURE GAUGES

- A.      Contractor shall supply all pressure gauges used for leakage testing meeting the following requirements:
  - 1.      **Dial Size: Nominal 2-inch dial size.**
  - 2.      **Accuracy: 2 percent of span.**
  - 3.      **Scale Range: Such that normal operating pressure lays between 50 percent and 80 percent of the scale range.**

4. **The maximum allowable pressure gauge increment shall be five (5) psi.**

**PART 15**      **– EXECUTION**

**15.1**      **GENERAL**

- A. Testing shall be conducted when:
  1. **Backfill and compaction has been completed, but before street improvements are installed.**
  2. **Main has been flushed.**
    - a. ***Disinfection shall occur after leak testing is completed and accepted. Disinfection to follow construction specification Section 02511, Disinfection of Water Utility Distribution.***
- B. Contractor shall ensure that thrust blocking or other types of restraining systems will provide adequate restraint prior to pressurizing the system.
  1. **At least seven (7) days shall have elapsed since the last concrete thrust restraint was cast.**
  2. **A minimum of seventy-two (72) hours shall elapse if high-early-strength cement is used.**
- C. The Contractor shall provide all equipment and personnel to perform the hydrostatic test.
  1. **Test equipment shall be able to maintain a continuous internal pipe pressure required for the test psi and accurately measure leakage from the pipe over a two (2) hour, minimum, test period.**
  2. **A water meter shall be used to measure the amount of water used in pressurizing the system.**
- D. When existing water mains are used to supply the test water, they shall be protected from backflow pressures by temporarily installing a double check-valve assembly between the test and the supply main.
- E. Do not test against the City's existing valves.

1. **Provide temporary watertight plugs and temporary thrust restraint until tests pass.**
  2. **After system passes testing, remove plugs and thrust restraint and connect to existing valve with cut-in sleeve or solid sleeve.**
- F. New Piping Connected to Existing Piping:
1. **Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to the City.**
  2. **Test joint between new piping and existing piping by methods that do not place entire existing system under test load, as approved by the City.**
- G. The City shall be notified 48 hours in advance of testing. The City shall witness tests and record times, leakage readings, and pressure over the test period.
- H. A hydrostatic pressure test shall be performed against all new valves at the point of connection to the existing system. This test shall be performed prior to connecting the new system to the existing one.
- I. Only City personnel shall operate existing City owned valves.
- J. Filling the Line
1. **Potable water shall be used. An alternative water source will require prior approval from the City.**
  2. **When filling the pipeline, it shall be filled at a rate which will not cause surges nor will it exceed the rate at which the air can be released.**
  3. **Where permanent air release vents are not available, the Contractor shall install corporation stops at high points in the water line in order to evacuate trapped air.**
  4. **All corporation stops, which were installed to facilitate evacuation of air from the water main, shall be removed and plugged with a "cc" threaded brass plug after the water main is filled, and prior to pressure testing.**
- K. Pipe shall remain filled with water for a minimum of twenty-four (24) hours prior to

the hydrostatic pressure test.

- L. Prior to the tests, inspect valves within the test section to make sure they are fully operational.
- M. Operate all valves in the system in the presence of City personnel.
- N. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.

## 15.2 PRESSURE TEST

- A. "Leakage" is the quantity of water that must be added to the pipeline to maintain a pressure within five (5) psi of the specified test pressure after the air has been expelled and the pipe has been filled with water.
- B. Test pressure

- 1. **Test pressure shall be 150 psi or 150% of the operating pressure, whichever is greater, at the highest elevation of the test section.**
  - 2. **A residual pressure, within five (5) psi of the test pressure, shall be maintained for a minimum two (2) hours.**

- C. The maximum allowable leakage for each test section is determined by the following formula and table:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where: L = maximum allowable leakage, in gallons per hour

**S = length of pipe tested, in feet**

**D = nominal pipe diameter, in inches**

**P = average test pressure during the leakage test, in psi (gauge)**

There will be no additional leakage allowance for valves.

- D. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

## 15.3 PASSING

- A. If the tests disclose leakage greater than that specified, the defective materials and joints shall be located and repaired. The tests shall be repeated until the leakage is less than the maximum allowed.



- B. With the exception of obvious leaks, passing of the pressure test shall be on the basis of maximum allowable leakage per section tested. No leakage is allowed through the bonnet of any valve or appurtenance. Any valve or appurtenance that is tested and leaks will be removed and replaced.
- C. All visible leaks shall be repaired regardless of maximum allowable leakage.

SECTION 01715  
SEWER AND MANHOLE TESTING

**PART 1 – GENERAL**

**1.1 SCOPE**

- A. This section addresses the testing of sanitary sewer collection mains, manholes, and appurtenances.
- B. All sanitary sewer pipelines shall be air tested per these specifications.
- C. All sanitary sewer manholes shall be vacuum tested per these specifications.
- D. All sanitary sewer collection systems shall be video inspected per these specifications.

**1.2 REFERENCES**

- A. ASTM International (ASTM)
  - 1. **C1244, Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test Prior to Backfill, latest revision.**
  - 2. **F1417, Standard Test Method for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air, latest revision.**

**1.3 SUBMITTALS**

- A. Video Inspections
  - 1. **DVDs**
    - a. ***Submit three copies of completed, narrated, color DVDs identified by Project name, street name, right-of-way property name, and manhole numbers.***
    - b. ***DVDs become property of the City of Greeley Water and Sewer Department***
  - 2. **Inspection Logs**

- a. ***Submit cleaning and television inspection logs for each section of sewer line to be rehabilitated.***
- b. ***Include the following minimum information***
  - i. ***Stationing and location of lateral services, wyes, or tees***
  - ii. ***Date and clock time references***
  - iii. ***Pipe joints***
  - iv. ***Infiltration/Inflow defects***
  - v. ***Cracks***
  - vi. ***Leaks***
  - vii. ***Offset joints***
3. **Submit specific detailed description of proposed bypass pumping system, including written description of plan addressing schedule, quantity, capacity, and location of pumping equipment.**
4. **Submit spill plan to address any spills that might occur.**
5. **Field Quality-Control Submittals: Indicate results of Contractor-Furnished tests and inspections.**
6. **Qualifications Statement**
  - a. ***Submit qualifications of applicator.***
- B. **Exfiltration and Infiltration Testing**
  1. **Submit the following items prior to the start of testing**
    - a. ***Testing procedures***
    - b. ***List of test equipment***
    - c. ***Testing sequence schedule***

- d. ***Provisions for disposal of flushing and test water***
    - e. ***Certification of test gage calibration***
  - 2. **Test and Evaluation Reports: Indicate results of manhole and piping tests**
  - 3. **Qualifications Statement**
    - a. ***Submit qualifications for applicator***
- C. Vacuum Testing
  - 1. **Submit the following items prior to start of testing**
    - a. ***Testing procedures***
    - b. ***List of test equipment***
    - c. ***Testing sequence schedule***
    - d. ***Provisions for disposal of flushing and test water***
    - e. ***Certification of test gage calibration***
  - 2. **Test and Evaluation Reports: Indicate results of manhole tests**
  - 3. **Qualifications Statement**
    - a. ***Submit qualifications for applicator***
- D. Air Testing
  - 1. **Submit the following items prior to the start of testing**
    - a. ***Testing procedures***
    - b. ***List of test equipment***
    - c. ***Testing sequence schedule***
    - d. ***Provisions for disposal of flushing and test water***
    - e. ***Certification of test gage calibration***

2. **Test and Evaluation Reports: Indicate results of piping tests**
3. **Qualifications Statement**
  - a. ***Submit qualifications for applicator***

E. Mandrel Testing

1. **Submit the following items prior to start of testing**
  - a. ***Testing procedures***
  - b. ***List of test equipment***
  - c. ***Testing sequence schedule***
  - d. ***Provisions for disposal of flushing and test water***
  - e. ***Certification of test gage calibration***
  - f. ***Deflection mandrel drawings and calculations***
2. **Test and Evaluation Reports: Indicate results of piping tests.**

**PART 2 – PRODUCTS**

**2.1 Video Inspections**

A. DVDs

1. **Description: Digital video formatted discs**
2. **Audio track containing simultaneously recorded narrative commentary and evaluations of videographer, describing in detail condition of pipeline interior.**

**2.2 Exfiltration and Infiltration Testing**

A. Equipment

1. **Plugs**
2. **Pump**
3. **Measuring device**

## 2.3 Vacuum Testing

### A. Equipment

1. **Vacuum pump**
2. **Vacuum line**
3. **Vacuum tester base**
  - a. ***Compression band seal***
  - b. ***Outlet port***
4. **Shutoff valve**
5. **Stopwatch**
6. **Plugs**
7. **Vacuum Gage: Calibrated to 0.1 in. Hg**

## 2.4 Air Testing

### A. Equipment

1. **Air compressor**
2. **Air supply line**
3. **Shutoff valves**
4. **Pressure regulator**
5. **Pressure relief valve**
6. **Stopwatch**
7. **Plugs**
8. **Pressure Gage: Calibrated to 0.1 psi**

## 2.5 Mandrel Testing

### A. Equipment

1. **Properly sized rigid ball or “go, no go” mandrel**
2. **Pull/retrieval ropes**

### **PART 3 – EXECUTION**

#### **3.1 GENERAL**

- A. Testing shall be conducted when:
  1. **Backfill and compaction has been completed, but before paving and curb gutter improvements are installed.**
  2. **Line and manholes have been thoroughly cleaned of all foreign material.**
- B. The Contractor shall furnish all equipment, labor, and incidentals necessary to perform tests. The pressure gauge shall be capable of indicating pressure to the nearest 0.1 pounds per square inch (psi) increment.
- C. The City shall witness tests and record times, leakage readings, and pressure over the test period. Contractor shall provide the City a minimum forty-eight (48) hours advance notice of any tests.

#### **3.2 ALIGNMENT TEST**

- A. Lamp testing shall be on an as needed basis at the City’s discretion.
- B. Lamp each section of sanitary sewer between manholes to determine whether any displacement of pipe has occurred.
- C. Lamping shall be done after pipe trench is compacted and brought to grade or pavement subgrade.
- D. “Full moon” shall be visible for vertical grade alignment. No less than “half moon” shall be visible for horizontal alignment.
- E. Repair poor alignment, displaced pipe, or other defects discovered at the city’s discretion.

#### **3.3 PIPE DEFLECTION TEST**

- A. Mandrel testing shall be completed on an as needed basis at the City’s discretion.
- B. Each section of sanitary sewer shall be tested for deflection by an independent testing firm as hired by the Contactor prior to City acceptance and as deemed

necessary within the warranty period by the City.

1. **The maximum allowable deflection for City acceptance is 5% of the base internal diameter.**
2. **The maximum allowable deflection at the end of the warranty period shall be 7.5% of the base internal diameter.**
3. **Mandrel outside diameters in inches are as follows:**

*TABLE 3.3-A: Allowable Pipe Deflection – Mandrel Test*

<i>Pipe Size (in)</i>	<i>Base I.D.</i>	<i>5% Deflection Mandrel</i>	<i>7.5% Deflection Mandrel</i>
<b>8"</b>	<b>7.665</b>	<b>7.282</b>	<b>7.090</b>
<b>10"</b>	<b>9.563</b>	<b>9.085</b>	<b>8.846</b>
<b>12"</b>	<b>11.361</b>	<b>10.793</b>	<b>10.509</b>
<b>15"</b>	<b>13.898</b>	<b>13.203</b>	<b>12.856</b>

- C. Sections of the pipe which fail the deflection test shall have the defects repaired and the test repeated.

### **3.4 AIR TESTING SANITARY SEWER MAINS**

- A. Conduct tests in conformance with ASTM F1417 and these specifications.
- B. All pressures in this section assume no groundwater back pressure, if groundwater is present, increase test air pressures to compensate for the back pressure. Each foot of groundwater produces approximately 0.433 psi back pressure. For groundwater in excess of five feet (5') above the pipe crown, an infiltration test shall be used in lieu of air testing.
- C. Preparation for tests:
  1. **Flush and clean the sewer line prior to testing in order to wet the pipe surfaces and produce more consistent results.**
  2. **Provide a relief valve on the pressuring equipment to avoid over-pressurizing and damaging an otherwise acceptable line. Set relief valve at 5.0 psi.**
  3. **Plug and brace all openings in the main sanitary sewer line and the upper connections. Check all pipe plugs with a soap**



**solution to detect any air leakage. If leaks are found, release the air pressure, eliminate the leaks and start the test procedures over again.**

**D. Test Procedure:**

- 1. Add air until internal pressure of the sewer line is raised to approximately 4.0 psi gage. Maintain the air pressure between 3.5 psig and 4.5 psig until the air temperature in the pipe is stabilized with the pipe/ground temperature.**
- 2. Disconnect the air supply and reduce the air pressure to 3.5 psig before starting the test.**
- 3. If the groundwater is higher than the top of the pipe, the test pressure shall be adjusted to account for the higher groundwater. The test pressure shall be increased by 0.433 psi per foot of ground water up to five (5) feet of groundwater. For groundwater over five (5) feet in depth, an infiltration test shall be conducted in place of the air test.**
- 4. Determine the time required for the air pressure to drop from 3.5 psig to 2.5 psig.**

- a. *The time elapsed shall not be less than:***

$$T = 0.085 \frac{DK}{Q}$$

**Where: *T = shortest time(s) allowed for the air pressure to drop 1.0 psig.***

***K = 0.000419DL but not less than 1.0***

***Q = leak rate in cubic feet/minute/square feet of internal surface =***

***0.0015 CFM/SF***

***D = measured average inside diameter of pipe (in)***

***L = length of test section (ft)***

- b. *Example calculation for an eight-inch (8") diameter sanitary sewer pipe with a test section 400 feet long:***

$$T = 0.085 \left[ \frac{8in(0.000419)(8in)(400ft)}{0.0015CFM / SF} \right]$$

T= 608 seconds or 10 minutes 08 seconds (10:08)

- c. **The following table contains the test durations for pipe diameters between eight-inches (8") and fifteen inches (15"), for pipe lengths up to 500 feet.**

TABLE 3.4-D: Specified Test Duration for Length of Pipe

Indicated

(Duration indicated in min:sec)

Pipe Diameter (in)	Pipe Length (feet)						
	0-	200	250	300	350	400	500
8	7:34	7:34	7:34	7:36	8:52	10:0	12:3
10	9:26	9:26	9:53	11:5	13:5	15:4	19:4
12	11:2	11:2	14:1	17:0	19:5	22:4	28:2
15	14:1	17:4	22:1	26:4	31:0	35:3	44:2

5. If lateral or service lines are included in the test, their length may be ignored for computing required test time if the test time requirements are met. If the test section fails, time shall be recomputed to include all the lateral lengths using the following formula:

$$T = 0.085 \left[ \frac{D_1^2 L_1 + D_2^2 L_2 + \dots + D_n^2 L_n}{D_1 L_1 + D_2 L_2 + \dots + D_n L_n} \right] \frac{K}{Q}$$

**Where:**

**T = shortest time(s) allowed for the air pressure to drop 1.0 psig.**

**K = 0.000419(D<sub>1</sub>L<sub>1</sub> + D<sub>2</sub>L<sub>2</sub> + ... + D<sub>n</sub>L<sub>n</sub>) but not less than 1.0**

**Q = leak rate in cubic feet/minute/square feet of internal surface = 0.0015 CFM/SF**

**D<sub>1</sub>, D<sub>2</sub>, etc. = measured average inside diameter of pipe (in)**  
**L<sub>1</sub>, L<sub>2</sub>, etc. = length of test section (ft)**

**If the recomputed test time is short enough to allow the section tested to pass, then the test section meets the requirements of this specification.**

- E. Sections of the pipe which fail the air test shall have the defects repaired and the test repeated.

### 3.5 EXFILTRATION TEST

- A. Exfiltration testing may only be completed upon approval from the City.
- B. Contractor shall provide a pre-approved device capable of measuring flow in the pipe in fifteen (15) minute intervals and providing a total flow at the end of the testing period.
- C. Flow measurement shall be twenty-four (24) hours minimum and shall be conducted before backfill and trench/area dewatering operations are complete.
- D. The maximum allowable exfiltration for sanitary sewers shall not exceed 50 gallons per day/inch nominal diameter pipe/mile (0.95 gpd/inch/100ft).

### 3.6 INFILTRATION TEST

- A. If groundwater exists in excess of five feet (5') above the pipe crown an infiltration test for leakage shall be used.
- B. Contractor shall provide a pre-approved device capable of measuring flow in the pipe in fifteen (15) minute intervals and providing a total flow at the end of the testing period.
- C. Flow measurement shall be twenty-four (24) hours minimum and shall be conducted only after backfill and trench/area dewatering operations are complete and groundwater has returned to normal elevations.
- D. The maximum allowable infiltration for sanitary sewers shall not exceed 50 gallons per day/inch nominal diameter pipe/mile (0.95 gpd/inch/100ft).

### 3.7 VACUUM TESTING MANHOLES

- A. Manholes shall be tested before the ring and cover and grade adjustment rings are installed, and after backfill and compaction is complete.

- B. Conduct tests in conformance with ASTM C1244 and these specifications.
- C. Preparation for tests:
  - 1. **All lift holes, joints, and other imperfections shall be filled with an approved non-shrink grout, to provide a smooth finish appearance.**
  - 2. **All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manholes.**
- D. Test Procedure:
  - 1. **The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendation.**
  - 2. **A vacuum of ten-inches (10") mercury shall be drawn in the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off.**
  - 3. **The time shall be measured for the vacuum to drop to nine-inches (9") mercury.**
  - 4. **The manhole shall pass if the time for the vacuum reading to drop from ten-inches (10") mercury to nine-inches (9") mercury meets or exceeds the values indicated in the following table:**

TABLE 3.6-D: Manhole Vacuum Testing Durations

Depth* (ft)	Diameter (in)		
	48	60	72
	Time (seconds)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121
* Round actual depth of manhole to next depth up (ex. 11 foot deep manhole, use depth of 12 feet)			

- E. If the manhole fails any test, necessary repairs shall be made by an approved method and the manhole shall be retested until a satisfactory test is obtained.

### 3.8 TELEVISIONING SANITARY SEWER MAIN

- A. All sanitary sewer lines shall be televised prior to final acceptance and three (3) months prior to the end of the warranty period or as deemed necessary within the warranty/construction period by the City. The televising shall be made by the Contractor or a Sub-consultant to the contractor and the recording shall be submitted to the City for review and acceptance. The individual completing the video recording shall be NASSCO trained and certified.
- The recording shall be made using a color camera, self-propelled or other, having sufficient light to show detail of problem areas and joints.**
  - Camera shall have a swivel head capable of looking up each service connection.**
  - Camera speed shall not exceed three (3) ft/s.**
  - If problem area or concerns are seen by the operator, then the camera shall be backed up and an extended look at the**

**area will be recorded.**

5. **All recordings will have location (i.e. manhole # to manhole #), time, date, and footage displayed.**
  6. **All recordings will include an evaluation of the manholes.**
- B. The warranty period for the sanitary sewer collection system WILL continue to be in effect for the time specified in these specifications or until the Water and Sewer Department has received and approved the video recordings, which ever is longer.

SECTION 02315  
EXCAVATION AND FILL

**PART 1 – GENERAL**

**1.1 SCOPE**

- A. This section covers excavation and trenching, including but not limited to dewatering, preparation of subgrades, pipe bedding, backfilling, compacting, groundwater barriers, materials testing, and finish grading for underground pipelines and appurtenances.

**1.2 REFERENCES**

- A. American Association of State Highway and Transportation Officials (AASHTO)
1. **T26, Standard method of Test for Quality of Water to be Used in Concrete, latest revision.**
  2. **T99, Moisture–Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop (Method A), latest revision.**
- B. American Concrete Institute (ACI)
1. **305, Hot Weather Concreting, latest revision.**
- C. ASTM International (ASTM)
1. **C33, Standard Specification for Concrete Aggregates, latest revision.**
  2. **C94, Standard Specification for Ready-Mixed Concrete, latest revision.**
  3. **C150, Standard Specification for Portland Cement, latest revision.**
  4. **D422, Standard Test Method for Particle-Size Analysis of Soils, latest revision.**
  5. **D448 (AASHTO M43), Standard Classification for Sizes of Aggregate for Road and Bridge Construction, latest revision.**

6. **C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete**, latest revision.
  7. **D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))**, latest revision.
  8. **C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution**, latest revision.
  9. **D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))**, latest revision.
  10. **D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils**, latest revision.
  11. **D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders**, latest revision.
  12. **D6023, Standard Test Method for Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM)**, latest revision.
  13. **D6024, Standard Test Method for Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application**, latest revision.
  14. **D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)**, latest revision.
- D. (National Electrical Manufacturers Association (NEMA))
1. **Z535.1, Safety Color Code**, latest revision.
- E. Occupational Safety and Health Administration (OSHA)



1. **29 CFR Part 1926, *Safety and Health Regulations for Construction*, latest revision.**

### 1.3 SUBMITTALS

#### A. Dewatering

1. **Water Control Plan: Submit for review by the City prior to start of any field work. At a minimum, the Water Control Plan shall include the following:**
  - a. ***Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment; methods; standby equipment and power supply, discharge locations to be utilized, and dewatering pollution control BMPs.***
  - b. ***Drawings showing locations, dimensions, and relationships of elements of each system.***
  - c. ***Design calculations demonstrating adequacy of proposed dewatering systems and components.***
  - d. ***Surface water control and drainage installations and related pollution control BMPs.***
  - e. ***Locations and types of monitoring systems.***
  - f. ***Proposed methods and locations for disposing of the removed water.***
  - g. ***Any treatment system in place to meet discharge quality criteria if applicable.***
  - h. ***If the system is modified during installation or the operation, revise or amend and resubmit the Water Control Plan.***
2. **Statement of Qualifications for Dewatering Specialist: Provide a summary of project experience and references for designer of dewatering systems.**
3. **Well Permits: Submit to City before start of field work.**

4. **Discharge Permits: Submit to City before start of field work and keep onsite for the duration of the work.**

B. **Fill and Backfill**

1. **Results of particle size testing of proposed offsite source material in accordance with ASTM D422.**
2. **Results of Atterberg limit testing of proposed offsite source material in accordance with ASTM D4318 (fine-grained material only).**
3. **Results of Modified proctor testing of proposed offsite source material in accordance with ASTM D1557.**
4. **Certified test results from independent testing agency.**

C. **Trench Backfill**

1. **Shop Drawings: Manufacturer's descriptive literature for marking tapes.**
2. **Samples: Submit samples of materials proposed to be used in the Work to demonstrate material conformance with these Specifications.**
  - a. ***Samples to be provided include:***
    - i. ***Trench stabilization material.***
    - ii. ***Bedding and pipe zone material.***
    - iii. ***Granular drain.***
    - iv. ***Granular backfill.***
    - v. ***Earth backfill.***
    - vi. ***CLSM.***
    - vii. ***Geotextile.***

3. **CLSM: Certified mix designs, certified laboratory performance of mix designs, and strength test results provided by a certified laboratory.**
  - a. *Include material types, weight per cubic yard, and 2- and 28-day unconfirmed compressive strengths for each component of CLSM mix.*
    - i. *Form a minimum of six test cylinders with proposed materials to confirm design strength and mix design in accordance with ASTM D4832. Break four of the cylinders at 7 days in conformance with applicable concrete cylinder specifications and provide test results to City for review. Break the remaining two cylinders at the discretion of City. Complete mix design and cylinder breaks at least 21 days prior to use of the material in the Work. Final mix approval and use of the material will not occur prior to confirmation for strength by the cylinder breaks.*
    - ii. *Determine the materials and proportions used to meet the requirements of these Specifications. Continuously monitor soil composition. Perform sieve analysis and adjust CLSM mix if general composition changes or as directed by City. Modify CLSM mix as necessary to meet the strength, flowability, pumpability, and set time requirements for each individual pour.*
    - iii. *Do not place CLSM until City has approved the mix design. City's approval of the mix design indicates conditional acceptance. Final acceptance will be based on tests conducted on field samples and conformance with these Specifications.*
4. **Catalog and manufacturer's data sheets for compaction equipment.**
5. **Certified Gradation Analysis: Submit not less than 30 days prior to delivery for imported materials or anticipated use for**

**excavated materials, except for trench stabilization material that will be submitted prior to material delivery to Site.**

6. **Credentials of certified labs.**
7. **Description and location of proposed sources of imported material. Include documentation that imported materials are free of hazardous substances.**
8. **Test for conformance and submit certification and test records of materials showing that they meet the applicable requirements prior to commencing permanent placement of the materials for the Work. Tests, certification, and test records of materials will be performed within 6 months of submittal.**
9. **Submit a description of material testing work plan and program including as minimum onsite and offsite soils/materials laboratory testing facility location, facility details, testing certifications, experience of testing personnel, frequency of testing regarding material quality and material placement.**

#### **1.4** CONSTRUCTION STAKING

- A. Construction staking shall be performed under the direct supervision of a Professional Land Surveyor licensed in the State of Colorado.
- B. Adequate staking shall be provided to establish acceptable horizontal and vertical control.
- C. Offsets shall be staked so that the City Inspector may check vertical and horizontal alignment.
- D. All survey notes and construction staking notes shall be entered into bound, hard cover field books, kept at the construction site for the duration of the project, and shall be made available to the City upon request.
- E. All survey data, which is developed by the Contractor or the Engineer in performing surveys required by the work, shall be available to the City for examination and reproduction throughout the construction and warranty periods.

- F. The City Inspector shall be informed of all field changes to the City accepted Construction Drawings. Approval for the changes shall be required from the City prior to the changes being made in the field.

## 1.5 FIELD CONDITIONS

- A. Drainage and groundwater.

1. **Keep excavations and trenches free of water during construction. Divert surface runoff and utilize sumps, gravel blankets, well points, drain lines or other means of dewatering, as necessary.**
  - a. *Dewater the excavation or trench until the structure, pipe, or other, to be installed therein, is completed to the extent that no damage from hydrostatic pressure, floatation, or other cause will result.*
  - b. *Water shall be removed from the trench to the extent necessary in order to provide a firm subgrade and dry conditions for pipeline installation.*
2. **The pipeline being constructed shall not be used for dewatering.**
3. **The piping used to dewater the trench shall not be left in the trench when backfilled.**
4. **Groundwater barriers shall be installed if groundwater is encountered or expected. Groundwater barriers shall be installed as shown on the drawings and, as necessary, every 400'. Refer to the City of Greeley Standard Drawing for additional installation requirements.**
5. **Prior to beginning dewatering operations, the Contractor shall obtain all necessary permits and appropriate authorization to start dewatering. If groundwater will be discharged or drained into an irrigation ditch, pond, stream or waterway, a CDPHE Dewatering Permit will be required.**

- a. ***The Contractor is required to complete and process the Discharge Monitoring Report (DMR) that is typically a part of the Dewatering Permit.***
  - b. ***Upon completion of the work, the Contractor shall be responsible for completing a CDPHE Discharge Termination Notice.***
- B. Blasting is not permitted within the jurisdiction of the City unless otherwise authorized by the City. If authorized, permitting and requirements associated with blasting are the responsibility of the Contractor.
- C. Sequencing
  1. **Backfill shall be completed, at the end of each day, to the extent that no damage from hydrostatic pressure, flotation, or other causes will result.**
  2. **Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the time duration of that opening shall be minimized. The City shall direct the amount of open trench that is acceptable for the condition encountered.**
  3. **During construction, maintain access to private residence and businesses.**
- D. Underground Obstructions
  1. **It is the Contractor/City's responsibility to call for utility locates. Call UNCC at 1-800-922-1987 or dial 811 for locates.**
  2. **The Contractor shall expose and verify the size, location, and elevation of underground utilities and other obstructions, sufficiently in advance of construction to permit changes to be made to the Construction Drawings in the event there is a conflict with the proposed and existing utilities. In the event there is a conflict, the Contractor shall notify the City, and affected utility company immediately.**
  3. **Protect and support utilities, appurtenances, structures, etc., by shoring, bracing or other means necessary.**

## E. Weather

1. **Do not install pipe or place pipe bedding on frozen soil in the trench bottom.**
2. **Do not place frozen materials, snow or ice in backfill, fill, or embankments.**
3. **Do not deposit, tamp, roll or otherwise mechanically compact backfill in water.**

## 1.6 Quality Assurance

## A. Preparation of Subgrade

1. **Notify City when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.**

## B. Excavation

1. **Provide adequate survey control to avoid unauthorized overexcavation.**

## C. Fill and Backfill

1. **Notify City when:**
  - a. ***Structure or pipeline is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.***
  - b. ***Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.***
  - c. ***Fill material appears to be deviating from Specifications.***

**PART 2—PRODUCTS**

## 2.1 GENERAL

- A. All material shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders, corrosive material, debris, broken asphalt and concrete, and any other objectionable material that is not suitable in the opinion of the City.

- B. If job excavated material is not sufficient or suitable, suitable material shall be imported. Reference *SDC* construction specifications for import fill requirements.

## 2.2 DEWATERING

### A. Experience Requirements

1. **Dewatering System Designer: Registered professional engineer with a minimum of 5 years of experience in the design of dewatering systems for excavations with shoring support.**
2. **Dewatering System Installer (Subcontractor): Experience record including minimum of three projects with dewatering systems for shored excavations in similar conditions. Experienced in the installation and operation of similar dewatering systems as employed by the dewatering plan.**

### B. Equipment and Materials

1. **Equipment and materials are at the discretion of Contractor as necessary to achieve desired results for dewatering.**
2. **Eductors, well points, or deep wells, where used, must be furnished, installed and operated by an experienced contractor regularly engaged in groundwater control system design, installation, and operation.**
3. **All equipment must be in good repair and operating order and standby equipment and materials shall be kept available and in operating condition to ensure continuous operation.**

## 2.3 MARKING TAPE

### A. Nondetectable:

1. **Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.**
2. **Thickness: Minimum 5 mils.**



3. **Width: 3 inches.**
  4. **Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.**
  5. **Manufacturers and Products:**
    - a. ***Reef Industries; Terra Tape.***
    - b. ***Mutual Industries; Non-detectable Tape.***
    - c. ***Presco; Non-detectable Tape.***
- B. Detectable:
1. **Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.**
  2. **Foil Thickness: Minimum 0.35 mils.**
  3. **Laminate Thickness: Minimum 5 mils.**
  4. **Width: 3 inches.**
  5. **Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.**
  6. **Joining Clips: Tin or nickel-coated furnished by tape manufacturer.**
  7. **Manufacturers and Products:**
    - a. ***Reef Industries; Terra Tape, Sentry Line Detectable.***
    - b. ***Mutual Industries; Detectable Tape.***
    - c. ***Presco; Detectable Tape.***
- C. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Facilities.

Color*	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communication alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewer and drain lines
Blue	Potable water
Purple	Reclaimed water, irrigation, and slurry lines
* As specified in NEMA Z535.1, Safety Color Code.	

## 2.4 STABILIZATION MATERIAL

- A. If the existing soil in the trench bottom is judged to be unsuitable by the City, at a minimum, the top six-inches (6") of the trench subgrade shall be removed and replaced with stabilization material. If deemed necessary by the City, more than six-inches (6") of material from the trench bottom may require removal and replacement with a stabilization material.
- B. Stabilization material is crusher-run rock, conforming to CDOT #357 (ASTM D448, AASHTO M43).

**TABLE 2.4-C: Stabilization Material – CDOT #357**

Size (inch)	Percent (%) Passing
<b>2 ½"</b>	<b>100</b>
<b>2"</b>	<b>95-100</b>
<b>1"</b>	<b>35-70</b>
<b>½"</b>	<b>10-30</b>
<b>#4</b>	<b>0-5</b>

***Or approved equivalent.***

## 2.5 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

- A. The CLSM facility shall be certified by the National Ready Mixed Concrete Association. Mixing times shall conform to the requirements of ASTM C94, Specification for Ready-Mixed Concrete. Hand mixing is not allowed. The production facility shall supply a load ticket with the actual batch weights of the component materials.
- B. Thoroughly mix all water added at the project site in accordance with the recommendations stated in ACI 305, Hot Weather Concreting. Measure all water added to the mix. The water cement ratio as stated in the flowable fill mix design

approved by the City is not to be exceeded. Do not add water after discharge of the flowable fill from the mixer begins.

- C. Place flowable fill within the 90 minutes after the addition of cement or fly ash to the mix. The City reserves the right to reduce the allowable time for placement to account for adverse weather conditions or other factors that may accelerate the stiffening of the mix.
- D. Select and proportion the ingredients to obtain an unconfined compressive strength at 2 days to be a minimum of 50 psi, an unconfined compressive strength at 28 days a maximum of 125 psi, and an air content between 7 and 13 percent. Proportion the materials to produce a mixture with a consistency that flows under a very low head. Determine compressive strength in accordance with ASTM D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders. Determine air content in accordance with ASTM D6023, Standard Test Method for Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM).
- E. Materials:
  - 1. **Portland Cement: Cement Type I or Cement Type II as defined by ASTM C150, Specification for Portland Cement including Table 1, 2, and 4.**
  - 2. **Aggregate: Conform to all requirements for fine aggregate as defined by ASTM C33, Specification for Concrete. Keep the aggregate materials moist for 24 hours before use in the mixture.**
  - 3. **Fly Ash (if used): Conform to requirements of Class F fly ash as defined by ASTM C618, Specification for Coal Fly Ash and Raw or Calcined Natural Pollolan for Use as a Mineral Admixture in Concrete, except as modified herein:**
    - a. *Test in accordance with ASTM C1012/C1012M to verify that the sulfate resistance is acceptable.*
  - 4. **Water: All water used in the CLSM mixture shall meet the requirements of AASHTO T26, Quality of Water to be used in Concrete. Obtain such water from a source approved by the City.**

## 2.6 GEOTEXTILE (FILTER) FABRIC

- A. Geotextile fabric shall be used in conjunction with stabilization material unless approved otherwise by the City. See City of Greeley Standard Drawings for more details.
- B. Geotextile fabric shall conform to Colorado Department of Transportation, Division of Highways, State of Colorado *"Standard Specifications for Road and Bridge Construction"*, Section 712.08, Class A Table 712-2, latest edition.
- C. Acceptable geotextile fabric manufacturers are:
  - 1. **TenCate – Mirafi 500X**
  - 2. **Webtec, Inc. Geosynthetics – TerraTex GS**
  - 3. **Or approved equivalent.**

## 2.7 BEDDING ZONE MATERIALS

- A. The bedding zone shall extend six-inches (6") below the invert of the pipe to six-inches (6") above top of pipe.
- B. Bedding material for sanitary sewer pipe shall be 57/67 rock.

**TABLE 2.7-B: Bedding Material – 57/67 rock**

<i>Size (inch)</i>	<i>Percent (%) Passing</i>
<b>1 ½"</b>	<b>100</b>
<b>1"</b>	<b>95-100</b>
<b>¾"</b>	<b>90-100</b>
<b>½"</b>	<b>25-60</b>
<b>3/8"</b>	<b>20-55</b>
<b>#4</b>	<b>0-10</b>
<b>#8</b>	<b>0-5</b>
<b>#200</b>	<b>1 max</b>

Or City approved equal.

- C. Bedding material for water pipe shall be ASTM C33 sand.

**TABLE 2.7-C: Bedding Material – ASTM C33 Sand**

<i>Size (inch)</i>	<i>Percent (%) Passing</i>
<b>3/8"</b>	<b>100</b>

<b>#4</b>	<b>95-100</b>
<b>#8</b>	<b>80-100</b>
<b>#16</b>	<b>50-85</b>
<b>#30</b>	<b>25-60</b>
<b>#50</b>	<b>5-30</b>
<b>#100</b>	<b>0-10</b>
<b>#200</b>	<b>0-3</b>

- D. Or approved equal.
- E. Groundwater Barrier shall meet the following soil classification:

1. **Unified Soil Classifications**

- a. ***GC – clayey gravels, clayey sandy gravels***
- b. ***SC – clayey sands, clayey gravelly sands***
- c. ***CL – inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, clean clays.***
- d. ***Material shall not be lumpy or hard but shall be finely divided, suitable, and free from stones.***

2. **Or Flow Fill in conformance with SDC construction specifications.**

**2.8 INSULATION BOARD**

- A. Insulation board shall be installed above the bedding zone when the depth of cover over the water line is less than five (5) feet.
- B. Insulation board shall be a minimum one-inch (1") thick. Acceptable insulation board manufacturers are:
  1. **Dow Chemical Company - Styrofoam™**
  2. **Owens-Corning**
  3. **Or approved equivalent.**

**2.9 TRENCH BACKFILL MATERIAL**

- A. Trench backfill material shall be placed from a point six-inches (6") above the top of pipe exterior to six-inches (6") below the ground surface, or bottom of topsoil

layer, or bottom of the pavement subgrade, whichever is applicable. Trench backfill shall conform to *SDC* construction specifications.

- B. Reference *SDC* construction specifications for flow fill requirements.

### **PART 3 – EXECUTION**

#### **3.1 PREPARATION**

- A. Topsoil shall be stripped from areas which are to be disturbed by construction and stockpiled.
- B. Topsoil shall be segregated from non-organic trench material and debris.

#### **3.2 SUBGRADE PREPARATION**

- A. General
  - 1. **Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.**
  - 2. **Bring subgrade to proper grade and cross-section and uniformly compact surface.**
  - 3. **Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.**
  - 4. **Maintain prepared ground surface in finished condition until next course is placed.**
- B. Compaction
  - 1. **Under Earthfill and Exposed Cut Surfaces: Compact upper 8 inches to minimum of 90 percent relative compaction as determined in accordance with ASTM D1557 or 93 percent relative compaction as determined in accordance with ASTM D698.**
  - 2. **Under Structures Including Slabs, Tanks and Other Miscellaneous Structures: Areas shall be overexcavated to such an extent so as to provide a minimum of 6 inches of granular fill on prepared subgrade. Scarify and compact the**

**upper 8 inches of subgrade to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.**

C. Moisture Conditioning

1. **Dry Subgrade: Add water, then mix to make moisture content uniform throughout.**
2. **Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.**

D. Testing

1. **Proof-roll subgrade with a fully loaded tandem-axle dump truck or similar vehicle to detect soft or loose subgrade or unsuitable material. Proof-roll shall be conducted prior to scarifying/recompaction to identify soft or loose subgrade or unsuitable material. City shall be notified 2 days in advance of proof-rolling activities and will be present to examine and approve subgrade before backfilling begins.**
2. **Contractor shall provide an independent testing laboratory to conduct in-place density tests in accordance with ASTM D6938 at a minimum rate of one test per every 5,000 square feet of prepared subgrade.**

E. Correction

1. **Soft or Loose Subgrade:**
  - a. ***Adjust moisture content and recompact, or***
  - b. ***Over excavate as specified in Section 3.3 of this specification, and replace with suitable material from the excavation. If unsuitable soil is encountered at a depth of 3 feet below planned subgrade, excavation shall be halted and the City notified immediately.***
  - c. ***In the event the unacceptable material is encountered at the 3-foot overexcavation, a geogrid shall be provided and placed, and overlain with a geotextile. The overexcavation shall be filled to plan grade with subgrade stabilization***

***aggregate. Subgrade Stabilization Aggregate shall be placed in lifts not more than 10 inches thick and shall be compacted to the satisfaction of the City.***

2. **Unsuitable Material: Over excavate as specified in Section 3.3 of this specification, and replace with suitable material from the excavation.**

### 3.3 EXCAVATION

#### A. General

1. **Excavate to lines, grades, and dimensions shown in the drawings and as necessary to accomplish work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.**
2. **Do not overexcavate without written authorization of City.**
3. **Remove or protect obstructions as shown in the drawings.**

#### B. Unclassified Excavation

1. **Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.**

#### C. Trench Width

1. **Minimum Width of Trenches: As specified in Section 3.6 of this specification.**
2. **Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.**

#### D. Pipe Bedding Grooves for Nonperforated Drain Lines

1. **Semicircular, trapezoidal, or 90-degree-V.**



2. **Excavated or plowed into trench bottom. Forming groove by compaction will not be acceptable.**

E. Embankment and Cut Slopes

1. **Shape, trim, and finish cut slopes to conform with lines, grades, and cross- sections shown in the drawings, with proper allowance for topsoil or slope protection, where shown.**
2. **Remove stones and rock that exceed 3-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.**
3. **Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed work.**
4. **Temporary earthen slopes shall be at an inclination of maximum 3 horizontal to 1 vertical (3H:1V) or designed by a Professional Engineer in the State of Colorado.**

F. Stockpiling Excavated Material

1. **Stockpile excavated material that is suitable for use as fill or backfill until material is needed.**
2. **Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.**
3. **Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.**
4. **Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.**

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

G. Disposal of Spoil

1. **Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, offsite.**
2. **Dispose of debris resulting from removal of underground materials, organic matter, trash, refuse, junk, and other materials in accordance with local and federal governmental regulations.**

### 3.4 DEWATERING

A. General

1. **Design and operate surface water and groundwater dewatering controls to protect work in progress at all times.**

B. Surface Water Control

1. **Remove surface runoff controls when no longer needed.**

C. Dewatering Systems

1. **Design, install, and operate dewatering systems to bring groundwater to a depth of 3 feet or greater below the lowest point of excavation, prior to beginning excavation and at all times during excavation, and as necessary to accomplish the following:**
  - a. ***To prevent loss of ground as water is removed.***
  - b. ***To avoid inducing settlement or damage to existing facilities, completed work, or adjacent property.***
  - c. ***To establish adequate factor of safety against uplift or instability of excavation bottom.***
2. **Install instrumentation prior to beginning excavation, as necessary to demonstrate the above requirements are met.**

**Provide detailed summary of findings from instrumentation, and comparison to the expectations of the Water Control Plan, prior to beginning excavation.**

3. **Continuously control water during construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water until Backfill has been placed, and the structures are capable of resisting hydrostatic force and have been properly leak tested.**
4. **Perform dewatering operations in a manner that will protect existing roads, structures, utilities, and receiving waters. The Contractor shall be solely responsible for preventing damage to roads, buildings or structures, sewers and other utility installations, pavements, sidewalks, and other property that may result from Contractor's dewatering operations.**
5. **Immediately repair any structure damaged as a result of the dewatering operations at no additional costs to the City.**
6. **Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.**
7. **Provide 100 percent emergency power backup with automatic startup and switchover in event of electrical power failure.**
8. **Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.**
9. **The City shall be advised of any changes made to accommodate field conditions. Upon completion of the dewatering system installation, revise and resubmit information drawings as necessary to show the installed configuration including grade elevation at the time wells were installed, well depth, screen lengths, slot size, filter pack grain size analysis, and depth of pump intake.**

10. **Remove system in accordance with CDPHE upon completion of construction or when dewatering and control of surface or ground water is no longer required.**

**D. Disposal of Water**

1. **Obtain discharge permit for water disposal from CDPHE.**
2. **Treat water collected by dewatering operations, to meet effluent limitations and other requirements as required by CDPHE prior to discharge.**
3. **Discharge water as required by discharge permit and in a manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed work, or adjacent property. Dewatering flows shall be discharged directly through piping and dewatering /treatment facilities to a receiving stream or storm sewer at a location acceptable to the City and approved in the discharge permit.**
4. **Remove solids from dewatering flow treatment facilities and perform other maintenance of dewatering flow treatment facilities (best management practices) as necessary to maintain their efficiency.**

**E. Protection of Property**

1. **Make assessment of potential for dewatering induced settlement. Provide and operate devices or systems, including but not limited to reinjection wells, infiltration trenches and cutoff walls, necessary to prevent damage to existing facilities, completed work, and adjacent property.**
2. **Securely support existing facilities, completed work, and adjacent property vulnerable to settlement due to dewatering operations. Support shall include, but not be limited to, bracing, underpinning, or compaction grouting.**
3. **Limit lowering of groundwater table outside of excavation to no lower than 5 feet below the lowest recorded stabilized**

**ground water table, unless lower levels have been agreed to by City prior to dewatering.**

F. Remediation of Groundwater Depletion

1. **If dewatering reduces quantity or quality of water produced by existing wells, temporarily supply water to affected well owners from other sources. Furnish water of a quality and quantity equal to or exceeding the quality and quantity available to well owner prior to beginning the work or as satisfactory to each well owner.**

3.5 FILL AND BACKFILL

A. General

1. **Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.**
2. **Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to the specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.**
3. **During filling and backfilling, keep level of fill and backfill around each structure and pipeline even.**
4. **Do not place fill or backfill if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.**
5. **If pipe, conduit, duct bank, or cable is to be laid within fill or backfill:**
  - a. ***Fill or backfill to an elevation 2 feet above top of item to be laid.***
  - b. ***Excavate trench for installation of item.***

- c. ***Install bedding, if applicable, as specified in Section 3.6 of this specification.***
- d. ***Install item.***
- e. ***Backfill envelope zone and remaining trench, as specified in Section 3.6 of this specification, before resuming filling or backfilling specified in this section.***

6. **Tolerances:**

- a. ***Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.***
- b. ***Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.***

7. **Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.**

B. **Backfill Under and Around Structures**

1. **Under Structures:**

- a. ***Overexcavate and prepare subgrade as specified in Section 3.2 of this specification, or fill on prepared subgrade with earthfill to within 6 inches of bottom of structure.***
- b. ***Earthfill shall be placed in 8-inch maximum lifts and compacted at moisture content of optimum plus or minus 2 percent. Each lift of moisture conditioned earthfill shall be compacted to a minimum 95 percent relative compaction as determined in accordance with ASTM D1557.***
- c. ***Place a minimum 6 inches of granular fill below structures and slabs. Granular fill shall be compacted to a minimum 95 percent of maximum dry density at plus or minus 2 percent of optimum moisture content as determined in accordance with ASTM D1557.***

2. **Select Cohesive Fill: Backfill with Select Cohesive Fill to lines and grades shown, with proper allowance for topsoil**

**thickness where shown. Place in lifts of 8-inch maximum thickness and compact each lift to minimum 90 percent relative compaction as determined in accordance with ASTM D1557 or 93 percent relative compaction as determined in accordance with ASTM D698.**

3. **Other Areas: Backfill with earthfill to lines and grades shown, with proper allowance for topsoil thickness where shown. Place in lifts of 8-inch maximum thickness and compact each lift to minimum 90 percent relative compaction as determined in accordance with ASTM D1557 or 93 percent relative compaction as determined in accordance with ASTM D698.**

**C. Fill**

1. **Outside Influence Areas beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place earthfill as follows:**
  - a. ***Allow for 6-inch thickness of topsoil where required.***
  - b. ***Maximum 8-inch thick lifts.***
  - c. ***Place and compact fill across full width of embankment.***
  - d. ***Compact to minimum 90 percent relative compaction as determined in accordance with ASTM D1557 or 93 percent relative compaction as determined in accordance with ASTM D698.***
  - e. ***Dress completed embankment with allowance for topsoil, crest surfacing, and slope protection, where applicable.***

**D. Site Testing**

1. **Gradation:**
  - a. ***One sample from each 1,500 tons of finished product or more often as determined by City, if variation in gradation is occurring, or if material appears to depart from Specifications.***

- b. ***If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.***
  - c. ***Remove material placed in Work that does not meet Specification requirements.***
- 2. **Contractor shall provide an independent testing laboratory to conduct in-place Density Tests: In accordance with ASTM D1556 or D6938. During placement of materials, test every 500 cubic yards, but no less than two tests per day for each day material is being placed, and no less than two tests per lift.**

E. Replacing Overexcavated Material

- 1. **Replace excavation carried below grade lines shown or established by City as follows:**
  - a. ***Beneath Structures: Granular fill.***
  - b. ***Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.***
  - c. ***Trenches:***
    - i. ***Unauthorized Overexcavation: Either trench stabilization material or granular pipe base material, as specified in Section 3.6 of this specification.***
    - ii. ***Authorized Overexcavation: Trench stabilization material, as specified in Section 3.6 of this specification.***
  - d. ***Permanent Cut Slopes (Where Overlying Area is Not to Receive Fill or Backfill):***
    - i. ***Flat to Moderate Steep Slopes (3:1, Horizontal Run: Vertical Rise or Flatter): Earthfill.***
    - ii. ***Steep Slopes (Steeper than 3:1):***



- ii-a. ***Correct overexcavation by transitioning between overcut areas and the designed slope adjoining areas, provided such cutting does not extend offsite or outside easements and right-of-ways, or adversely impacts existing facilities, adjacent property, or completed work.***
- ii-b. ***Backfilling overexcavated areas is prohibited, unless in City's opinion, backfill will remain stable, and overexcavated material is replaced as compacted earthfill.***

F. Placing Fill Over Geosynthetics

1. **General:**

- a. ***Place fill over geosynthetics with sufficient care so as not to damage.***
- b. ***Place fill only by back dumping and spreading only.***
- c. ***Dump fill only on previously placed fill.***
- d. ***While operating equipment, avoid sharp turns, sudden starts or stops that could damage geosynthetics.***

2. **Hauling: Operate hauling equipment on minimum of 3 feet of covering.**

3. **Spreading:**

- a. ***Spreading equipment shall be track mounted D 6 or lighter.***
- b. ***Operate spreading equipment on minimum of 12 inches of fill over geosynthetics.***
- c. ***Spread fill in same direction as unseamed overlaps to avoid separation of seams and joints.***
- d. ***Never push fill downslope. Spread fill over sideslopes by pushing up from slope bottom.***

- e. ***Correct wrinkles in geomembranes as required by manufacturer.***
- f. ***Maintain proper overlap of unseamed geosynthetics as required by manufacturer.***
- g. ***Avoid overstressing geosynthetics and seams.***
- 4. **Compaction: Compact fill only after uniformly spread to full thickness shown.**
- 5. **Geosynthetic Damage:**
  - a. ***Mark punctures, tears, or other damage to geosynthetics, so repairs may be made.***
  - b. ***Clear overlying fill as necessary to repair damage.***
  - c. ***Repairs to geosynthetics shall be made by respective installers as specified in respective specification section for each geosynthetic.***

### 3.6 TRENCHING

- A. Do not drop backfill directly upon any structure or pipe. Do not place backfill around or upon any structure until the concrete or CLSM has attained sufficient strength to withstand the loads imposed.
- B. Place backfill after water is removed from the excavation as specified in Section 3.4 of this specification, and the excavation bottom or surface upon which backfill is to be placed is firm and has been dried to a moisture content suitable for scarifying and recompaction. Remove water in a manner that minimizes soil erosion from trench sides and bottom. Provide continuous water control until trench backfill is complete.
- C. Excavate trenches by open cut methods, except where a boring is indicated on the Construction Drawings, required by jurisdictional agencies, or desired by the Contractor and approved by the City.
- D. Do not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, utilities, structures or other property above or below ground. In all such locations, hand-excavating methods shall be used.
- E. Use mechanical equipment designed and operated so the rough excavated trench bottom elevation can be controlled with uniform trench width and vertical

sidewalls from an elevation one (1) foot above the top of installed pipe to the bottom of the trench. The trench alignment shall be sufficiently accurate to permit pipe to be aligned properly between the pipe and sidewalls of the trench. Do not undercut the trench sidewall to obtain clearance.

F. Contractor shall follow the most current regulations concerning excavations set forth by OSHA: 29 CFR Part 1926.

G. Excavation in Rock

1. **When rock is present, over-excavate a minimum of six-inches (6") below the bottom of the required trench bottom.**
2. **Backfill to required trench bottom with compacted bedding material.**

H. Preparation of Trench Bottom

1. **Grade trench bottom uniformly to provide clearance for each section of pipe and bedding material.**
2. **Remove loose materials, water and foreign objects.**
3. **Provide firm subgrade suitable for placement of bedding material.**
4. **Wherever unstable material is encountered in the bottom of the trench, over-excavate such material to a depth suitable for constructing a stable subgrade or as determined by the City. Backfill over-excavation with stabilization material and compact. A geotextile fabric layer shall be placed between the stabilization material and the bedding material.**

I. Stockpiling Excavated Materials

1. **Pile suitable material for backfilling in an orderly manner a sufficient distance from trench banks to avoid overloading and to prevent slide or cave-ins.**
2. **Do not stockpile excavated material against existing structures or appurtenances.**

3. **The Contractor shall follow the most current OSHA regulations concerning excavations.**

J. Trench Widths

1. **Trench width shall be maintained to within three-inches (3") of that specified on the City of Greeley Standard Drawings unless otherwise specified by the City.**

3.7 PIPE BEDDING

A. Placement and Compaction

1. **Distribute, grade, and compact bedding material to provide uniform and continuous support beneath the pipe at all points between bells and pipe joints.**
2. **Bell holes shall be dug deep enough to provide a minimum two-inches (2") of clearance between the bell and bedding material. The pipe shall not be supported by the pipe bell.**
3. **Deposit bedding material and compact uniformly and simultaneously on each side of the pipe to prevent lateral displacement.**
4. **Compact granular bedding material by vibrating, slicing with a shovel, or bent tee-bar.**
5. **All utility trenches within the street right-of-way (including service lines) must be mechanically compacted to not less than 95% of maximum density within  $\pm$  two percent (2%) of optimum moisture content as determined by AASHTO T99. Alternatively, utility trenches can also be backfilled with flowable fill to within one foot of finished grade.**
6. **Trench backfill in utility easements within 20 feet of right-of-way shall be mechanically compacted to 95% maximum density or backfilled with flowable fill to within one foot of finish grade.**

7. **Trench backfill in utility easements beyond 20 feet from right-of-way shall be compacted to 90% maximum density.**
8. **Place pipe bedding in accordance with the City of Greeley Standard Drawings.**

### 3.8 MARKING TAPE INSTALLATION

- A. Continuously install marking tape along centerline of all buried piping, at depth of 2 feet. Coordinate with piping installation drawings.
  1. **Detectable Marking Tape: Install with nonmetallic piping and waterlines.**
  2. **Nondetectable Marking Tape: Install with metallic piping.**

### 3.9 GROUND WATER BARRIERS

- A. Ground water barriers shall be constructed in such a manner to impede the passage of water through the bedding material and shall be installed when high groundwater conditions exist or as directed by the City.
- B. Ground water barriers shall be keyed at least one (1) foot into the trench wall and bottom, and spaced ten (10) feet upstream of each manhole for gravity sanitary sewers or every 400 feet on water lines and sanitary sewer force mains.
- C. At a minimum, ground water barriers shall extend one (1) foot above the bedding material.
- D. Refer to City of Greeley Standard Drawings for additional installation requirements.

### 3.10 INSULATION BOARD

- A. Insulation board, if preapproved by the City, shall be installed above the bedding zone wherever the depth of cover over the water main is less than five (5) feet.
  1. **Insulation board installation shall consist of two (2) overlapping boards, one-inch (1") minimum thickness per board, with off-set joints.**
  2. **Insulation board shall be placed across the full trench width.**

- B. Refer to City of Greeley Standard Drawings for additional installation requirements.

### 3.11 BACKFILLING AND COMPACTION

- A. Backfill trench promptly after completion of pipe bedding, but only after the City has inspected the work.
- B. Backfilling and compaction operations and requirements shall be in accordance with the *SDC*.
- C. Use backfilling and compaction methods and equipment appropriate for the backfill material. Do not use equipment or methods that will transmit damaging shocks to the pipe.
- D. Do not perform compaction by jetting or water settling.
- E. Rock and bedrock encountered in the excavation shall not be used in backfill.
- F. For areas not receiving surface improvements after construction, return the final grading to the depth of stripping over all areas disturbed by construction operations and replace topsoil.
- G. All surface cuts shall be, as a minimum, restored to a condition equal to, or better than, that prior to construction. All gravel or paved streets shall be restored in accordance with the regulation and requirements of the agency having control or jurisdiction over the street, roadway or right-of-way.
- H. Controlled Low Strength Material:
  - 1. **Discharge side of trench from truck mounted drum type mixer into trench.**
  - 2. **Discharge CLSM into trench at temperature below 75 degrees F.**
  - 3. **Utilize pumps or chutes to place the CLSM in the trench. When CLSM material is indicated for the entire pipe zone, continue placing CLSM on one side of the pipe until CLSM has traveled under the pipe and up the other side to a depth of 1 foot above the pipe bottom. Adjust water in mixture to maintain fluid consistency but maintain strength requirements. Rod or vibrate CLSM as necessary to keep soil particles in suspension so that the material flows freely.**

4. **Maintain stability of pipe and conduit throughout CLSM placement and curing. Anchor pipe as needed to prevent movement of the pipe caused by flotation or lateral displacement. If any movement occurs, remove the CLSM material and place the pipe back on line and grade. Remove sloughed material or other debris from top of previously placed CLSM.**
5. **Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.**
6. **In traveled areas fill entire trench section to pavement finish grade for a temporary driving surface, and screed off excess and finish with a float.**
7. **In other areas fill the trench section as shown.**
8. **Allow CLSM to set before placing backfill. Prior to placing backfill over CLSM, achieve an indentation diameter less than or equal to 3 inches as determined by ASTM D6024.**

### 3.12 MATERIALS AND QUALITY CONTROL TESTING

- A. The Contractor is responsible for quality control testing and the testing shall be performed by an independent testing agency employed by the Contractor.
- B. For backfill compaction and moisture requirements and the required materials testing, frequency of tests, and standard testing methods, reference the *SDC*.
- C. The following requirements shall also apply:
  1. **Groundwater Barriers**
    - a. ***Compaction – 95%***
    - b. ***Moisture –  $\pm 2\%$***
  2. **Bedding Material**
    - a. ***Compaction – 80% of relative density***
  3. **CLSM:**

- a. ***Provide adequate facilities for safe storage and proper curing of CLSM test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.***
- b. ***Provide CLSM testing of air content and for making cylinders from the point of discharge into forms. When CLSM is pumped, Samples used shall be taken from discharge end of pump hose.***
- c. ***Specimens shall be made, cured, and tested in accordance with ASTM D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.***
- d. ***One set of test cylinders shall be tested per each 100 cubic yard of CLSM placed, but no less than one set per day. Frequency of testing may be changed at discretion of City.***
- e. ***Reject CLSM represented by cylinders failing to meet strength and air content specified.***

D. Services

- 1. **Water services shall have a minimum of one (1) moisture/density test per service.**
- 2. **Sanitary sewer services shall have a minimum of two (2) moisture/density tests per service or at the City Inspector's discretion.**
- 3. **Moisture/density tests in the vicinity of vaults, valve boxes and manholes shall be performed at a minimum of one (1) foot away from the edge of vault/manhole sections or valve boxes.**
  - a. ***Tests shall be performed in random directions from the vault, manhole, or valve box, on separate lifts.***
  - b. ***A minimum of one (1) test shall be performed, on opposite sides of the vault, manhole or valve box, for every two (2) feet of backfill material.***



4. **The Contractor shall keep copies of all quality control test results in a notebook at the job site for the duration of the project. Test results shall be made available to the City at all times.**

### 3.13 COMPACTION TEST FAILURE

- A. If the required compaction and moisture is not obtained, it shall be the responsibility of the Contractor to recompact or rework the material to the required state of compaction and moisture.
- B. In cases where there is a failure to achieve the required compaction or moisture, the City may require that the backfill be removed and recompact or replaced entirely with suitable materials.
- C. Water line and sanitary sewer line/manhole testing may be required after recompaction if the testing had been performed prior to recompaction.
  1. **Water line testing shall be performed between valves on both sides of the recompact area.**
  2. **Sanitary sewer line testing shall be performed between manholes on both sides of the recompact area.**
  3. **Sanitary sewer manhole testing shall be performed if recompaction occurs in the vicinity of the manhole.**

SECTION 02445  
CASING PIPE – BORINGS AND ENCASEMENTS

**PART 1 – GENERAL**

**1.1 SCOPE**

- A. This section addresses the installation of a casing pipe by boring (or jacking) or as an open trench encasement and includes the acceptable products, materials, and construction practices.
- B. The specifications provided in this section are the minimum City requirements for casing pipe borings and encasements.
- C. The Design Engineer may be required by the City to provide additional design and installation considerations depending on the situation.
- D. The requirements included in this Section shall be superseded by other regulators if the other regulators requirements are more stringent. Other regulations could include CDOT, railroad, county, etc.

**1.2 REFERENCES**

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1. **C206, Field Welding of Steel Water Pipe, latest revision.**
  - 2. **C150/A21.50, Thickness Design of Ductile-Iron Pipe, latest revision.**
  - 3. **C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, For Water, latest revision.**
  - 4. **C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In., For Water Distribution, latest revision. (Both slip joint and fusible)**
- B. ASTM International (ASTM)
  - 1. **A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over), latest revision.**
  - 2. **D3350, Polyethylene Plastic Pipe and Fittings Materials, latest revision.**

3. **F714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter, latest revision.**

C. American Water Works Association (AWWA)

1. **C901, Polyethylene (PE) Pressure Pipe and Tubing ½ inch through 3 inch, latest revision.**
2. **C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch, latest revision.**
3. **M23, PVC Pipe – Design and Installation, latest revision.**
4. **M41, Ductile-Iron Pipe and Fittings, latest revision.**

### 1.3 DESIGN CONSIDERATIONS

- A. The Design Engineer shall specifically design each casing pipe boring (or jacking) installation.
1. **Casing pipe thicknesses specified in this section are based upon superimposed loads and not upon the loads which may be placed on the casing pipe as a result of jacking operations.**
  2. **Provide increased casing pipe strength as necessary to withstand jacking loads.**
- B. The Design Engineer shall size the casing pipe such that the inside clearance is at least one and one-inch (1") greater than the maximum outside diameter of the casing spacer runners.

### 1.4 REQUIREMENTS OF REGULATORY AGENCIES

- A. The type of casing pipe material and its properties will normally be specified by the agency granting permission to cross. Such crossings shall be subject to approval by the City to avoid conflicts in requirements or standards between the City and the agency granting permission to cross.
- B. The Contractor shall provide a letter, permit, or an approved crossing application to the City from the agency granting the crossing approval. Copies of all documents required to be sent to the regulating agency shall be provided to the City.

- C. The Contractor shall obtain the necessary bonds, insurance or indemnity required by the crossing permit for protection against damage, interference with traffic, or service that may be caused by the construction activities.

## **PART 2 – PRODUCTS**

### **2.1 CARRIER PIPE**

- A. The carrier pipe shall be the same nominal diameter as the system main on either side of the casing pipe.
- B. In situations where one (1) pipe joint falls within the casing pipe, the carrier pipe material shall be consistent with the pipe material being used for the rest of the project.
- C. For situations where more than one (1) pipe joint falls within the casing pipe, the carrier pipe shall be restrained through the casing and the carrier pipe material shall be:
  - 1. **Potable Water Distribution System and Non-Potable Irrigation System – Restrained ductile iron pipe (DIP) in accordance with construction specification *Section 02512, Ductile-Iron Pipe*.**
  - 2. **Sanitary Sewer System – Restrained gravity sewer C-900 PVC (green in color) in accordance with construction specification *Section 02533, Polyvinyl Chloride (PVC) Non-Pressure Pipe*. Restrained gravity sewer PVC shall extend from manhole to manhole on either side of the casing pipe.**
  - 3. **Or other approved equivalent.**

### **2.2 CASING PIPE**

- A. Material
  - 1. **AWWA C900 Polyvinyl Chloride (PVC) Pipe**
  - 2. **Steel Pipe**
    - a. ***The casing pipe shall be new, smooth steel conforming to ASTM A139, Grade B (no hydro.)***
    - b. ***Minimum Yield Strength – 35,000 psi***

c. **Exterior Coating – Not required.**

3. **AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing**

4. **AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings**

- B. The following table indicates what casing pipe diameter and material to use in relation to the carrier pipe diameter. It also provides steel casing pipe minimum wall thicknesses and specifies when to use casing spacers and end seals.

**TABLE 2.1-B: Casing Pipe Specifications**

Carrier Pipe Diameter (in)	Casing Pipe Diameter (in)	Borings and Encasements	Encasements Only
		Steel Casing Pipe – Minimum Wall Thickness (in)	Casing Pipe Materials
2" or less Water Services	4"	0.250	C900 PVC
3"	6"	0.258	C900 PVC, Steel, HDPE
4"	8"	0.322	C900 PVC, Steel, HDPE
6"	12"	0.375	C900 PVC, Steel, HDPE
8"	16"	0.375	C900 PVC, Steel, HDPE
10"	20"	0.375	Steel
12"	24"	0.375	Steel
15"	30"	0.500	Steel
16"	30"	0.500	Steel
- End seals are required on all casing pipe installations. - Casing spacers are required on all carrier pipes except for 2" diameter or less water services.			

Or approved equivalent.

## 2.3 ACCESSORIES

A. Casing Spacers

- Casing spacers shall be in a "centered-restrained" configuration in the casing pipe.**
- Casing spacers shall be sized such that the height of the risers and runners have no less than one-inch (1") clearance from the inside wall of the casing pipe.**
- Band**

- a. ***Casing spacers shall be constructed of circular stainless steel bands that bolt together to form a shell around the carrier pipe.***
- b. ***Material – T-304 stainless steel***
- c. ***Minimum Thickness – 14 gauge***
- d. ***Use an eight-inch (8”) band width for carrier pipes twelve-inches (12”) in diameter and smaller, unless otherwise recommended by the manufacturer.***
- e. ***Use a twelve-inch (12”) band width for carrier pipes larger than twelve-inches (12”) in diameter, unless otherwise recommended by the manufacturer.***

4. **Liner**

- a. ***Material – Polyvinyl Chloride (PVC)***
- b. ***Minimum Thickness – 0.090-inches***
- c. ***Hardness-Durometer – 85-90***
- d. ***Electrical Properties – 1,380 V/min***

5. **Risers (Support Structures)**

- a. ***Material – T-304 stainless steel***
- b. ***Maximum Thickness – 10 gauge***
- c. ***Reinforced over six-inches (6”) in height***
- d. ***MIG welded to band***

6. **Assembly Hardware**

- a. ***Bolts – 5/16” - 18 x 2 ½” T-304 stainless steel or plated***
- b. ***Nuts – Hex, 5/16”***
- c. ***Washers – 5/16” SAE 2330***

7. **Runners**

a. ***Material - Glass Filled Polymer or Ultra High Molecular Weight (UHMW) Polyethylene***

b. ***Minimum Width – Two-inches (2")***

c. ***Runners shall be mechanically bolted to the risers.***

8. **Manufacturers**

a. ***Cascade Waterworks Mfg.***

b. ***PSI Pipeline Seal & Insulator, Inc.***

c. ***CCI Pipeline Systems***

d. ***Or approved equivalent.***

B. Casing Pipe End Seals

1. **Material - Seamless neoprene rubber**

2. **Minimum Thickness – 1/8"**

3. **Type – Pull on**

4. **Bands and clamps – T-304 stainless steel**

5. **Size shall be specific to the casing-carrier pipe combination.**

6. **Manufacturers**

a. ***Cascade Waterworks Mfg. – Model CCES***

b. ***PSI Pipeline Seal & Insulator, Inc. – Model C***

c. ***CCI Pipeline Systems – Model ESC***

d. ***Or approved equivalent.***

C. Grout

1. **Grout shall consist of one (1) part Portland Cement and three (3) parts sand.**

D. Anode Bags

1. **17-pound high potential magnesium anode bags.**

E. Connections

1. **Connections shall be made with Perma-lock.**

**PART 3 - EXECUTION**

**3.1 CARRIER PIPE INSTALLATION**

- A. Carrier pipe shall be installed at the elevations and grades shown on the Construction Drawings.
- B. Install the carrier pipe in accordance with the pipe material's specification.
- C. Restrain the carrier pipe within the casing pipe, as required in accordance with this specification.
- D. Install casing spacers one (1) to two (2) feet on either side of the bell joint and one (1) every six (6) to eight (8) feet apart thereafter, for a total of three (3) casing spacers per pipe length unless otherwise specified by the manufacturer or City. Casing spacers are required on all carrier pipes except for two-inch (2") diameter or less water services.
- E. Seal the ends of the casing pipe with casing pipe end seals. End seals are required on all casing pipe installations.

**3.2 CASING PIPE INSTALLATION**

- A. General
  1. **All excavations shall meet the requirements set forth in the construction specification *Section 02315, Excavation and Fill*.**
  2. **Vertical and horizontal offset staking shall be provided at both ends of the casing pipe.**
  3. **Casing pipe shall be installed to the grade and alignment shown on the approved Construction Drawings. Grade and alignment shall not deviate more than 0.3 feet horizontally and 0.1 foot vertically from that shown on the Construction Drawings.**



4. **Open trench excavation shall not be permitted where boring or jacking is specified.**

B. Polyvinyl Chloride (PVC) Casing Pipe

1. **AWWA C900 Polyvinyl Chloride (PVC) casing pipe shall be installed in accordance with construction specification *Section 02513, Polyvinyl Chloride (PVC) Pressure Pipe.***

C. Smooth Steel Pipe

1. **Provide adequate equipment to ensure a smooth, continuous, and uniform casing with no exterior voids.**
2. **Joints shall be butt welded in accordance with AWWA C206. Weld each section of pipe around the entire circumference of the joint to form a continuous conduit capable of resisting all applied stresses, including jacking stresses.**
3. **A seventeen (17) pound high potential magnesium anode shall be installed at each end of steel casing pipes with a cathodic testing station as shown in the Standard Drawings.**

D. High Density Polyethylene (HDPE)

1. **Installed per manufacturers standards.**
2. **Minimum SDR-17**

E. Grouting (As required)

1. **Fill all spaces between the casing pipe and the earth with grout.**
2. **Plug each hole after pumping through the casing has stopped to prevent backflow of grout.**

SECTION 02510  
WATER UTILITY DISTRIBUTION PIPING

PART 1     – GENERAL

1.1     SCOPE

- A.     This section addresses the installation of potable water distribution mains from six-inch (6") to twenty-four inch (24") diameter and includes the acceptable products, materials, and construction practices that may be used in installation.

1.2     REFERENCES

- A.     American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1.     **C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water, latest revision.**
  - 2.     **C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, latest revision.**
  - 3.     **C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water, latest revision.**
  - 4.     **C153/A21.53, Ductile-Iron Compact Fittings for Water Service, latest revision.**
- B.     ASTM International (ASTM)
  - 1.     **A536, Standard Specification for Ductile Iron Castings, latest revision.**
  - 2.     **F3125/F3125M, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPA Minimum Tensile Strength, latest revision.**

1.3     SUBMITTALS

- A.     Shop Fabricated Piping:

1. **Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, color, and other pertinent information.**
  2. **Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.**
- B. Hydraulic Thrust Restraint for Restrained Joints: Details including materials, sizes, assembly ratings, and pipe attachment methods.
- C. Dissimilar Buried Pipe Joints: Joint types and assembly drawings.
- D. Pipe Corrosion Protection: Product data.

#### **1.4 JOB CONDITIONS**

- A. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material.
- B. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or pipe laying is not in progress.
- C. Do not allow debris, tools, clothing, rags, or other materials to enter the pipe. Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination.
- D. Use effective measures to prevent uplifting or floating of the pipeline prior to completion of backfilling operations.
- E. Protect pipe and appurtenances against dropping and damage. Damaged pipe and appurtenances that are rejected shall be marked and removed from the site.
- F. Do not install pipe when the trench contains water or when the trench bottom is unstable as determined by the City. Water that is encountered in the trench shall be removed to the extent necessary to provide a firm subgrade, permit connection to be made in dry conditions, and to prevent the entrance of water into the pipeline.
1. **Surface runoff shall be diverted as necessary to keep excavations and trenches free from water during construction.**
  2. **The excavation or trench shall be kept free from water until**

**the structure, or pipe, to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.**

3. **The pipe shall not be used to dewater the trench.**

## **PART 2 – PRODUCTS**

### **2.1 PIPE**

- A. The same type of pipe material shall be used for each size pipe. Pipe material shall not be interchanged, except where another type of pipe material is specifically indicated.
- B. Reference construction specifications *Section 02512, Ductile-Iron Pipe* and *Section 02513, Polyvinyl Chloride (PVC) Pressure Pipe*.

### **2.2 MECHANICAL JOINT**

- A. General
  1. **This specification shall cover mechanical joint DIP in four-inch (4”) through twenty-four inch (24”) nominal diameters.**
  2. **All DIP shall be manufactured in accordance with AWWA C151.**
- B. Pipe joint shall be “mechanical single gasket” type conforming to applicable requirements of AWWA C111.
- C. DIP shall have normal laying lengths of either eighteen (18) feet or twenty (20) feet. Random pipe lengths are not acceptable.
- D. All mechanical joint glands shall be sized and drilled in accordance with AWWA C111.
- E. Iron used in the manufacture of DIP for these specifications shall have:
  1. **Minimum tensile strength – 60,000 psi**
  2. **Minimum yield strength – 42,000 psi**
  3. **Minimum elongation – 10%**
- F. DIP shall have standard thickness cement mortar linings in accordance with

AWWA C104.

- G. DIP shall have a bituminous coating, minimum one (1) mil thick, on the pipe exterior, unless otherwise specified.
- H. As shown in AWWA C151, mechanical joint DIP shall conform, at a minimum, to the following pressure classes:

**TABLE 2.2-H: Pressure Class and Wall Thickness – Mechanical Joint Pipe**

<i>Diameter (inch)</i>	<i>Pressure Class (psi)</i>	<i>Nominal Wall Thickness (inch)</i>
<b>3</b>	<b>350</b>	<b>. 25</b>
<b>4</b>	<b>350</b>	<b>0.25</b>
<b>6</b>	<b>350</b>	<b>0.25</b>
<b>8</b>	<b>350</b>	<b>0.25</b>
<b>12</b>	<b>350</b>	<b>0.28</b>
<b>16</b>	<b>250</b>	<b>0.30</b>
<b>20</b>	<b>250</b>	<b>0.33</b>
<b>24</b>	<b>250</b>	<b>0.33</b>
<i>Higher pressure class pipe will be required when the W&amp;S Dept determines that excessive dead loads, pressures, or other conditions warrant increased wall thickness.</i>		

- I. Corrosion resistant, high strength, low-alloy steel bolts and nuts shall be used where in contact with the soil, immersed, or in splash zones in accordance with ASTM F3125, Type 3. Acceptable bolts and nuts are:

- 1. **Cor-Ten**
- 2. **Usalloy**
- 1. **Romac Industries, Inc**
- 3. **Or approved equivalent.**

## **2.3 MECHANICAL JOINT RESTRAINTS**

### **A. General**

- 1. **Mechanical joint restraints shall be used for restraining fittings, valves, hydrants, and fire sprinkler lines.**

2. **All mechanical joint pipe restraints shall be incorporated in a follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Twist-off nuts, sized same as tee-head bolts, shall be used to ensure proper actuating of restraining devices.**
- B. Glands shall be manufactured of ductile-iron conforming to ASTM A536, grade 60-42-10. Restraining devices shall be of ductile-iron heated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C153.
- C. Mechanical joint restraint devices shall have the following minimum working pressures and shall not be less than piping working pressure ratings:
  1. **350 psi with a minimum safety factor of 2:1, for four-inch (4") through twenty-four inch (24") diameter.**
  2. **250 psi with a minimum safety factor of 2:1, for larger than twenty-four inch (24") diameter.**
- D. Acceptable manufacturers and styles are:
  1. **Mechanical Joint Restraint**
    - a. ***EBAA Iron, Inc. – MEGALUG, SERIES 1100***
    - b. ***Uni-Flange Corp. – SERIES 1400***
    - c. ***Romac Industries, Inc.***
  2. **Slip Joint Restraint**
    - a. ***EBAA Iron, Inc. – MEGALUG, SERIES 1700***
    - b. ***Uni-Flange Corp. – SERIES 1450***
    - c. ***Romac Industries, Inc.***

## 2.4 VALVES

Reference construction specification *Section 02515, Water Utility Distribution Valves*.

## 2.5 FIRE HYDRANTS

Reference construction specification *Section 02516, Water Utility Distribution Fire Hydrants*.

## 2.6 BLOW-OFFS

Reference City of Greeley Standard Drawing.

## 2.7 SERVICE LINES, METERS, AND APPURTENANCES

Reference construction specification *Section 02514, Water Service Lines, Meters, and Appurtenances*.

## 2.8 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping sleeves and valves are required for connections to existing distribution mains unless otherwise indicated on the approved Construction Drawings.
- B. Tapping sleeves for PVC and ductile iron pipe shall have a cast iron or ductile iron body. Tapping sleeves for steel pipe shall be a weld-on type or fabricated steel.
- C. Accepted manufacturers are:
  - 1. **ROMAC**
  - 2. **Ford**
  - 3. **Smith Blair**
  - 4. **JCM Industries, Inc.**
  - 5. **Or approved equivalent**
- D. Tapping sleeves shall be rated at 200 psi, minimum, working pressure.
- E. Tapping sleeves shall provide a 100% leak-tight seal.
- F. Prior to ordering tapping sleeve, manufacturer's shop drawings and specifications shall be submitted to the City for review and acceptance.
- G. For tapping valves, reference construction specification *Section 02515, Water Utility Distribution Valves*.

## 2.9 TRACER WIRE AND TEST STATIONS

- A. Copper: 12-gauge stranded or solid, watertight insulation for direct bury.
- B. Connector: solderless, 3M Direct Bury splice kit, or approved equivalent.
- C. Test station to be flush-to-grade type complete with insulated terminal block with four (4) terminals.
- D. Cover shall be lockable, cast-iron, with "WATER TEST" cast in the cover.
- E. Test station section to be four-inch (4") inside diameter with an eighteen-inch (18") long flared plastic shaft to prevent removal.

## 2.10 MECHANICAL COUPLINGS

- A. All mechanical couplings shall be of a gasketed, sleeve-type, with diameter to properly fit the pipe. Tolerance on pipe and coupling, together with proper bolt and gasket arrangements, shall be sufficient to ensure permanent watertight joints under all conditions.
- B. Materials used in the manufacture of these couplings shall be new and shall conform to AWWA C219.
- C. Couplings shall be sufficiently wide, so that each type of pipe joined will have as much pipe end inserted in the coupling as is provided by the standard push-on mechanical joint for the pipe size and type involved.
- D. Acceptable manufacturers and styles of couplings are:

**TABLE 2.6-D: Couplings**

<i>Straight Couplings</i>		
<b><i>Dresser</i></b>	<b><i>Style 138</i></b>	<b><i>all sizes</i></b>
<b><i>Romac</i></b>	<b><i>Style 501</i></b>	<b><i>4" through 12"</i></b>
<b><i>Romac</i></b>	<b><i>Style 400</i></b>	<b><i>16" and larger</i></b>
<b><i>Smith-Blair</i></b>	<b><i>Style 441</i></b>	<b><i>all sizes</i></b>
<i>Insulating Couplings</i>		
<b><i>Romac</i></b>	<b><i>Style IC501</i></b>	<b><i>4" through 12"</i></b>
<b><i>Romac</i></b>	<b><i>Style IC400</i></b>	<b><i>16" and larger</i></b>
<b><i>Smith-Blair</i></b>	<b><i>Style 416</i></b>	<b><i>all sizes</i></b>
<i>Reducing Couplings</i>		
<b><i>Dresser</i></b>	<b><i>Style 62</i></b>	<b><i>all sizes</i></b>
<b><i>Romac</i></b>	<b><i>Style RC501</i></b>	<b><i>4" through 12"</i></b>



<b><i>Romac</i></b>	<b><i>Style RC400</i></b>	<b><i>16" and larger</i></b>
<b><i>Smith-Blair</i></b>	<b><i>Style 415</i></b>	<b><i>all sizes</i></b>
<b><i>Transition Coupling</i></b>		
<b><i>Dresser</i></b>	<b><i>Style 162</i></b>	<b><i>all sizes</i></b>

***Or approved equivalent.***

## 2.11 FITTINGS

- A. All fittings shall be manufactured in accordance with AWWA C104, C110, and C111.
- B. All fittings shall have either mechanical joint or flanged joint connections.
- C. All fittings shall be made of either gray-iron or ductile-iron, and have a minimum working pressure rating of 350 psi for four-inch (4") through twenty-four inch (24") diameter and 250 psi for larger than twenty-four inch (24") diameter.
- D. All sizes of ductile and gray iron fittings shall be furnished with a cement –mortar lining of standard thickness or fusion-bonded epoxy coating in accordance with AWWA C116.
- E. Iron used in the manufacture of fittings for these specifications shall have:
  - 1. **Minimum tensile strength – 60,000 psi**
  - 2. **Minimum yield strength – 42,000 psi**
  - 3. **Minimum elongation – 10%**

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. All materials used in the construction of potable water distribution shall be new.
- B. Construction Staking
  - 1. **Reference construction specification *Section 02315, Excavation and Fill.***
  - 2. **Tolerances:**
    - a. ***Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.***

- b. ***Horizontal alignment shall not deviate from the City accepted Construction Drawings by more than 0.3 feet.***
  - c. ***Vertical alignment shall not deviate from the City accepted Construction Drawings by more than 0.3 feet as measured from the top of pipe.***
- C. The minimum effective area of thrust blocks shall be as specified in City of Greeley Standard Drawings.

### 3.2 INSPECTION

- A. Pipe barrel and fittings shall be free of dirt or other foreign objects prior to installation.
- B. Pipe and fittings shall be inspected for cracks, dents, abrasions, or other flaws prior to installation.
- C. Damaged or flawed pipe or fittings shall be rejected, marked, and removed from the site.
- D. Operational Inspection: At the completion of the project and in the presence of the City, the Contractor shall operate all valves to ascertain that the entire facility is in good working order, all valve boxes are centered and valves are open, all hydrants operate and drain properly, all curb boxes are plumb centered and water is available at all curb stops. Any valves or hydrants that do not meet these requirements shall be satisfactorily repaired as directed by the City or removed and replaced with working and properly installed valves or hydrants at no expense to the City.

### 3.3 PREPARATION

- A. Trenching, Backfilling, and Compaction
  - 1. **Reference construction specification *Section 02315, Excavation and Fill.***
- B. Existing Utilities
  - 1. **The horizontal and vertical location of existing utilities shall be field verified prior to start of construction.**
  - 2. **Any deviation from what is shown on the approved Construction Drawings shall be reported to the City**

**immediately and documented on the As-Constructed Record Drawings.**

### 3.4 CONNECTIONS TO EXISTING SYSTEM

- A. When connecting to the existing potable water distribution, ONLY City Water and Sewer Department personnel shall operate existing system valves. The Contractor shall provide at least forty-eight (48) hours notification prior to needing any valve operated, except in the case of emergencies.
- B. At locations where connections to existing mains are to be made, the Contractor shall locate the existing mains both vertically and horizontally and verify their exact size and material in advance of the time scheduled for making the connections.
  - 1. **Prior to connecting to existing mains, the Contractor shall have all labor, materials, and equipment ready to connect the fitting to the existing main, so as to keep the shutoff time to a minimum.**
  - 2. **The Contractor shall notify the City of Greeley 48 hours in advance to examine the existing pipe or appurtenance and specify any necessary adjustments in line, grade, or connection requirements to accomplish the connection. Contractor to make corrections as directed by the City.**
  - 3. **Use effective measures to prevent contamination to existing potable water lines.**
  - 4. **Refer to construction specification *Section 02511, Disinfection of Water Utility Distribution* for more information on disinfection prior to connecting to existing waterlines.**
- C. The City shall not be responsible for valve water tightness on existing facilities. If existing valves leak, the City Water and Sewer Department may assist in reducing the influx of water, but the Contractor must use methods at his own disposal to dewater the trench and complete any required testing and disinfection of the potable water line.
- D. All connections shall have valves installed to separate new construction from the existing system. New construction shall not be connected to the existing system until the new system has been tested, disinfected, and accepted by the City.

### 3.5 PIPE INSTALLATION

#### A. Pipe Laying

1. **Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.**
2. **Measure for grade at top of pipe.**
3. **Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.**
4. **Lay pipe with the bells pointing in the direction the work is progressing.**
5. **Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:**
  - a. ***Shorter pipe lengths.***
  - b. ***Special mitered joints.***
  - c. ***Standard or special fabricated bends.***
6. **After joint has been made, check pipe alignment and grade.**
7. **Place sufficient pipe zone material to secure pipe from movement before next joint is installed.**
8. **Take effective measures to prevent opening of joints during bedding and backfilling operations.**
9. **Complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade as each length of pipe is placed in the trench. Make adjustments in line and grade by scraping away or filling pipe bedding under the entire length of the pipe, except at bells, and not by wedging, blocking, or mounding up the pipe or bells.**

10. **Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints. Do not disturb the pipe after the jointing has been completed.**
11. **Install the pipeline so that a positive or negative grade is maintained between high and low points.**
12. **The minimum and maximum depth of cover shall be five (5) feet and six (6) feet respectively, for potable water mains unless otherwise indicated on the Construction Drawings.**
13. **No water pipe may be covered or backfilled until inspection of pipe and bedding has been made or City Inspector has given approval.**
14. **Tracing wire shall be installed with PVC pipe and ductile iron pipe (DIP).**

**B.** Separation of Water Mains and Services in Relation to Other Utilities

1. **Potable water services and distribution mains shall have a minimum ten (10) feet horizontal and eighteen-inches (18") vertical separation from all utilities measured from outside diameter.**
2. **Where sanitary sewer lines cross beneath potable water lines with less than eighteen-inches (18") clearance, sanitary sewer lines cross above potable water lines, or the ten (10) feet horizontal clearance between potable water lines and sanitary sewer lines cannot be maintained, pipe encasement shall be provided in accordance with construction specification *Section 02445, Casing Pipe – Borings and Encasements*.**
3. **Where storm water lines cross above potable water mains, storm water pipe joints shall be grouted a minimum ten (10) feet on either side of the crossed potable water main, measured from the outside diameter of the pipe.**
4. **Dry utility crossings shall be encased in high density**

**polyethylene pipe (HDPE), Standard Dimension Ratio (SDR) 11 from edge to edge of the easement or right-of-way, or ten (10) feet on either side of the potable water main, whichever is greater.**

- 5. Right angle only utility crossings are permitted above and below the potable water main. Parallel installation of other utilities in exclusive water easements is not permitted.**
- 6. Bored utility crossings shall have a minimum twenty-four inches (24") of vertical clearance from the outside diameter of the utility casing to the outside diameter of the potable water line if the bored utility crosses above the potable water line and a minimum thirty-six inches (36") of vertical clearance from the outside diameter of the utility casing to the outside diameter of the potable water line if the bored utility crosses below the water line.**
- 7. If there are horizontal or vertical clearance conflicts between the potable water line and a utility, the City may require that the potable water main be lowered, raised, or realigned in order to maintain the required clearances.**
- 8. For a potable water line crossing situation not specifically mentioned in this section, the crossing requirements provided in these Criteria shall be applied to that particular situation to the best extent possible.**

**C. Tracer Wire**

- 1. Tape to top centerline of pipe every three (3') to four (4') feet with adhesive tape or plastic tie straps such that wire remains in place during embedding of pipe.**
- 2. Tracing wire shall be brought to the surface on the inside of a test station behind every fire hydrant. Provide a two (2) foot loop of wire at each test station.**
- 3. Tracer wire shall be installed per City of Greeley Standard Drawings.**

D. Test Station

1. **Test stations shall be installed per City of Greeley Standard Drawings.**

3.6 THRUST RESTRAINT

A. Anchorage and Blocking

1. **Reference City of Greeley Standard Drawings.**
2. **Concrete thrust blocks and anchors for preventing movement shall be provided at all mechanical joint plugs, tees, crosses, reducers, valves, bends, and changes in direction of 11-¼° or more.**
3. **The minimum size of thrust blocks and thrust anchors shall be determined from the table provided on the City of Greeley Standard Drawings.**
4. **The concrete thrust block-bearing surface shall be excavated into undisturbed soil.**
  - a. *All loose soil shall be disposed of, and the location where the thrust block is to be poured shall be carefully shaped to provide a uniform bearing surface of the required size.*
  - b. *The concrete thrust block bottom shall be flat, and sides shall be vertical.*
  - c. *If soil is to be disturbed, making a concrete thrust block or thrust anchor unusable, alternate restraining systems must be approved for use by the Water and Sewer Department prior to pipeline installation.*
5. **The concrete thrust block shall be formed to provide access to fittings, valves, and hydrants. Care shall be taken not to block outlets or to cover bolts, nuts, clamps, or other fittings to make them inaccessible.**
6. **The concrete thrust block shall be extended from the fitting or valve to be blocked to undisturbed earth. Concrete thrust**

**blocks shall be constructed so that joints and drain holes are clear and accessible.**

7. **Concrete shall be separated from fittings, valves, and hydrants by eight (8) mil polyethylene film.**
8. **The City shall be notified a minimum twenty-four (24) hours prior to concrete being placed.**

B. Restraining Devices

1. **If concrete thrust blocks cannot be used for any reason, or if otherwise required, push-on and mechanical joints may be restrained with mechanical restraint systems.**
2. **The City shall determine the length of pipe to be restrained for each situation where mechanical restraint systems are to be installed. Refer to Construction Drawings or coordinate with City as necessary for location.**
3. **Reference construction specifications *Section 02512, Ductile-Iron Pipe* and *Section 01513, Polyvinyl Chloride (PVC) Pressure Pipe*.**

3.7 INSTALLATION OF PIPELINE APPURTENANCES

- A. Install valves, hydrants, blow-offs, and other pipeline appurtenances at the locations shown on the Construction Drawings or as designated by the City to accommodate field conditions.
- B. Horizontal and Vertical record measurements of the actual location of fittings, valves, and appurtenant equipment prior to backfill and record for the As-Constructed Record Drawings.
- C. All dead-end potable water lines will have a hydrant blow-off at the end of the. Dead-end potable water lines that will be extended in the future shall have a valve which controls that section of potable water line left in the off position. The valve shall be positioned so no service will be left without water when the line is extended in the future.

3.8 PROTECTION OF METAL SURFACES

- A. Protect supplied material including coatings that have been damaged.



- B. For polyethylene encasement, reference construction specification *Section 02512, Ductile-Iron Pipe*.
- C. Apply two (2) coats of coal tar paint to ferrous metal rods, rebar, clamps, bolts, nuts and other accessories which are subject to submergence or contact with earth or fill material. Apply first coat of coal tar paint to a dry, clean surface. Allow first coat of coal tar paint to dry before the second coat is applied.

### 3.9 DISSIMILAR METALS AND INSULATOR KITS

- A. Whenever it is necessary to join dissimilar metals, a City approved insulated joint shall be installed.

### 3.10 FIELD QUALITY CONTROL

- A. Pipe Leakage Tests.
  - 1. **Reference construction specification *Section 01713, Water Distribution System Testing*.**
- B. Tracer Wire Testing.
  - 1. **Pass current through wire and demonstrate that wire is capable of locating the pipe.**
  - 2. **If wire will not pass current, locate break in circuit and test until tracer wire works in accordance with its intended use.**
- C. Soil Compaction.
  - 1. **Reference construction specification *Section 02315, Excavation and Fill*.**

### 3.11 PIPELINE DISINFECTION

- A. Reference construction specification *Section 02511, Disinfection of Water Utility Distribution*.

SECTION 02511  
DISINFECTING OF WATER UTILITY DISTRIBUTION

**PART 4 – GENERAL**

**4.1 SCOPE**

- A. This section addresses the filling and disinfection of potable water distribution lines.
- B. The Contractor is responsible for the disinfection and testing of water lines.

**4.2 REFERENCES**

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1. **B300, Hypochlorites, latest revision**
  - 2. **C651, Disinfecting Water Mains, latest revision.**

**4.3 SUBMITTALS**

- A. Procedure and plan for cleaning, disinfection, and testing of system. Plan shall include:
  - 1. **Plan describing and illustrating conformance to appropriate AWWA standards and this Specification.**
  - 2. **Proposed locations within system where Samples will be taken.**
  - 3. **Type of disinfecting solution and method of preparation.**
  - 4. **Method of disposal for highly chlorinated disinfecting water.**
- B. Certification that employees working with concentrated chlorine solutions have received appropriate safety training.
- C. Certification that independent testing agency is qualified to perform bacteriological testing in accordance with AWWA standards, agency requirements, and this Specification.
- D. Certified Bacteriological Test Results confirming area tested is free from coliform bacteria contamination. Forward results directly to City.

#### 4.4 QUALITY ASSURANCE

- A. Independent Testing Agency: Certified in the State of Colorado with 10 years of experience in the field of water sampling and testing. Agency shall use calibrated testing instruments and equipment and documented standard procedures for performing specified testing. The City may choose to self-perform the testing.

### **PART 5 – PRODUCTS**

#### 5.1 WATER FOR DISINFECTION AND TESTING

- A. Clean, uncontaminated, and potable.

#### 5.2 DISINFECTANT

- A. Hypochlorite - Reference AWWA B300. Hypochlorite for use in swimming pools is not allowed.

### **PART 6 – EXECUTION**

#### 6.1 GENERAL

- A. Perform disinfection after completion of leakage testing and acceptance of results. If pre-approved by the City, leakage test and disinfection can be completed at the same time.
- B. The Contractor shall disinfect all pipe and fittings which will be installed in the main after the main has been chlorinated or installed at connections to existing mains, which will not be subjected to the chlorination procedure. The Contractor shall notify City of Greeley a minimum of 48 hours prior to the disinfection so the City can be onsite to observe.
- C. The Contractor shall flush and satisfactorily disinfect new water lines prior to acceptance of the lines by the City and placing them in service.
- D. New water lines shall not be connected to existing lines until the new lines have been flushed, tested, disinfected, and accepted by the City.
- E. Under NO circumstances shall a non-disinfected potable water main be connected to an existing disinfected potable water main without prior acceptance by the City.
- F. As soon as possible after making the connections, the Contractor shall flush the connection so as to prevent contamination of the existing facilities. The Contractor shall take every precaution necessary to prevent dirt or debris from entering the main.

- G. Complete flushing and disinfection in accordance with AWWA C651, except as modified in these Specifications.
- H. Contractor to furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.
- I. Water used to fill pipeline may be supplied using a temporary connection to existing distribution system. Provide protection against cross-connections and appropriate backflow preventer assembly as required by AWWA C651.
- J. Disinfect items installed or modified under this Project, intended to hold, transport, or otherwise contact potable water.

## **6.2 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Reference the Forwards to AWWA B300 and AWWA C651.
- B. Exercise extreme care in handling hypochlorites, as they may be dangerous to health.

## **6.3 GROUNDWATER OR SURFACE RUNOFF CONTAMINATION**

- A. If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to assure that any of the water that may enter the pipe joint spaces contains an available chlorine concentration of approximately 25 mg/L. This may be accomplished by adding calcium hypochlorite granules to each length of pipe before it is lowered into a wet trench.
- B. If the main is flooded during construction, it shall be cleared of the flood water by draining and by flushing with potable water until clean. The section exposed to the flood water shall then be filled with chlorinated potable water which at the end of a twenty-four (24) hour holding period shall have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous feed or slug method.
- C. If dirt and debris enters the pipe that, in the opinion of the City, will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then shall be swabbed with a 1% hypochlorite disinfection solution. Cleaning with the use of a pig, swab, or "go-devil" should be undertaken only when such operations will not force mud or debris into pipe joint spaces.

## **6.4 FILLING PIPE**

- A. Only City personnel shall operate existing City owned valves to prevent disinfecting solution from flowing back into the line supplying the water.

- B. Where permanent air release vents are not available, the Contractor shall install corporation stops at high points in the water line in order to evacuate trapped air.
1. **All corporation stops shall be installed using an approved tapping saddle. No direct taps will be allowed.**
  2. **All locations for corporation stops shall either be shown on the City accepted Construction Drawings or as directed in the field by the City.**
  3. **All corporation stops, which were installed to facilitate evacuation of air from the water main shall be removed and plugged with a brass “cc” threaded plug after the water main is filled, and prior to pressure testing. All tap locations shall be shown on the As-Constructed Record Drawings.**
- C. Refer to specific method of disinfection in this Specification for maximum filling velocity.
- D. Water supplied from a temporary, backflow protected connection to the existing distribution system or other approved supply source, shall flow at a constant measured rate into the newly installed water main.
- E. Prior to application of disinfectants, clean all pipelines of loose and suspended material. If continuous feed method or slug method of disinfection, as described in AWWA C651, are used flush pipelines with potable water until clear of suspended solids and color. Provide hoses, temporary pipes, ditches, and other conduits as needed to dispose of flushing water without damage to adjacent properties.
- F. Flush service connections and hydrants. Flush distribution lines prior to flushing hydrants and service connections. Operate valves during flushing process at least twice during each flush.
- G. Allow freshwater and disinfectant solution to flow into pipe or vessel at a measured rate so chlorine-water solution is at specified strength. Do not place concentrated liquid commercial disinfectant in pipeline or other facilities to be disinfected before it is filled with water.

## 6.5 METHODS

- A. General
1. **The City, in accordance with AWWA C651, shall approve the**

chlorinating agent and method of application. The City has the authority to restrict the method of disinfection on a case by case basis.

2. The City shall sample and test water from the pipe system extremities until clear, potable water is obtained.
3. The Contractor shall properly and legally dispose of flushing and heavily chlorinated water. Do not allow flow into a waterway without neutralizing disinfectant residual. See appendix of AWWA C651 for acceptable neutralization methods.
4. Operate new valves and other appurtenances while the lines are filled with heavily chlorinated water.

B. Tablet Method

1. The tablet method consists of placing calcium hypochlorite tablets in the water main as it is being installed and then filling the main with potable water when installation is complete. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.
2. **Placing Calcium Hypochlorite Tablets**
  - a. *During construction, 5-gram calcium hypochlorite tablets shall be placed in each section of pipe. Also, one tablet shall be placed in each hydrant, hydrant branch, and other appurtenance.*
  - b. *The number of 5 gram tablets required for each pipe section shall be*

$$0.0012d^2L$$

*rounded to the next higher integer, where d is the inside pipe diameter, in inches, and L is the length of the pipe section, in feet. Reference Table 2, AWWA C651 for commonly used sizes of pipes.*

- c. *Tablets shall be attached to the top of the pipe by a food-*

*grade adhesive.*

- d. *The adhesive shall be only on the broadside of the tablet attached to the surface of the pipe.*
- e. *If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section to indicate that the pipe has been installed with the tablets at the top.*

3. **Filling and contact**

- a. *Introduce water into the pipes at a velocity no greater than one (1) foot per second (fps).*
- b. *The chlorinated water shall be retained in the lines for a minimum of twenty-four (24) hours. If the water temperature is less than 41° F, the water shall remain in the pipe at least forty-eight (48) hours.*
- c. *Detectable chlorine residual of not less than 10 mg/L shall be found at each sampling point after the twenty-four (24) hour or forty-eight (48) hour period.*

C. **Continuous-Feed Method**

- 1. **The continuous-feed method of disinfecting water mains consists of completely filling the main to remove all air pockets, flushing the completed main to remove the particulates, and filling the main with potable water.**
- 2. **Chlorinated water shall be introduced into the water lines at a point not more than ten (10) feet downstream from the beginning of the new main. Water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25 mg/L free chlorine.**
  - a. *The entire main shall be filled with the chlorine solution.*
  - b. *Reference Table 4, AWWA C651 for required chlorine amounts.*
  - c. *Prior to and during the disinfection process, valves shall be*

*positioned so that the chlorine solution in the newly constructed main will not flow into water mains in active service.*

3. **The chlorinated water shall be retained in the main for a minimum of twenty-four (24) hours, at which time the treated water in all portions of the main shall have a free chlorine residual of not less than 10 mg/L.**

**D. Slug Method**

1. **The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/L.**
2. **Placing Calcium Hypochlorite Granules**
  - a. *Calcium hypochlorite granules may only be used with prior written approval by the City.*
  - b. *During construction, calcium hypochlorite granules shall be placed at the upstream end of each section of pipe and at the upstream end of each branch main.*
  - c. *The quantity of granules used shall be as shown in Table 1, AWWA C651.*
3. **At a point not more than ten (10) feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will not have less than 100 mg/L free chlorine.**
4. **The chlorine shall be applied continuously and for a sufficient period to develop a solid column, or “slug” of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L.**



5. **The free chlorine residual shall be measured in the slug as it moves through the main. If the free chlorine drops below 50 mg/L, the flow shall be stopped, chlorination equipment moved to the head of the slug, and as flow resumes, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.**
6. **Flow rate shall be set so that all interior surfaces are exposed to a chlorine concentration of approximately 100 mg/L for a minimum of three (3) hours.**

#### 6.6 PIPE AND FITTING INSTALLED AFTER CHLORINATION

- A. All pipes and fittings which will be installed after the pipe has been chlorinated or installed at connections to existing mains, which will not be subject to chlorination, shall be disinfected:
  1. **The ends of the existing pipe shall be thoroughly cleaned both inside and outside before any new parts are installed.**
  2. **The ends of the existing pipe shall be sprayed with a concentrated chlorine solution (min. of 100 parts per million chlorine), both inside and outside. The inside of the pipe shall be sprayed as far back into the main as possible.**
  3. **All inside surfaces of any new material that will have contact with potable water shall be cleaned and sprayed with a concentrated chlorine solution (minimum of 100 parts per million chlorine). This includes middle rings and gaskets for mechanical couplings, punch joints, mechanical joints, and split sleeves.**

#### 6.7 FINAL FLUSHING

- A. After the applicable retention period, the heavily chlorinated water shall be flushed from the water lines until chlorine measurement show that the concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/L.
- B. The Contractor shall be responsible for all necessary permits and to ensure that no environmental damage occurs from the flushed water line. Reference Appendix B of AWWA C651 for a list of neutralizing chemicals.

## 6.8 BACTERIOLOGICAL TESTS

- A. The Testing Agency shall collect water samples to test for bacteriological quality to show the absence of coliform and heterotrophic organisms in the pipeline. Testing shall be done after final flushing. Under no circumstances shall the main put in service prior to bacteriological testing.
- B. The Contractor shall schedule with the Testing Agency for sample collection upon notification of need from the Contractor.
- C. The Testing Agency, based upon AWWA C651, shall determine the number and frequency of samples.
- D. All test results shall be sent to the City for review and approval.
- E. Water mains shall not be placed in service until written release is obtained from the City.

## 6.9 REPETITION OF PROCEDURE

- A. If the initial disinfection, or subsequent disinfections, fails to produce satisfactory samples, the main shall be reflushed and resampled. If the samples are still not satisfactory, the continuous-feed or the slug method of chlorination shall be used to rechlorinate the main until satisfactory results are obtained.

SECTION 02513  
POTABLE POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

**PART 1 – GENERAL**

**1.1 SCOPE**

- A. This section includes materials and installation procedures for polyvinyl chloride (PVC) pressure pipe for potable water distribution.
- B. Pipe shall be furnished complete with all fittings, specials, and other accessories.
- C. Refer to specification section 02510 Water Utility Distribution Piping, for additional requirements.

**1.2 REFERENCES**

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1. **C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In., For Water Distribution, latest revision.**
- B. ASTM International (ASTM)
  - 1. **D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds, latest revision.**
  - 2. **F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe, latest revision.**
- C. American Water Works Association (AWWA)
  - 1. **M23, Manual of Water Supply Practices, PVC Pipe: Design and Installation, latest revision.**
- D. National Sanitation Foundation (NSF)
  - 1. **Standard No. 61 – Drinking Water System Components – Health Effects, latest revision.**
- E. Plastic Pipe Institute (PPI)

1. **TR-3 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe, latest revision.**

### 1.3 SUBMITTAL REQUIREMENTS

- A. See *Section 02510, Water Utility Distribution Piping* for general submittal requirements.
- B. Additional submittal requirements for PVC include:
  1. **Pipe Manufacturer**
  2. **Pipe Class / Pressure Rating**
  3. **Color**
  4. **Recommended Minimum bending Radius**
  5. **Recommended Maximum Safe Pull Force (For Fusible PVC)**
  6. **Fusion Technician qualifications indicating conformance with this specification. (For Fusible PVC)**

### 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All PVC pipe shall be supplied by one manufacturer.
- B. Handling.
  1. **Use wide fabric choker slings.**
  2. **Do not drop pipe or fittings including dropping on cushions.**
  3. **Do not use hooks.**
  4. **Polyvinyl chloride (PVC) pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling and installing PVC pipe during cold weather.**

5. **Care must be taken to prevent damage to the pipe and fittings by impact, bending, compression, or abrasion.**

C. **Storage.**

1. **Store and use pipe lubricants in a manner that will avoid contamination.**
2. **Pipe shall be stored in accordance with the manufacturer's specifications.**
3. **Pipe, gaskets, and all other installation materials shall be stored in accordance with the manufacturer's specifications.**
  - a. *Pipe shall be stored on a surface that provides even support for the pipe barrel. Pipe shall not be stored in such a way as to be supported by the bell.*
  - b. *No pipe stored outside and exposed to sunlight shall exceed the manufacturer's recommended exposure time. This time shall begin from the date of manufacture.*
  - c. *If the exposure time will be greater than the manufacturer's recommended time, the pipe shall be covered with an opaque material. Air circulation shall be provided under the covering.*
  - d. *Pipe that exhibits excessive ultraviolet deterioration and cracking, which in the opinion of the City degrades the pipe quality, shall not be used.*

**PART 2 – PRODUCTS**

**2.1 POLYVINYL CHLORIDE (PVC) PIPE – SLIP JOINT**

A. **General.**

1. **This specification shall cover slip joint PVC pipes in 6-inch (6") through 24-inch (24") nominal diameters with cast iron equivalent outside diameters.**
2. **All PVC pipe shall be manufactured in accordance with AWWA C900.**

3. **Pipe shall be blue in color.**

- B. Pipe joints shall be made using an integral bell with elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.
- C. All sizes of pipe under these specifications shall be pressure class as shown on the City accepted Constructed Drawings. Pressure Class 235 (DR-18) shall be the minimum pipe class accepted.
- D. Each length of pipe shall be a standard laying length of twenty (20) feet. Random lengths are not acceptable.
- E. Polyvinyl chloride (PVC) pipe materials shall be made from Class 12454A of 12454B virgin compounds as defined in ASTM D1784. All compounds shall qualify for a rating of 4000 psi for water at 73.4°F (23°C) per the requirements of Plastic Pipe Institute (PPI), TR-3, and complies with the National Sanitation Foundation Standard, No. 61, for water service.
- F. Elastomeric gaskets shall conform to ASTM F477.

2.2 POLYVINYL CHLORIDE PIPE (PVC) – RESTRAINED JOINT

- A. General.
  - 1. **This specification shall cover restrained joint PVC pipe in 6-inch (6”) through 24-inch (24”) nominal diameters with cast iron equivalent outside diameters.**
  - 2. **All PVC pipe shall be manufactured in accordance with AWWA C900.**
  - 3. **Pipe shall be blue in color.**
- B. Pipe joints shall be non-metallic restrained joint design by utilizing precision-machined grooves on the pipe and in the coupling. When aligned, a nylon spline is inserted, resulting in a fully circumferential restrained joint that locks the pipe and coupling together. A flexible elastomeric seal (o-ring) in the coupling provides a hydraulic pressure seal.
- C. All sizes of pipe under these specifications shall be pressure class as shown on the City accepted Constructed Drawings. Pressure Class 235 (DR-18) shall be the minimum pipe class accepted.

- D. Each length of pipe shall be a standard laying length of twenty (20) feet. Random lengths are not acceptable.
- E. Polyvinyl chlorine pipe materials shall be made from Class 12454A of 12454B virgin compounds as defined in ASTM D1784. All compounds shall qualify for a rating of 4000 psi for water at 73.4°F (23°C) per the requirements of Plastic Pipe Institute (PPI), *TR-3*, and complies with the National Sanitation Foundation Standard, *No. 61*, for water service.
- F. Elastomeric gaskets shall conform to ASTM F477.
- G. Acceptable restrained joint PVC manufacturers are:
  - 1. **Certain Teed – CERTA-LOK C900/RJ**
  - 2. **Or approved equivalent.**
- H. Acceptable high deflection restrained joint PVC manufacturers are:
  - 1. **Certain Teed – HD (High Deflection)**
  - 2. **Or approved equivalent.**

### 2.3 POLYVINYL CHLORIDE (PVC) PIPE – FUSED

- A. General.
  - 1. **This specification shall cover slip joint PVC pipes in 6-inch (6”) through 24-inch (24”) nominal diameters with cast iron equivalent outside diameters.**
  - 2. **All PVC pipe shall be manufactured in accordance with AWWA C900.**
  - 3. **Pipe shall be blue in color.**
- B. All sizes of pipe under these specifications shall be pressure class as shown on the City accepted Constructed Drawings. Pressure Class 235 (DR-18) shall be the minimum pipe class accepted.
- C. Each length of pipe shall be a standard laying length of twenty (20) feet or more. Random lengths are not acceptable
- D. Polyvinyl chlorine (PVC) pipe materials shall be made from Class 12454A of 12454B virgin compounds as defined in ASTM D1784. All compounds shall qualify

for a rating of 4000 psi for water at 73.4°F (23°C) per the requirements of Plastic Pipe Institute (PPI), *TR-3*, and complies with the National Sanitation Foundation Standard, *No. 61*, for water service.

E. Fusion Technician

1. **Fusion Technician shall be fully qualified by the pipe supplier to install Fusible PVC of the type(s) and size(s) being used. Qualifications shall be current as of the actual date of fusion performance on the project.**

F. Fusion Joints

1. **Unless otherwise specified, fusible PVC pipe lengths shall be assembled in the field with butt-fused joints. Contractor shall follow the pipe suppliers written guidelines for this procedure. All Fusion joints shall be completed as described in these specifications.**

## 2.4 MECHANICAL JOINT PIPE RESTRAINTS

- A. Refer to construction specification *Section 02510, Water Utility Distribution Piping* for additional requirements for mechanical joint pipe restraint.

- B. Acceptable manufacturers for PVC pipe are:

1. **Mechanical joint Restraint:**
  - a. ***EBAA Iron, Inc. – MEGALUG, SERIES 2000 PV***
  - b. ***Uni-Flange Corp. – SERIES 1500 Slip joint restraint:***
  - c. ***EBAA Iron, Inc. – MEGALUG, SERIES 1500***
  - d. ***Uni-Flange Corp. – SERIES 1390***
  - e. ***ROMAC Industries, Inc***

## 2.5 TRACER WIRE AND TEST STATIONS

- A. Reference construction specification *Section 02510, Utility Distribution Piping* for additional requirements for tracer wire and test stations.



## 2.6 FITTINGS AND COUPLINGS

- A. Reference construction specification *Section 02510, Utility Distribution Piping* for additional requirements for fittings and couplings.

## **PART 3—EXECUTION**

### 3.1 INSPECTION

- A. In addition to any deficiencies covered by AWWA M23, PVC pipe which has any of the following visual defects will be rejected:
  - 1. **Pipe which is sufficiently out-of-round to prohibit proper joining or be able to pass a mandrel test.**
  - 2. **Improperly formed bell and spigot ends.**
  - 3. **Fractured, cracked, chipped, dented, abrasions, or otherwise damaged pipe.**
  - 4. **Pipe that has been damaged during shipment or handling. Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in material of the completed pipeline.**
- B. Damaged or flawed pipe shall be rejected, marked, and removed from the site.

### 3.2 PREPARATION

- A. Trenching, backfilling, and compaction.
  - 1. **Reference construction specification *Section 02315, Excavation and Fill.***

### 3.3 FUSION PROCESS

- A. General
  - 1. **Fusible PVC pipe to handled in a safe and non-destructive manner before, during and after the fusion process and in accordance with this specification and the pipe's supplier's guidelines**

2. **Fusible PVC pipe will be fused by a qualified fusion technician, as documented by the pipe supplier**
3. **Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine**
4. **Only appropriately sized and outfitted fusion machines that have been approved by the pipe manufacture shall be used in the fusion process. Fusion machines must incorporate the following elements:**
  - a. *Heat Plate – Heat plates shall be good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.*
  - b. *Carriage – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.*
  - c. *General Machine – Overview of machine body shall yield to obvious defects, missing parts, or potential safety issues during fusion.*
  - d. *Data Logging Device – An approved data logging device with current version of pipe suppliers recommendation and compatible software shall be used. Datalogging device operation and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110 V power source shall be available to extend battery life.*
5. **Other equipment specifically required for the fusion process shall include the following:**

- a. ***Pipe rollers shall be used for support of the pipe to either side of the machine***
- b. ***A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and / or windy weather, per the pipe suppliers recommendations***
- c. ***An infrared (IR) pyrometer for checking pipe and heat plate temperatures.***
- d. ***Fusing machine operations and maintenance manual shall be kept with the fusion machine at all times.***
- e. ***Face blades specifically designed for cutting fusible PVC pipe shall be used.***

#### B. Joint Recording

- 1. **Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe. The software shall register and / or record the parameters required by the supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.**

### 3.4 FUSION PIPE INSTALLATION

#### A. General Installation

- 1. **Installation guidelines from the pipe supplier shall be followed for all installations.**
- 2. **The fusible PVC pipe will be installed in a manner so as not to exceed the recommended bending radius.**

3. **Where fusible PVC pipe is installed by pulling in tension, the recommended Safe Pulling Forces established by the pipe supplier shall not be exceeded.**

**B. Connections to Existing and New Piping Systems**

1. **Approximate locations for existing piping systems are shown in the construction documents. Prior to making connection into existing piping systems, the contractor shall:**
  - a. *Field verify locations, size, piping material, and piping system of the existing pipe.*
  - b. *Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or other as shown in the construction documents.*
  - c. *Allow all piping that has been installed to relax for a period of 24 hours or longer before making final connections.*
  - d. *Have installed all temporary pumps and / or pipes in accordance with the established connection plans.*
2. **Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.**

**C. Cutting the pipe.**

1. **Cut pipe smooth, straight and at right angles to the pipe axis with saws or pipe cutters designed specifically for the material.**
2. **Remove burrs and wipe off all dust from the jointing surfaces.**
3. **Bevel the cut end in accordance with manufacturer's recommendation.**
4. **Do not disturb previously installed joints during cutting operations.**

**D. Field joints.**

1. **Use push-on joints for buried pipe except where indicated otherwise on the Construction Drawings.**
2. **Dirt, oil, grit, and other foreign matter shall be removed from the inside of the bell and the outside of the spigot.**
3. **A thin film of lubricant shall be applied to the inside surface of the gasket and the spigot end of the pipe, per the manufacturer's recommendation.**
4. **The lubricated joint surface shall be kept clean until joined.**

E. Bending

1. **Bending of pipe can be up to 75% of manufacturers recommendation.**

### 3.5 INSTALLATION

A. Reference construction specification *Section 02510, Water Utility Distribution Piping* for additional requirements for installation of pipe.

B. Install buried pipe in accordance with these specifications, City of Greeley accepted Construction Drawings, and AWWA M23.

C. Joints.

1. **The pipe shall be joined to the tolerances recommended by the manufacturer (i.e. home line).**
2. **Stabbing of the pipe shall not be allowed.**
3. **Previously completed joints shall not be disturbed during the jointing operation.**
4. **All joints shall be watertight and free from leaks.**
5. **Test all pipe under concrete and asphalt construction prior to placing concrete to asphalt.**
6. **Install concrete blocking against undisturbed earth in a manner to allow access to joints.**

D. Curves in Trench Alignment.

1. **PVC pressure pipe may be curved to change alignment or grade or to avoid obstructions. The allowable joint offset for PVC pressure pipe is provided in the table below:**

*TABLE 3.3-D: Maximum PVC Pipe Joint Deflection*

<i>Pipe Diameter (in)</i>	<i>Maximum Joint Deflection (°)</i>
<b>8"</b>	<b>2.5°</b>
<b>12"</b>	<b>2.0°</b>
<b>HD Couplings</b>	<b>5.0°</b>

2. **In making the pipe conform to the curve, the pipe lengths should first be assembled in a straight line and then curved as they are lowered into the trench.**

**3.6** FIELD QUALITY CONTROL

- A. Reference construction specification *Section 02510, Water Utility Distribution Piping* for additional requirements for field quality control.

**3.7** PIPELINE DISINFECTION

- A. Reference construction specification *Section 02511 Disinfection of Water Utility Distribution* for additional requirements for pipeline disinfection.

SECTION 02514  
WATER SERVICE LINES, METERS, AND APPURTENANCES

PART 1 – GENERAL

**1.1** SCOPE

- A. This section is a minimum guideline for furnishing and installation of corporation stops, service lines, meters, meter setters, and meter pits.
- B. Service lines are from the water main to the property line.
- C. All services shall be metered with the exception of fire sprinkler lines.

**1.2** REFERENCES

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1. **C800, Underground Service Line Valves and Fittings, latest revision.**
- B. ASTM International (ASTM)
  - 1. **F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing, latest revision.**
  - 2. **F2080, Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe and SDR 9 Polyethylene of Raised Temperature (PE-RT) Pipe.**

**1.3** PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The products shall be handled, stored and protected in a manner that will prevent damage to materials, coatings, and finishes.
- B. All material shall be kept free from dirt, oil, and grease.
- C. All material shall be new.

**1.4** INSTALLATION OF SERVICES

- A. All water services 1 ½-inch (1 ½") and 2-inch (2") shall be fitted with an approved backflow prevention device.

1. **Any case where a cross-connection potential exists, all taps must be fitted with a backflow prevention device.**
2. **Backflow prevention devices shall be installed according to the Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division's Cross-Connection Control Manual, latest edition, and tested upon installation and every year thereafter by a certified cross-connection control technician.**
  - a. *Product information sheets for proposed backflow prevention devices shall be submitted to the Water and Sewer Department for acceptance during the building review process and prior to requesting building permits.*
  - b. *Test reports shall be forwarded to the Water and Sewer Department.*
  - c. *The Water and Sewer Department reserves the right to enhance the requirements of the CDPHE based on City requirements.*
- B. There shall be no physical connection between any potable water service line, inside or outside of any property or building, and any pipes, pumps, hydrants, or tanks, whereby any unsafe or contaminated water (including steam condensation or cooling water) could be discharged or drawn into the potable water system.
- C. Pressure reducing valves may be required according to the plumbing regulations.
- D. No pressure booster shall be allowed unless adequate backflow protection is used.

## **PART 2 – PRODUCTS**

### **2.1 TAPPING SADDLES**

- A.  $\frac{3}{4}$ -inch ( $\frac{3}{4}$ ") inclusive through two-inch (2") tapping saddles shall be constructed of materials in accordance with one of the following descriptions.
  1. **Bronze body.**
  2. **Nuts, bolts, and accessories shall be in accordance with the manufacturer's specifications.**



3. **Acceptable manufacturers and models of ¾-inch (¾") inclusive through two-inch (2") tapping saddles are:**

*TABLE 2.1-A: ¾" – 2" Tapping Saddles*

Manufacturer	Model	Pipe Material
Mueller	BR 2 B CC	DIP, CIP
Mueller	H-13000 CC	C900 PVC
Ford	Style 202B CC	DIP, CIP
Ford	Style S90 CC Hinged	C900 PVC

***Or approved equivalent.***

- B. Four-inch (4") and larger taps on new construction shall use tees.
  - C. Four-inch (4") and larger taps on existing water mains may be tapped with approval from the City.
1. **Tapping saddles shall be a cast-iron or ductile iron mechanical joint tapping sleeve with totally confined end gaskets.**
  2. **Reference the City of Greeley Standard Drawings for tapping sleeve requirements.**
  3. **Acceptable manufacturers and models of four-inch (4") and larger tapping saddles are:**

*TABLE 2.1-C: 4" and Larger Tapping Saddles*

Manufacturer	Model
Mueller	H-615 for centrifugal CI, DI, PVC
Mueller	H-616 for pit cast CI pipe

***Or approved equivalent.***

## 2.2 CORPORATION STOPS

- A. All corporation stops shall conform to AWWA C800 and be capable of operating

at a working pressure of 150 psi.

1. **All corporation stops shall be full opening plug type and constructed of no-lead brass.**
  2. **Corporation stop inlet threads for tapping saddles shall be “cc” type only.**
  3. **All corporation stop outlets shall use a compression connection.**
- B. Corporation stops shall be used for all taps which are two-inch (2”) and smaller.
- C. Tap sizes shall match line sizes, i.e. one-inch (1”) corporation tap with a one-inch (1”) line.
- D. Acceptable manufacturers and models of corporation stops are:

TABLE 2.2-C: Corporation Stops

Manufacturer	Model
Mueller	H-15013
Ford	F1000

***No substitutions allowed.***

## 2.3 SERVICE LINES

- A. Two-inch (2”) and smaller service lines shall be Municipex®, or Uponor and conform to AWWA C800.
1. **Municipex®**
    - a. ***The pipe shall be Municipex® SDR 9 Pipe only, conforming to ASTM F2080***
    - b. ***All connections shall be Municipex® compression only.***
  2. **Uponor**
    - a. ***The pipe shall be Uponor AquaPEX® conforming to ASTM F876***
    - b. ***All connections shall be Uponor ProPEX® compression only.***

- B. Three-inch (3") and larger service lines shall be ductile iron pipe and conform to construction specification *Section 02512, Ductile-Iron Pipe*. Three-inch (3") service lines shall use a four-inch (4") tap/tee and reduce to three-inches (3") immediately after the tap/tee.
- C. Fire service lines shall be a minimum of four-inch (4") diameter and shall be restrained ductile iron pipe and conform to construction specification *Section 02512, Ductile-Iron Pipe*.

## 2.4 COUPLINGS

- A. All couplings shall be compression x compression only.
- B. Acceptable manufacturers and models of couplings are:

**TABLE 2.4-B: Couplings**

Manufacturer	Model
Mueller	H-15433
Ford	C44

***No substitutions allowed.***

## 2.5 CURB STOPS

- A. Curb stops  $\frac{3}{4}$ -inch ( $\frac{3}{4}$ ") inclusive to two-inches (2") shall conform to AWWA C800.

1. **All curb stops shall have FIP x FIP connections at both ends.**
2. **Curb stops shall be plug type, full opening, Minneapolis pattern.**
3. **Acceptable manufacturers and models of one-inch (1") curb stops are:**

**TABLE 2.5-A.3:  $\frac{3}{4}$ " and 1" Curb Stops**

Manufacturer	Model
Mueller	H-10228
Ford	Z11-333 or Z11-444

***No substitutions allowed.***

4. **Acceptable manufacturers and models of 1 ½-inch (1 ½") and two-inch (2") curb stops are:**

**TABLE 2.5-A.4: 1 ½" and 2" Curb Stops**

Manufacturer	Model
Mueller	H-10228

***No substitutions allowed.***

- B. Curb stops three-inches (3") and larger shall be gate valves and conform to construction specification *Section 02515, Water Utility Distribution Valves*.

## 2.6 CURB STOP BOXES

- A. Curb stop boxes are required with all curb stops.
- B. Acceptable manufacturers and models of one-inch (1") curb stop boxes are:

**TABLE 2.6-B: ¾" and 1" Curb Stop Boxes**

Manufacturer	Model
Mueller (1")	H-10300-99002 (6 ft)
Ford	EM2-50-47-42R or EM2-55-46-48R (6 ft)

***Or approved equivalent.***

- C. Acceptable manufacturers and models of 1 ½"-inch (1 ½") and two-inch (2") curb stop boxes are:

**TABLE 2.6-C: 1 ½" and 2" Curb Stop Boxes**

Manufacturer	Model
Mueller	H-10300-99002 (6 ft)
Ford	EM2-50-57 (6 ft)

***Or approved equivalent.***

- D. Curb stop boxes for three-inches (3") and larger shall be in street valve box and conform to construction specification *Section 02515, Water Utility Distribution Valves*.

## 2.7 METERS

- A. All water meters shall be purchased from the Water and Sewer Department. No exceptions.

## 2.8 METER SETTERS

- A. Meter setters to be installed as shown in the City of Greeley Standard Drawings.

- B. All  $\frac{3}{4}$ -inch ( $\frac{3}{4}$ " ) and one-inch (1" ) meter setters shall have a meter stop inlet valve with a lockwing. Note that the lay lengths listed do not account for gasket thickness. The acceptable manufacturers and models of meter setters are:

TABLE 2.8-A:  $\frac{3}{4}$ " and 1" Meter Setters

Meter Size	Setter Manufacturer	Setter Model	Total Lay Length (in)
$\frac{3}{4}$ " x $\frac{3}{4}$ " Meter	Ford	VV-83W-22-33-NL	9 $\frac{3}{8}$ "
$\frac{3}{4}$ " x $\frac{3}{4}$ " Meter	Mueller	H-1489N	9 $\frac{3}{8}$ "
1" Meter	Ford	V84-10W-22-44-NL	11 $\frac{1}{8}$ "
1" Meter	Mueller	H-1489N	11 $\frac{1}{8}$ "

***No substitutions allowed.***

- C. All 1  $\frac{1}{2}$ "-inch (1  $\frac{1}{2}$ " ) and two-inch (2" ) meter setters shall have a meter stop inlet valve with a lockwing, and a built-in locking by-pass. Note that the lay lengths listed do not account for gasket thickness. The acceptable manufacturers and models of meter setters are:

TABLE 2.8-B: 1  $\frac{1}{2}$ " and 2" Meter Setters

Meter Size	Setter Manufacturer	Setter Model	Total Lay Length (in)
1 $\frac{1}{2}$ " Meter	Ford Meter	V76-12B-11-66-NL	13 $\frac{3}{8}$ "
1 $\frac{1}{2}$ " Meter	Mueller	H-1423N	13 $\frac{1}{4}$ "
2" Meter	Ford Meter	V77-12B-11-77-NL	17 $\frac{3}{8}$ "
2" Meter	Mueller	H-1423N	17 $\frac{1}{4}$ "

***No substitutions allowed.***

## 2.9 METER PITS AND VAULTS

- A.  $\frac{3}{4}$ -inch ( $\frac{3}{4}$ " ) meters and one-inch (1" ) meters:
1. **Meter pits shall be twenty inches (20") in diameter and shall be constructed of rigid High Density Polyethylene (HDPE).**
  2. **Meter pit covers shall be constructed of aluminum with cap type top lid and frost-proof rubber inner lids.**
    - a. ***The minimum allowable opening for meter pit covers shall be eleven-inches (11") diameter.***

- b. ***All meter pit covers shall have a 27/32-inch worm-lock with a Standard Waterworks pentagon head.***

B. 1 ½ -inch (1 ½") and two-inch (2") meters:

1. **Meter pits shall be forty-eight inches (48") diameter.**
2. **Meter vaults shall be a pre-cast concrete manhole in accordance with construction specification *Section 03400, Precast Concrete*. All vault openings shall have modular sealing units and be grouted with non-shrink grout between the modular sealing unit and the vault inside and outside wall.**
3. **Meter vault covers shall be a cast iron ring and aluminum manhole cover with a twenty-four-inch (24") diameter opening unless approved otherwise, in writing, by the City Water and Sewer Department. All meter vault covers shall have the word "WATER" cast in the lid.**
4. **Reference City of Greeley Standard Drawings.**

C. Three-inch (3") and larger meters:

1. **Meter vaults shall be a pre-cast concrete in accordance with construction specification *Section 03400, Precast Concrete*.**
2. **All vault openings shall be link-sealed.**
3. **All joints shall be watertight.**
4. **Meter vault covers shall be a cast iron ring and cast iron or aluminum manholes cover with a thirty-six inch (36") diameter opening unless approved otherwise by the City. All potable water meter vault covers shall have the word "WATER" cast in the lid.**
5. **Include gravel sump**
6. **Reference City of Greeley Standard Drawings for vault size and layout.**

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Only those Contractors licensed and bonded with the City of Greeley will be permitted to install water service connections.
- B. The Contractor shall make all taps on new lines, with approved equipment, and install the service line to the curb stop prior to disinfection and pressure testing of the water main.
- C. The Contractor shall adjust meter pits to the horizontal location and to the final grade as determined by grade stakes.
  - 1. **Grade stakes shall be placed a minimum five (5) feet from the location of the meter pit.**
  - 2. **The grade shall be determined from the top of sidewalk elevation to top of building finished floor.**
  - 3. **Grade stakes shall not be disturbed prior to service inspection by the City.**
- D. The Contractor shall mark the location of water services and fire sprinkler lines with a stamped “W” and “F”, respectively, four-inches (4”) high, three-inches (3”) wide into the face of the curb and gutter.

### **3.2 TRENCHING, BACKFILLING, AND COMPACTION**

- A. Reference construction specification *Section 02315, Excavation and Fill*.

### **3.3 TAPS**

- A. Unless prior approval is given by the City, only City personnel shall make service taps on mains which have been accepted by the City. Contractor to bolt everything prior to the City personnel making the service taps.
- B. The Contractor shall not make any taps without permission from the City.
- C. All taps shall be made with a tapping saddle in accordance with these specifications and the manufacturer’s recommendations.
- D. Service taps on mains will be made only under the direct supervision of the City. The Contractor shall give forty-eight (48) hours advance notice to the City before any taps are made.

- E. The City reserves the right to make taps in lieu of the Contractor and the right to deny permission for any main to be tapped.
- F. Tapping equipment shall be of good quality, used for the purpose intended, and used in accordance with the manufacturer's instructions.
- G. Taps shall not be made within two (2) feet of any joint, fitting, or valve.
- H. Taps shall be separated by at least two (2) feet, measured along the pipe length, even when taps are made on opposite sides of the pipe.
- I. Taps shall be made at the 2:00 or 10:00 location on the pipe circumference. Taps that are made on the same side of the pipe and within ten (10) feet of each other, measured along the pipe length shall be staggered by fifteen degrees (15°).

### 3.4 SERVICE LINES

- A. All water service lines and fire sprinkler lines shall be a minimum five (5) feet and a maximum six (6) feet below the final grade unless otherwise approved by the City.

#### 1. Water Service

- a. ***There will be a maximum of one (1) coupling per service, between the main and the curb stop. The coupling shall be used only for repair situations and not for utilizing short pieces of tubing during construction. Couplings shall be compression x compression for services two-inches (2") and smaller.***
- b. ***Service lines shall be uniform in size from the corporation stop to five (5) feet past the meter pit.***
- c. ***The expansion loop shall not be installed higher than the top of the main being tapped. When backfilling the service trench, bedding shall be used under and six-inches (6") above the expansion loop at the service connection to the main.***

#### 2. Fire Service

- a. ***Fire sprinkler services shall be uniform in size from the main to the structure being serviced.***



- b. ***Fire Sprinkler lines shall be a minimum of four-inches (4") in diameter.***
  - c. ***A resilient seat gate valve the same diameter as the fire sprinkler service pipe shall be installed at the main and restrained back to the mainline tee by use of restrained joint pipe or mechanical joint restraint.***
  - d. ***Fires sprinkler lines are not metered.***
- B. A two-inch by four-inch (2" x 4") wood post shall be placed at the end of the service line.
  - 1. **All wooden posts shall extend from the end of the service to a point two (2) feet, minimum, above the ground surface and shall be painted blue.**
  - 2. **Locator balls/rings or adequate steel to be located by a ferrous metal detector should be placed at the end of the service at an adequate depth so it will not be disturbed by grading and construction operations.**
  - 3. **Maintenance of the marker posts shall be the responsibility of the Contractor until the City accepts the project. After acceptance by the City the maintenance of the marker posts shall be the responsibility of the property owner.**
- C. Service trenches shall be subject to compaction specifications. Reference construction specification *Section 02315, Excavation and Fill*.
- D. Where a water service or fire service line crosses another utility or any underground structure, the service shall preferably pass above the other utility or structure.
  - a. ***In no instance shall there be less than eighteen-inches (18") clearance between the water service or fire service line and any other utility or structure.***
  - b. ***The space between the water or fire service line and the other utility or structure shall be backfilled with compacted bedding material or flow-fill concrete.***

### 3.5 CURB STOPS

- A. Reference City of Greeley Standard Drawings for curb stop location.
- B. The Contractor shall adjust the curb stop box to ½-inch (1/2") above final grade prior to final inspections.
- C. Curb stop boxes shall not be placed in driveways or sidewalks.
- D. Curb stop boxes shall be plumb.
- E. Contractor shall demonstrate to the City that curb stops are operable prior to City acceptance.

### 3.6 LANDSCAPE SPRINKLER SYSTEMS

- A. Underground sprinkler systems shall be designed in strict conformance with the City of Greeley Building Inspection guidelines for the installation of underground sprinkling systems and shall receive approval by permit prior to start of construction. The sprinkler system installer shall be responsible for the submittal of a permit application and the scheduling of inspections prior to installation and operation. A copy of the guidelines is available at the City of Greeley Building Inspection Department.
- B. Each irrigation system shall have appropriate backflow protection.
- C. With the exception of single family houses, all sprinkler irrigation systems shall have their own separate irrigation services and meters.

### 3.7 METER PITS AND VAULTS

- A. Meter pits or vaults shall not be installed in any street, parking area, driveway, or sidewalk unless prior written permission is obtained from the Water and Sewer Department. If a meter pit or vault is permitted to be located in any traffic area, the pit/vault shall be required to be designed to withstand HS-20 traffic loading.
- B. There shall be no major landscaping (trees, boulder, shrubs over three (3) feet in mature height, etc.) or structure (retaining wall, etc.) within ten (10) feet of the meter pit or vault. All shrubs less than three (3') feet in mature height shall be located no closer than five (5) feet to a meter pit or vault.
- C. The finished ground around the meter pit or vault shall slope away from the lid at a minimum grade of two percent (2%).
- D. There shall be no plumbing connections inside the meter pit or vault.

- E. All tees, connections, and couplings shall be a minimum five feet (5') from the meter pit or vault wall, and be on the outlet side.
  - 1. **There shall be no tees, connections, or couplings installed between the curb stop and the meter setter or meter horn.**
  - 2. **All pipes coming into any meter vault or pit three-inches (3") or larger shall be flanged pipe only.**
- F. The meter pit or vault shall be adjusted to ½-inch (1/2") above final grade if the surrounding grade is changed.

### 3.8 INSPECTION

- A. The Contractor shall ensure that the curb stop, corporation stop, and any couplings remain exposed until after inspection and the City gives the approval for backfill.
- B. All tap and service inspections shall be scheduled with the City a minimum forty-eight hours (48) prior to desired time of inspection.
- C. The water shall be turned on at the curb stop by the Water and Sewer Department, only after the service line, curb stop, stop box, and meter setter are installed.
- D. Contact the City of Greeley Meter Shop a minimum forty-eight (48) hours prior to requesting final meter pit inspection. Refer to City of Greeley Standard Drawings.
- E. Meter pits and stop boxes shall be at finished grade at time of acceptance of subdivision improvements. If the stop box or meter pit is damaged, bent, or otherwise unacceptable to the City, the builder will be responsible for replacing the damaged stop box or meter pit prior to issuance of a Certificate of Occupancy.

SECTION 02515  
WATER UTILITY DISTRIBUTION VALVES

**PART 1      – GENERAL**

**1.1      SCOPE**

- A.      This section covers water system valves, valve operators, valve boxes, and other valve appurtenances.

**1.2      REFERENCES**

- A.      American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

1.      **B16.1, Grey Iron Pipe Flanges and Flanged Fittings, latest revision.**

- B.      American National Standards Institute/American Water Works Association (ANSI/AWWA)

1.      **C207, Steel Pipe Flanges for Waterworks Service – Size 4 in. through 144 in., latest revision.**

2.      **C500, Metal-Seated Gate Valves for Water Supply Service, latest revision.**

3.      **C508, Swing-Check Valves for Waterworks Service, 2-in. Through 24-in., latest revision.**

4.      **C509, Resilient-Seated Gate Valves for Water Supply Service, latest revision.**

5.      **C512, Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service, latest revision.**

6.      **C550, Protective Interior Coatings for Valves and Hydrants, latest revision.**

- C.      ASTM International (ASTM)

1.      **A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings, latest revision.**

2. **B62, Standard Specification for Composition Bronze or Ounce Metal Castings, latest revision.**

### 1.3 SUMBITAL REQUIREMENTS

- A. Information to be provided should include:
  1. **Valve Manufacture**
  2. **Valve Pressure Rating**
  3. **Valve Construction Materials**
- B. Two (2) sets of Shop Drawings for each valve size and type shall be furnished to the City for acceptance prior to start of construction.

### 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Take precautions so as not to damage materials during delivery or storage.
- B. Store valves off the ground and away from materials that could contaminate water systems.
- C. Take precautions to keep joints and internal parts clean.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. All water distribution valves shall open clockwise (right). (Valves on water transmission lines open counter-clockwise (left)).
- B. All valves shall be the same size as the main unless approved otherwise by the City.
- C. Valves shall be either mechanical or flanged joint as required.
  1. **Exposed locations shall use flanged joints.**
  2. **Buried locations shall use mechanical joints.**
- D. The interior and exterior of all buried valves shall be epoxy coated in accordance with AWWA C550.
- E. All buried valves shall have a two-inch (2") square-operating nut. The manufacturer shall paint all open right operating nuts red.

- F. The operating nut on buried valves shall be between four (4) feet and six (6) feet below the finished grade. If, in order to achieve the operating nut depth, it is necessary to use a riser stem, the riser shall be double pinned. The riser stem shall be a solid stem coated to prevent corrosion.

## 2.2 GATE VALVES

### A. General

1. **Four-inch (4") through twelve-inch (12") diameter gate valves shall be designed for a minimum working pressure of 200 psi and a test pressure of 400 psi. Sixteen-inch (16") diameter gate valves shall be designed for a minimum working pressure of 150 psi and a 300 psi test pressure.**
2. **Sixteen-inch (16") bonnets shall be set vertically.**
3. **Water distribution line gate valves shall be resilient seat gate valves.**

### B. Resilient Seat Gate Valves

1. **Resilient seat gate valves shall be manufactured in accordance with AWWA C509.**
2. **Valve stems shall be non-rising.**
3. **Stem seals shall be provided with two (2) o-ring type stem seals in accordance with AWWA C509.**
4. **Acceptable manufacturers of resilient seat gate valves are:**
  - a. ***Mueller***
  - b. ***Kennedy***
  - c. ***American AVK Company***

## 2.3 VALVE BOXES

- A. Valve boxes shall be cast-iron or ductile iron, buffalo type, two (2) piece boxes with round bases.

1. **Valve boxes shall have a five and ¼-inch (5-¼") screw type**

**shaft suitable for depth of cover as required.**

2. **Valve boxes shall be capable of future adjustment for street overlays.**

B. The word "WATER" shall be cast into the box lid for potable water.

C. Acceptable manufacturers of valve boxes are:

1. **Tyler 6850 series with drop lid**
2. **Or approved equivalent.**

#### **2.4 AIR RELEASE, AIR/VACUUM, AND COMBINATION AIR VALVES**

A. Air Release (AR) valves, Air/Vacuum (A/V) valves, and combination air valves shall be manufactured in accordance with AWWA C512.

B. Air Release and Air/Vacuum Valves

1. **All AR and A/V valves shall be rated a minimum working pressure of 150 psi and a hydrostatic test pressure equal to 150% of the actual rated working pressure of the valve.**
2. **The working parts and seat of the AR and A/V valves shall be brass, stainless steel, or other non-corroding material unless otherwise approved by the City.**

C. Combination air valves shall have features of both the AR and A/V valve.

D. The size of the AR valve, A/V valve, or combination air valve shall be as noted on the approved Construction Drawings.

E. Acceptable manufacturers of Air Release, Air/Vacuum, and Combination Air Valves are:

1. **¾-inch (¾"), one-inch (1"), and two-inch (2") Combination Air Valve – A.R.I. D-040**
2. **Two-inch (2") to ten-inch (10") Combination Air Valve – A.R.I. D060-C HF**
3. **Or approved equivalent.**

## 2.5 SWING CHECK VALVES

- A. All swing check valves shall be manufactured in accordance with AWWA C508.
- B. Swing check valves shall have an epoxy coated interior in accordance with AWWA C550.
- C. Swing check valves shall be ductile-iron, of the resilient-to-coated seat construction, have a resilient hinge arm, and be of the clear waterway design.
- D. The closure assembly shall assume the closed position by gravity under no-flow conditions.
- E. Swing check valves shall be designed for a minimum working pressure of 200 psi and 400 psi test pressure for check valves with diameters of four-inch (4") through twelve-inch (12"). Sixteen-inch (16") diameter check valves shall be designed for a minimum working pressure of 150 psi and 300 psi test pressure.
- F. Acceptable manufacturers of swing check valves are:
  - 1. **Mueller**
  - 2. **American Flow Control**
  - 3. **M & H**
  - 4. **Clow**
  - 5. **Kennedy**
  - 6. **Or approved equivalent.**

## 2.6 PRESSURE REGULATING VALVES

- A. The function of the Pressure Regulating Valve (PRV) is to reduce an existing high pressure to a pre-adjusted lower downstream pressure for varying rates of flow without causing shock of water hammer on the system.
- B. The PRV shall be hydraulically operated with a free floating guided piston having a seat diameter equal to the size of the valve.
- C. Materials and Construction
  - 1. **Flanges and covers shall conform to ASTM A126, Class B.**



2. **The PRV shall be fully bronze-mounted with bronze castings or parts conforming to ASTM B62.**
3. **All PRVs shall be furnished with flanged ends sized and drilled in accordance with ANSI/ASME B16.1, Class 125 specifications.**
  - a. *Flanges shall be machined to a flat face with a finish of 250 micro inches, or machined to a flat surface with a serrated finish in accordance with AWWA C207.*
4. **The PRV shall be purchased from the manufacturer as an assembly and shall include a main valve, pilot valve system which controls operation of the main valve, and other operational components.**
  - a. *The pilot valve shall be a single seated, diaphragm operated, spring loaded type.*
  - b. *The pilot valve shall be attached to the main valve with piping and isolation valves arranged for easy access to make adjustments and for its removal from the main valve while the main valve is under pressure.*
5. **All PRVs shall be rated a minimum working pressure of 150 psi and a hydrostatic test pressure equal to 150% of the actual rated working pressure of the valve.**
6. **Allow sufficient room around the PRV for assembly and to make adjustments and for servicing.**
7. **The standard PRV size is eight-inches (8') unless otherwise approved by the City.**

D. Acceptable manufacturers of pressure regulating valves are:

1. **Cla-Val – 90-01**
2. **Or approved equivalent.**

## PART 3      – EXECUTION

### 3.1      INSPECTION

- A.      Valves and valve boxes shall be examined for cracks, dents, abrasions, and other flaws prior to installation.
- B.      Damaged or flawed valves shall be rejected, marked, and removed from the site.

### 3.2      INSTALLATION

#### A.      Valves

- 1.      **With the exception of tapping valves, flanged valves shall not be buried.**
- 2.      **Valves shall be installed in such a manner that the operating nut is perpendicular to the pipe.**
- 3.      **Buried valves shall be supported on concrete as shown in the City of Greeley Standard Drawings.**

#### B.      Tapping Valves

- 1.      **Tapping valves shall be installed per the manufacturer's recommendation.**
- 2.      **Tapping valves and sleeves are to be hydraulically pressure tested to 150 psi for twenty (20) minutes, with no leakage, prior to proceeding with a wet tap.**
- 3.      **Tapping valves and sleeves shall be equipped with a threaded test hole.**

#### C.      Valve Boxes

- 1.      **All buried valves shall be provided with a valve box, including fire hydrant valves, unless indicated otherwise on the approved Construction Drawings.**
- 2.      **Install the valve box so that no stress is transmitted to the valve.**

3. **Set the valve box plumb and directly over the valve's operating nut. Valve operators that are mounted to one (1) side of the valve shall be located to the south or west of the valve.**
4. **The soil around the valve box shall be carefully compacted around the barrel, with hand equipment, to minimize misalignment and settling of the backfill.**

D. Air Release, Air/Vacuum, and Combination Air Valves

1. **AR, A/V, and combination air valves shall be installed at the locations shown on the Construction Drawings.**
2. **Air relief and vacuum relief valves shall be installed in accordance with City of Greeley Standard Drawings.**

E. Swing Check Valves

1. **Swing check valves shall only be used in four-inch (4") or larger service meter settings and shall be installed downstream of the meter.**
2. **Swing check valves shall be installed in a horizontal, level setting.**
3. **Swing check valves shall be installed in accordance with City of Greeley Standard Drawings.**

F. Pressure Regulating Valves

1. **PRVs shall be installed as shown on the Construction Drawings, per the manufacturer's recommendations, and in accordance with City of Greeley Standard Drawings.**

### 3.3 OPERATION

- A. Prior to requesting water system acceptance, the Contractor shall operate all valves in the presence of City personnel.
- B. Only City personnel shall operate valves that have been accepted by the City.

SECTION 02516  
WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 – GENERAL

**1.1** SCOPE

- A. This section is a minimum guideline for furnishing and installation of dry-barrel fire hydrants.

**1.2** REFERENCES

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1. **C502, Dry-Barrel Fire Hydrants, latest revision.**

**1.3** PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Fire hydrants shall be handled, stored, and protected in such a manner as to prevent damage to materials, coatings, and finishes.
- B. All fittings and joints shall be kept free from dirt, oil, and grease.

PART 2 – PRODUCTS

**2.1** FIRE HYDRANTS

- A. All fire hydrants shall be purchased from the City of Greeley Water and Sewer Department. No exceptions.
  - 1. **Requests for fire hydrants shall be made a minimum two (2) weeks prior to requested hydrant pickup date.**
  - 2. **A twenty-four (24) hour notice, with number of requested hydrants, shall be given to the Water and Sewer Department prior to Contractor picking up the fire hydrants.**
  - 3. **Fire hydrants may be picked up on normal business days between 7:30 a.m. and 8:30 a.m.**
- B. Fire hydrants purchased from the City shall be of the following, approved manufacturer:
  - 1. **Kennedy Valve, Guardian K-81D**

2. **City approved equal**

C. Specifications for fire hydrants purchased from the City are as follows:

1. **Type and Size of Hydrant**

- a. ***Dry-barrel type manufactured in accordance with AWWA C502.***
- b. ***Main valve opening size – 5 ¼-inch (5 ¼")***
- c. ***Three-way type with one (1) pumper nozzle and two (2) hose nozzles all located on the same horizontal plan.***

2. **Design and Testing**

- a. ***Minimum rated working pressure – 150 psi.***
- b. ***Minimum factory test pressure for assembled hydrants – 300 psi in both the open and closed positions.***
- c. ***Under test conditions, leakage through drain valve not to exceed five (5) fluid ounces (fl. oz.) per minute. No leakage allowed through the castings, main valve, joints, or stem packing.***

3. **Pumper Nozzle**

- a. ***Size – 4 ½-inch (4 ½") in diameter.***
- b. ***Threads – left handed, six (6) threads per inch (1"), National Standard threads.***

4. **Hose Nozzle**

- a. ***Size – 2 ½-inch (2 ½") in diameter.***
- b. ***Threads – left-handed, National Standard threads.***

5. **Nozzle Cap**

- a. ***Contains a synthetic rubber gasket installed in a retaining groove.***

- b. *Dimensions and shape of the nozzle cap nut are the same as the operating shaft nut.*
- c. *Attached to the hydrant with non-kinking type steel chains.*

6. **Operating Nut and Shaft**

- a. *Nut material – bronze.*
- b. *Nut shape – pentagon and tapered.*
- c. *Nut size – 1 5/16-inch (1 5/16") from point to flat base of the nut; 1 ¼-inch (1 ¼") at the top.*
- d. *Nut height – not less than 1-inch (1").*
- e. *Nut operation – Right turn (clockwise direction). An arrow on top of hydrant bonnet designates the direction of opening.*
- f. *Hydrants contain an oil reservoir that provides permanent lubrication of the operating nut threads.*
- g. *"O" rings protect operating mechanism from the waterway.*

7. **Barrel**

- a. *Component connections – bolted flange type*
- b. *Ground line connection – manufactured to allow positioning of the top section at increments not greater than fifteen degrees (15°).*

8. **Hydrant Base (Shoe)**

- a. *Four (4) mil minimum, epoxy lined, including lower valve (plant) and retainer.*
- b. *Inlet provided with a mechanical joint to accommodate six-inch (6") diameter DIP.*

9. **Drain Valve/Opening – One (1) or more provided.**

10. **Traffic Features – breakaway traffic flange.**

11. **Color – Orange**
12. **Certification – An affidavit of compliance shall be provided to the City of Greeley Water and Sewer Department from the hydrant manufacturer stating that all fire hydrant standard and supplemental specifications have been met.**

## 2.2 EXTENSIONS

- A. All fire hydrants extensions shall be purchased from the City of Greeley Water and Sewer Department. No exceptions.
  1. **Requests for fire hydrant extensions shall be made a minimum two (2) weeks prior to requested hydrant extension pickup date.**
  2. **A twenty-four (24) hour notice, with number of requested hydrant extensions, shall be given to the Water and Sewer Department prior to Contractor picking up the fire hydrant extensions.**
  3. **Fire hydrant extensions may be picked up on normal business days between 7:30 a.m. and 8:30 a.m.**
- B. No more than one (1) six-inch (6”) or one (1) twelve-inch (12”) hydrant extension section may be used.
- C. The extension manufacturer shall be the same as the fire hydrant manufacturer.
  1. **Kennedy Valve, K-8150**
- D. For extensions greater than twelve-inches (12”), a grade adjustment fitting shall be used. Acceptable manufacturers are:
  1. **Assured Flow Sales, Inc. - GRADELOK™**
  2. **Or approved equivalent.**
- E. Extension sections must be available to allow the fire hydrant to be raised to a new grade without shutting off the water.

## 2.3 FIRE HYDRANT LATERAL – PIPE AND MAIN CONNECTION

- A. Fire hydrant lateral piping shall be restrained DIP or PVC. Pipe shall be restrained by either restrained joint pipe or mechanical joint restraints.
- B. The hydrant tee on the potable water main line shall be a swivel tee. Tapping sleeves are acceptable when connecting to an existing potable water distribution main.
- C. Reference construction specification *Section 02512, Ductile-Iron Pipe* and *Section 02513 Potable Polyvinyl Chloride (PVC) Pressure Pipe*.

## 2.4 FIRE HYDRANT LATERAL – MAIN VALVE

- A. The main valve on the fire hydrant lateral shall be a six-inch (6”), resilient seat gate valve located at the main.
- B. The valve shall be provided with a H-20 traffic rated valve box.
- C. Reference construction specification *Section 02515, Water Utility Distribution Valves* for valve installation.

## 2.5 DRAIN GRAVEL

- A. Fire hydrant drain gravel shall be 1 ½-inch (1 ½”) washed rock.

# PART 3 - EXECUTION

## 3.1 INSPECTION

- A. Examine fire hydrants and all appurtenances, including valves and piping, for cracks, dents, abrasions, and other flaws.
- B. Mark defective pipe and fittings and store on site at a separate location from work until after City acceptance at which time it shall be removed from the site.

## 3.2 PREPARATION

- A. For trenching, backfilling, and compaction, reference construction specification *Section 02315, Excavation and Fill*.
- B. Reference construction specification *Section 02512, Ductile-Iron Pipe* for pipe installation preparation.



### 3.3 INSTALLATION

- A. All fire hydrants shall stand plumb and be installed in accordance with City of Greeley Standard Drawings.
- B. The minimum depth of bury shall be five feet six-inches (5'-6") and the maximum depth of bury shall be six (6) feet for restrained DIP fire hydrant laterals.
- C. All fire hydrants shall be connected to the potable water distribution main by a six-inch (6") restrained DIP lateral line. A six-inch (6") main valve shall be installed in the lateral line and be restrained back to the main line tee by use of restrained joint pipe or mechanical joint restraints.
- D. All fire hydrants shall be supported on a minimum of one (1) cubic yard of compacted drain gravel with a concrete thrust block.
  - 1. **The concrete thrust block, with a minimum bearing area of 4.5 square feet (sq. ft.), shall be placed behind the hydrant base (shoe) against undisturbed soil.**
  - 2. **A sheet of eight (8) mil polyethylene film shall be placed between the hydrant base (shoe) and concrete thrust block, and the barrel shall be polywrapped up to final ground line.**
  - 3. **After the concrete thrust block is poured and has ample time to cure, drain gravel shall be placed a minimum six-inches (6") above the lower buried flange per City of Greeley Standard Drawings. The concrete thrust block shall cure enough so that the drain gravel will not penetrate the concrete.**
  - 4. **Cover the gravel drain pit with polyethylene film or a City approved felt material.**
- E. Keep hydrant drain holes free of obstructions.
- F. Fire hydrants that are placed in pavement areas, shall maintain twelve-inches (12") of horizontal clearance between the concrete and the hydrant barrel. The twelve-inch (12") space between the concrete and the barrel shall be filled with drain gravel.

- G. After fire hydrant installation is complete, the oil reservoir shall be checked to ensure that it is full. If it is necessary to fill the reservoir, it shall be filled with the oil that is specified by the hydrant manufacturer.

### 3.4 LOCATION

- A. All hydrants shall be field staked for both vertical and horizontal location.

- B. Vertical

1. **The vertical distance from any finished surface to the centerline of the pumper nozzle shall not be less than eighteen-inches (18") or greater than twenty-one-inches (21")**
2. **If a hydrant is raised, no more than one (1) six-inch (6") or one (1) twelve-inch (12") extension section may be used. If the extension is greater than twelve-inches (12"), a grade adjustment extension fitting shall be used.**
3. **Extensions shall be installed per manufacturer's recommendations.**

- C. Horizontal

1. **Fire hydrants shall be located at least one (1) foot outside of the property line and shall conform to one of the following conditions:**
2. **When placed behind the curb when no sidewalk is to be installed, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than twenty-four inches (24") or more than thirty-inches (30") horizontal distance from the gutter face of the curb.**
3. **When placed in a landscaped area between the curb and the sidewalk or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within six-inches (6") of the sidewalk or greater than eighteen-inches (18") from the sidewalk.**

4. **A three (3) foot radius in all directions of the hydrant shall be clear of obstructions, which shall include, but is not limited to, posts, fencing, vehicles, trash, storage, shrubs, trees, or other plants with mature growth greater than one (1) foot in height.**

### 3.5 OPERATION

- A. Only City personnel shall operate fire hydrants and associated valves that have been accepted by the City unless written permission from the Water and Sewer Department is obtained. If written permission is received, an approved backflow prevention device and water meter shall be installed on the hydrant per City of Greeley Water and Sewer Department requirements.

SECTION 02530  
SANITARY UTILITY SEWERAGE PIPING

**PART 1 – GENERAL**

**1.1 SCOPE**

- A. This section addresses the installation of sanitary sewer collection mains and includes the acceptable products, materials, and construction practices that may be used in the installation of sanitary sewer collection systems.

**1.2 SUBMITTALS**

- A. Shop Fabricated Piping:
1. **Pipe Manufacturer.**
  2. **Pipe Size.**
  3. **Pipe Dimensions.**
  4. **Pipe Class / Pressure Rating.**
  5. **Color (For PVC).**
  6. **Manufacturer's Recommended Joint Deflection.**
  7. **Recommended Maximum Safe Pull Force (For Fusible PVC).**
  8. **Fusion Technician qualifications indicating conformance with specification *Section 02533, Polyvinyl Chloride (PVC) Non-Pressure Pipe* (For Fusible PVC).**
  9. **Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, and other pertinent information.**
  10. **Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.**
- B. Dissimilar Buried Pipe Joints: Joint types and assembly drawings.
- C. Pipe Corrosion Protection: Product data.

### 1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Pipe shall be handled and stored per manufacturer's recommendations.
- B. Handling
  - 1. **Use wide fabric choker slings when lifting pipe.**
  - 2. **Do not drop pipe or fittings including dropping on cushions.**
  - 3. **Do not use hooks or bare cable.**
  - 4. **Polyvinyl chloride pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling and installing PVC pipe during cold weather. Do not install pipe when temperature is below 40 degrees F.**
  - 5. **Care must be taken to prevent damage to the pipe and fittings and coating and lining (when applicable) by impact, bending, compression, or abrasion. If damage does occur due to manufacturers handling recommendations not being followed, Contractor is to replace the damaged piece(s) at no cost to the City.**
- C. Storage
  - 1. **Store and use pipe lubricants in a manner which will avoid contamination.**
  - 2. **Pipe, gaskets, and all other installation materials shall be stored in accordance with the manufacturer's specifications.**
  - 3. **Pipe shall be stored on a surface that provides even support for the pipe barrel. Pipe shall not be stored in such a way as to be supported by the bell.**
  - 4. **Cold Weather Storage: Locate products to prevent coating from freezing to ground.**
- D. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material.

- E. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of a day's work or for extended periods at inspectors discretion.
- F. Do not allow debris, tools, clothing or other materials to enter the pipe. Precautions shall be taken to protect the interior of pipes against contamination.
- G. Use effective measures to prevent uplifting or floating of the pipeline prior to completion of backfilling operations.
- H. Protect pipe and appurtenances against dropping and damage. Damaged pipe and appurtenances that are rejected shall be marked and removed from the site.
- I. Do not install pipe when the trench contains water. Water that is encountered in the trench shall be removed to the extent necessary to provide a firm subgrade and to prevent the entrance of water into the pipeline.
  - 1. **Surface runoff shall be diverted as necessary to keep excavations and trenches free from water during construction.**
  - 2. **The excavation or trench shall be kept free from water until the structure and/or pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.**
  - 3. **The installed pipe shall not be used to dewater the trench.**

## **PART 2 – PRODUCTS**

### **2.1 MANHOLES**

- A. Reference construction specification *Section 02535, Sanitary Utility Sewerage Manholes, Frames, and Covers.*

### **2.2 PIPE**

- A. Reference construction specification *Section 02533, Polyvinyl Chloride (PVC) Non-Pressure Pipe.*

### **2.3 SANITARY SEWER SERVICE LINES**

- A. Reference construction specification *Section 02534, Sanitary Sewer Service Lines.*

## 2.4 UNDERDRAINS

- A. Reference construction specification *Section 02622, Pipe Underdrains*.

## **PART 3—EXECUTION**

### 3.1 GENERAL

- A. All piping shall be supplied by one manufacturer.
- B. All materials used in the construction of gravity sanitary sewer collection systems shall be new.
- C. Construction Staking
  - 1. **Reference construction specification *Section 02315, Excavation and Fill*.**
  - 2. **Horizontal alignment shall remain uniform between consecutive manholes and shall not deviate from the City accepted Construction Drawings by more 2-inch.**
  - 3. **Vertical alignment shall remain uniform between consecutive manholes and shall not deviate from the City accepted Construction Drawings by more than ¼-inch, as measured from the pipe invert.**
  - 4. **Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.**

### 3.2 INSPECTION

- A. Pipe barrel and manholes shall be free of dirt or other foreign objects prior to installation.
- B. Pipe and manholes shall be inspected for cracks, dents, abrasions, or other flaws prior to installation.
- C. Damaged or flawed pipe or manholes shall be rejected, marked, and removed from the site.
- D. Operational Inspection: At the completion of the project, in the presence of the City, and as required by the City, the Contractor shall open all manholes and lamp all lines to ensure that no debris is left in the lines/manholes and the lines are not plugged.

### 3.3 PREPARATION

- A. Trenching, Backfilling, and Compaction.

**Reference construction specification *Section 02315, Excavation and Fill.***

- B. Existing Utilities

1. **The horizontal and vertical location of existing utilities shall be field verified prior to start of construction.**
2. **Contractor to protect all existing utilities and all damaged item shall be repaired or replaced to the satisfaction of the City at the Contractor's expense.**
3. **Any deviation from what is shown on the approved Construction Drawings shall be reported to the City immediately for approval and documented on the As-Constructed Record Drawings.**

- C. Underdrains

1. **If underdrain installation is required, underdrains shall be completely installed by the Contractor and accepted by the City prior to any pipe or manhole installation for the sanitary sewer collection system.**

### 3.4 CONNECTIONS TO EXISTING SYSTEM

- A. Connections to the City's existing sanitary sewer collection system shall be made at an existing manhole or by setting a new manhole on the existing line. A watertight plug shall be installed in the new line to prevent any material from entering the existing system until the City accepts the new system.
- B. At locations where a connection to an existing sanitary sewer collection main is to be made, the Contractor shall locate the existing main both vertically and horizontally and verify its exact size and material prior to start of construction. Report the information to the City immediately for confirmation of the design.
- C. The Water and Sewer Department personnel will examine the existing pipe or manhole. Any necessary adjustments in line, grade, or connection requirements to accomplish the connection shall be reviewed and accepted by the City prior to



making the connection.

### 3.5 PIPE INSTALLATION

- A. The only acceptable methods for laying sanitary sewer lines shall be with a laser.
- B. Pipe Laying
  - 1. **Pipe shall be installed per manufacturer's recommendations.**
  - 2. **Pipe installation shall begin at the lowest elevation and proceed upstream to the highest, unless prior written approval is obtained from the Water and Sewer Department.**
    - a. *Pipe shall be installed so that the bells are pointing uphill.*
    - b. *Lay pipe true to line and grade.*
  - 3. **Take effective measures to prevent opening of joints during bedding and backfilling operations.**
  - 4. **Complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade as each length of pipe is placed in the trench. Make adjustments in line and grade by scraping away or filling pipe bedding under the entire length of the pipe, except at bells, and not by wedging, blocking, or mounding up the pipe or bells.**
  - 5. **Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints.**
    - a. *Do not disturb the pipe after the jointing has been completed.*
    - b. *Do not use mechanical compacting equipment in the zone above the horizontal centerline of the pipe and below a plane one (1) foot above the top of the pipe.*
  - 6. **Do not walk on pipe or otherwise disturb pipe after the jointing has been completed.**
  - 7. **PVC piping placement:**

- a. ***Do not lay pipe when temperature is below 40 degrees F, or above 90 degrees F when exposed to direct sunlight.***
- b. ***Shield ends to be joined from direct sunlight prior to and during the laying operation.***

C. Sewer Crossing

- 1. **Where sanitary sewer lines cross beneath potable water lines with less than eighteen-inches (18") clearance, sanitary sewer lines cross above potable water lines, or the ten (10) feet horizontal clearance between potable water lines and sanitary sewer lines cannot be maintained, pipe encasement shall be provided in accordance with construction specification *Section 02445, Casing Pipe – Borings and Encasements*.**

3.6 MANHOLE INSTALLATION

- A. Reference construction specification *Section 02535, Sanitary Utility Sewerage Manholes, Frames, and Covers*.
- B. Manholes shall be installed at the location and to the elevation shown on the approved Construction Drawings or as approved by the Water and Sewer Department to accommodate field conditions.
- C. Measurements of the actual location and elevation of sanitary sewer inverts and rim shall be made for the As-Constructed Record Drawings.

3.7 SANITARY SEWER SERVICE CONNECTIONS

- A. Reference construction specification *Section 02534, Sanitary Sewer Service Lines*.

3.8 FIELD QUALITY CONTROL

- A. Pipe Deflection Tests
  - 1. **Refer to construction specification *Section 01715, Sewer and Manhole Testing*.**
- B. Pipe Leakage Tests
  - 1. **Refer to construction specification *Section 01715, Sewer and Manhole Testing*.**

C. Soil Compaction

2. Reference construction specification *Section 02315, Excavation and Fill*.

SECTION 02533  
POLYVINYL CHLORIDE (PVC) NON-PRESSURE PIPE

**PART 7 – GENERAL**

**7.1 SCOPE**

- A. This section is a minimum guideline for furnishing and the installation of polyvinyl chloride (PVC) pipe and fittings for lines without hydraulic pressure.
- B. Pipe shall be furnished complete with all fittings, specials, and other accessories.
- C. Refer to specification *Section 02530 Sanitary Utility Sewerage Piping*, for additional requirements.

**7.2 REFERENCES**

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1. **C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In (100 mm Through 1,500 mm), latest revision.**
- B. ASTM International (ASTM)
  - 1. **D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds, latest revision.**
  - 2. **D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, latest revision.**
  - 3. **D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals, latest revision.**
  - 4. **D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals, latest revision.**
  - 5. **F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe, latest revision.**

**PART 8 – PRODUCTS**

**8.1 POLYVINYL CHLORIDE (PVC) PIPE - GASKETED**

- A. All PVC pipe shall be manufactured from components which conform to ASTM D1784.
- B. All four-inch (4") through fifteen-inch (15") PVC non-pressure sewer pipe and all fittings shall be manufactured in accordance with ASTM D3034.
- C. The standard dimension ratio (SDR) of PVC non-pressure sewer pipe shall not exceed 35.
- D. The maximum pipe length shall be twenty (20) feet and no shorter than twelve feet, six inches (12'-6"), except at service tees and closure pieces.

## 8.2 POLYVINYL CHLORIDE (PVC) PIPE – SLIP JOINT

- A. General.
  - 1. **This specification shall cover slip joint PVC pipes in 6-inch (6") through 24-inch (24") nominal diameters with cast iron equivalent outside diameters.**
  - 2. **All PVC pipe shall be manufactured in accordance with AWWA C900.**
  - 3. **Pipe shall be green in color.**
- B. Pipe joints shall be made using an integral bell with elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.
- C. All sizes of pipe under these specifications shall be pressure class as shown on the City accepted Constructed Drawings. Pressure Class 235 (DR-18) shall be the minimum pipe class accepted.
- D. Each length of pipe shall be a standard laying length of twenty (20) feet. Random lengths are not acceptable.
- E. Polyvinyl chlorine (PVC) pipe materials shall be made from Class 12454A of 12454B virgin compounds as defined in ASTM D1784. All compounds shall qualify for a rating of 4000 psi for water at 73.4°F (23°C) per the requirements of Plastic Pipe Institute (PPI), *TR-3*, and complies with the National Sanitation Foundation Standard, *No. 61*, for water service.
- F. Elastomeric gaskets shall conform to ASTM F477.
- G. If bury depth is shallower than four (4) feet, pipe shall be manufactured in

accordance with AWWA C900 or city approved equal.

1. **Bedding design is to be submitted per manufacturers requirements.**

### 8.3 POLYVINYL CHLORIDE (PVC) PIPE – FUSED

#### A. General.

1. **This specification shall cover slip joint PVC pipes in 6-inch (6”) through 24-inch (24”) nominal diameters with cast iron equivalent outside diameters.**
2. **All PVC pipe shall be manufactured in accordance with AWWA C900.**
3. **Pipe shall be green in color.**

B. All sizes of pipe under these specifications shall be pressure class as shown on the City accepted Constructed Drawings. Pressure Class 235 (DR-18) shall be the minimum pipe class accepted.

C. Each length of pipe shall be a standard laying length of twenty (20) feet or more. Random lengths are not acceptable

D. Polyvinyl chlorine (PVC) pipe materials shall be made from Class 12454A of 12454B virgin compounds as defined in ASTM D1784. All compounds shall qualify for a rating of 4000 psi for water at 73.4°F (23°C) per the requirements of Plastic Pipe Institute (PPI), *TR-3*, and complies with the National Sanitation Foundation Standard, *No. 61*, for water service.

#### E. Fusion Technician

1. **Fusion Technician shall be fully qualified by the pipe supplier to install Fusible PVC of the type(s) and size(s) being used. Qualifications shall be current as of the actual date of fusion performance on the project.**

#### F. Fusion Joints

1. **Unless otherwise specified, fusible PVC pipe lengths shall be assembled in the field with butt-fused joints. Contractor shall follow the pipe suppliers written guidelines for this**

**procedure. All Fusion joints shall be completed as described in these specifications.**

#### 8.4 JOINTS

- A. For pipe manufactured in accordance with ASTM D3034 joints shall be of the push-on bell and spigot type, and shall be manufactured in accordance with ASTM D3212.
- B. For pipe manufactured in accordance with AWWA C900 joints shall be of the push-on bell and spigot type, and shall be manufactured in accordance with ASTM D3139.
- C. All gaskets shall be of an o-ring type in accordance with ASTM F477.
- D. All bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket, which is positively retained.
- E. Only lubricant that is specified by the pipe manufacturer shall be used.
- F. Solvent cement joints are strictly prohibited.

### **PART 9 - EXECUTION**

#### 9.1 INSPECTION

- A. In addition to any deficiencies covered by ASTM D3034 and AWWA C900, PVC pipe which has any of the following visual defects will not be accepted:
  - 1. **Straight pipe, measured from the concave side, shall not deviate from straight greater than 1/16-inch per foot of pipe length.**
  - 2. **Pipe which is sufficiently out-of-round to prohibit proper joining or be able to pass a mandrel test.**
  - 3. **Improperly formed bell and spigot ends.**
  - 4. **Fractured, cracked, chipped, dented, abrasions, or otherwise damaged pipe.**
  - 5. **Pipe that has been damaged during shipment or handling. Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in material of**

**the completed pipeline.**

- B. Damaged or flawed pipe shall be rejected, marked, and removed from the site.

## 9.2 PREPARATION

- A. Reference construction specifications *Section 02315, Excavation and Fill*.

- B. Cutting Pipe

1. **Cut pipe smooth, straight and at right angles to the pipe axis with saws or pipe cutters designed specifically for the material.**
2. **Remove burrs and wipe off all dust from the jointing surfaces.**
3. **Bevel the cut end in accordance with manufacturer's recommendation.**
4. **Do not disturb previously installed joints during cutting operations.**

- C. Joints

1. **Dirt, oil, grit, and other foreign matter shall be removed from the inside of the bell and the outside of the spigot.**
2. **A thin film of pipe lubricant shall be applied to the inside surface of the gasket and the spigot end of the pipe, per the manufacturer's recommendation.**
3. **The lubricated joint surface shall be kept clean until joined.**

## 9.3 INSTALLATION

- A. Sanitary sewer pipe construction shall be done in accordance with these specification section, City of Greeley accepted Construction Drawings and construction specifications *Section 02530, Sanitary Utility Sewerage Piping* and *Section 02315, Excavation and Fill*.
- B. No sanitary sewer pipe may be covered or backfilled until inspection of pipe and bedding has been made or City Inspector has given approval.
- C. Joints



1. **The pipe shall be joined to the tolerances recommended by the manufacturer (i.e. home line).**
2. **Stabbing of the pipe is not allowed.**
3. **Previously completed joints shall not be disturbed during the jointing operation.**
4. **All joints shall be watertight and free from leaks.**
5. **Test all pipe under concrete and asphalt construction prior to placing concrete or asphalt.**
6. **Support and block pipe as necessary to prevent flotation in high groundwater.**

#### **9.4** FUSION PROCESS

##### **A. General**

1. **Fusible PVC pipe to handled in a safe and non-destructive manner before, during and after the fusion process and in accordance with this specification and the pipe's supplier's guidelines**
2. **Fusible PVC pipe will be fused by a qualified fusion technician, as documented by the pipe supplier**
3. **Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine**
4. **Only appropriately sized and outfitted fusion machines that have been approved by the pipe manufacture shall be used in the fusion process. Fusion machines must incorporate the following elements:**
  - a. ***Heat Plate – Heat plates shall be good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of***

***maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.***

- b. ***Carriage – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.***
- c. ***General Machine – Overview of machine body shall yield to obvious defects, missing parts, or potential safety issues during fusion.***
- d. ***Data Logging Device – An approved data logging device with current version of pipe suppliers recommendation and compatible software shall be used. Datalogging device operation and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110 V power source shall be available to extend battery life.***

5. **Other equipment specifically required for the fusion process shall include the following:**

- a. ***Pipe rollers shall be used for support of the pipe to either side of the machine***
- b. ***A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and / or windy weather, per the pipe suppliers recommendations***
- c. ***An infrared (IR) pyrometer for checking pipe and heat plate temperatures.***
- d. ***Fusing machine operations and maintenance manual shall be kept with the fusion machine at all times.***
- e. ***Face blades specifically designed for cutting fusible PVC pipe shall be used.***

B. Joint Recording

1. **Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe. The software shall register and / or record the parameters required by the supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.**

9.5 FUSION PIPE INSTALLATION

A. General Installation

1. **Installation guidelines from the pipe supplier shall be followed for all installations.**
2. **The fusible PVC pipe will be installed in a manner so as not to exceed the recommended bending radius.**
3. **Where fusible PVC pipe is installed by pulling in tension, the recommended Safe Pulling Forces established by the pipe supplier shall not be exceeded.**

B. Connections to Existing and New Piping Systems

1. **Approximate locations for existing piping systems are shown in the construction documents. Prior to making connection into existing piping systems, the contractor shall:**
  - a. ***Field verify locations, size, piping material, and piping system of the existing pipe.***
  - b. ***Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or other as shown in the construction documents.***
  - c. ***Allow all piping that has been installed to relax for a period of 24 hours or longer before making final connections.***

- d. ***Have installed all temporary pumps and / or pipes in accordance with the established connection plans.***
    2. **Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.**
  - C. Cutting the pipe.
    1. **Cut pipe smooth, straight and at right angles to the pipe axis with saws or pipe cutters designed specifically for the material.**
    2. **Remove burrs and wipe off all dust from the jointing surfaces.**
    3. **Bevel the cut end in accordance with manufacturer's recommendation.**
    4. **Do not disturb previously installed joints during cutting operations.**
  - D. Field joints.
    1. **Use push-on joints for buried pipe except where indicated otherwise on the Construction Drawings.**
    2. **Dirt, oil, grit, and other foreign matter shall be removed from the inside of the bell and the outside of the spigot.**
    3. **A thin film of lubricant shall be applied to the inside surface of the gasket and the spigot end of the pipe, per the manufacturer's recommendation.**
    4. **The lubricated joint surface shall be kept clean until joined.**
  - E. Bending
    1. **Bending of pipe can be up to 75% of manufacturers recommendation.**

## **9.6** FIELD QUALITY CONTROL

- A. Refer to construction specification *Section 02530, Sanitary Utility Sewerage Piping*.

SECTION 02535  
SANITARY UTILITY SEWERAGE MANHOLES, FRAMES, AND COVERS

**PART 10**      – GENERAL

**10.1**    SCOPE

- A.    This section addresses sanitary sewer manholes and includes the acceptable products, materials, and construction practices to be used in the construction and installation of manholes.
- B.    Manholes shall be furnished with all accessories, including base, cone section, gaskets, and ring and cover.

**10.2**    REFERENCES

- A.    American Concrete Institute (ACI)
  - 1.    **350-06, Code Requirements for Environmental Engineering Concrete Structures & Commentary**, latest revision.
  - 2.    **440.1R-15, Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars**, latest revision.
  - 3.    **548.6R-96, Polymer Concrete-Structural Applications State-of-the-Art Report**, latest revision
- B.    ASTM International (ASTM)
  - 1.    **A48, Standard Specification for Gray Iron Castings**, latest revision.
  - 2.    **A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement**, latest revision.
  - 3.    **A996, Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement**, latest revision.
  - 4.    **A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete**, latest revision.

5. ***B108, Standard Specification for Aluminum-Alloy Permanent Mold Castings, latest revision.***
6. ***B179, Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Castings Processes, latest revision.***
7. ***C33, Standard Specification for Concrete Aggregates, latest revision.***
8. ***C144, Standard Specification for Aggregate for Masonry Mortar, latest revision.***
9. ***C150, Standard Specification for Portland Cement, latest revision.***
10. ***C207, Standard Specification for Hydrated Lime for Masonry Purposes, latest revision.***
11. ***C443, Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets, latest revision.***
12. ***C478, Standard Specification for Circular Precast Reinforcement Concrete Manhole Sections, latest revision.***
13. ***C497, Standard Test Method for Concrete Pipe, Manhole Sections, or Tile, latest revision.***
14. ***C579, Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic, Surfacing, and Polymer Concretes, latest revision.***
15. ***C580, Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes, latest revision.***
16. ***C857, Standard Practice for Minimum Structural Design Loading for Underground Utility Structures, latest revision.***

17. ***C923, Standard Specifications for Resilient Connectors between Concrete Manholes Structures and Pipe, latest revision.***
18. ***C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants, latest revision.***
19. ***D648, Test Method for Deflection Temperature of Plastics Under Flexural Load in Edgewise Position, latest revision.***
20. ***D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable, latest revision.***
21. ***D 2584, Test Method for Ignition Loss of Cured Reinforced Resins, latest revision.***
22. ***D4101, Standard Specification for Polypropylene Injection and Extrusion Materials, latest revision.***
23. ***D4976, Standard Specification for Polyethylene Plastics Molding and Extrusion Materials, latest revision.***
24. ***D6783, Standard Specification for Polymer Concrete Pipe, latest revision.***

### **10.3 SUBMITTAL REQUIREMENTS**

- A. Conform to bid document requirements
- B. Submit manufacturer's data and details of following items for approval:
  1. **Shop drawings of manhole sections, base units and construction details, jointing methods, materials, and dimensions**
  2. **Summary of criteria used in manhole design including, as minimum, material properties, loading criteria, and dimensions assumed. Include certification from manufacturer that polymer concrete manhole design meets or exceeds the**



**load and strength requirements of ASTM C478 and ASTM C857, reinforced in accordance with ACI 440.1R-15.**

3. **Frames, grates, rings, and covers**
  4. **Materials to be used in fabricating pipe drop connections**
  5. **Materials to be used for pipe connections**
  6. **Materials to be used for stubs and stub plugs, if required**
- C. Submitted sealed drawings by a registered Professional Engineer in the State of Colorado

#### **10.4** PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Manholes shall be delivered, handled, stored, and protected in such a manner as to prevent damage to materials. Rubber gaskets shall be stored in a clean area away from grease, oil, ozone producing electric motors, heat and direct rays of the sun.
- B. All joint surfaces shall be free from dirt, oil, and grease at the time of installation.

### **PART 11** **– PRODUCTS**

#### **11.1** GENERAL

- A. AASHTO HS-20 design or as required loading applied to manhole cover and transition and base slabs

#### **11.2** PRECAST CONCRETE MANHOLES

- A. Precast manhole bases, barrels, and cone sections shall be manufactured in accordance with ASTM C478, and shall be made with Type I/II cement. All cone sections shall be the eccentric type with the exception of shallow (flat top) manholes
- B. Concrete and Reinforcing Materials
1. **All reinforcing materials shall conform to ASTM A1064, ASTM A615, and ASTM A996.**
  2. **Reference construction specifications *Section 03400, Precast Concrete*.**

### 11.3 POLYMER CONCRETE MANHOLES

- A. Provide polymer concrete manhole sections, monolithic base sections and related components referencing to ASTM C 478. ASTM C 478 material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product
- B. Provide base riser section with monolithic floors, unless shown otherwise
- C. Provide riser sections joined with bell and spigot / ship-lap design seamed with butyl mastic and or rubber gaskets (ASTM C990) so that on assembly, manhole base, riser and top section make a continuous and uniform manhole structure
- D. Construct riser sections for polymer concrete manholes from standard polymer concrete manhole sections of the diameter indicated on drawings. Use various lengths of polymer concrete manhole sections in combination to provide correct height with the fewest joints
- E. Design wall sections for depth and loading conditions with wall thickness as designed by polymer concrete manufacturer
- F. Provide tops to support AASHTO HS-20 loading or loads as required and receiving cast iron frame covers or hatches, as indicated on drawings
- G. Acceptable manufactures:
  - 1. **Armorock LLC**
  - 2. **Or approved equivalent.**

### 11.4 POLYMER MANHOLE DESIGN CRITERIA

- A. Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet the intent of ASTM C 478 with allowable compositional and sizing differences as designed by the polymer concrete manufacturer.
  - 1. **AASHTO HS-20 design or as required loading applied to manhole cover and transition and base slabs**
  - 2. **Polymer manholes will be designed based upon live and dead load criteria in ASTM C 857 and ACI 350-06**
  - 3. **Unit soil weight of 120 pcf located above portions of manhole, including base slab projections**

4. **Internal liquid pressure based on unit weight of 63 pcf**
5. **Dead load of manhole sections fully supported by polymer concrete manhole base**

#### **11.5 POLYMER MANHOLE DESIGN**

1. **Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet loading requirements of ASTM C 478, ASTM C 857 and ACI 350-06 as modified for polymer concrete manhole design as follows:**
2. **Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment**
3. **Reinforcement – Shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design**
4. **The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer's design by less than 95% of stated design thickness**
5. **Thermosetting Resin - The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D 648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D 2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed**
6. **Each polymer concrete manhole component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part. Cosmetic defect shall not be cause for rejection. The nominal internal diameter of manhole**

**components shall not vary more than 2%. Variations in height of two opposite sides of risers and cones shall not be more than 5/8 inch. The under run in height of a riser or cone shall not be more than ¼ in/ft of height with a maximum of ½ inch in any one section**

- 7. Marking and Identification - Each manhole shall be marked with the following information - Manufacturer's name or trademark, Manufacturer's location and Production Date**
- 8. Manhole joints shall be assembled with a bell/spigot or shiplap butyl mastic and/or gasketed joint so that on assembly, manhole base, riser and top section make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity**
- 9. Minimum clearance between wall penetrations and joints shall be per manufacturer's design**
- 10. Construct invert channels to provide smooth flow transition with minimal disruption of flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. All precast base sections to be cast monolithically. Polymer bench and channel are to be constructed with all polymer concrete material. Extended ballast slab requirements for buoyancy concerns can be addressed with cementitious concrete material**
- 11. Provide resilient connectors conforming to requirements of ASTM C 923 or other options as available. All connectors are to be watertight. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions**

#### **11.6 CAST-IN-PLACE MANHOLES**

- A. All fine and coarse aggregate shall conform to ASTM C33. Fine aggregate shall be clean, sharp, natural sand. Coarse aggregate shall be clean, strong crushed gravel or stone.**

- B. All deformed reinforcing bars shall conform to ASTM A615 or ASTM A996. All bars shall be Grade 60.
- C. All welded steel wire fabric shall conform to ASTM A1064.
- D. Concrete used in cast-in-place manholes shall develop a minimum compressive strength of 3,500 psi after 28 days. Concrete shall have a maximum allowable water/cement ratio of 0.50, by weight.
- E. Reference construction specification *Section 03300, Cast-in-Place Concrete*.

#### 11.7 GRADE ADJUSTMENT RINGS

- A. Precast grade adjustment rings shall be manufactured in accordance with ASTM C478, and shall be made with Type I/II cement.
- B. Grade adjustment rings shall be minimum of 12-inch (12") and a maximum of 18-inch (18").
- C. High Density Polyethylene (HDPE) grade adjustment rings shall be manufactured in accordance with ASTM D4976. Acceptable manufacturers are:
  - 1. **LADTECH, Inc.**
  - 2. **Or approved equivalent.**

#### 11.8 GROUT – CONCRETE MANHOLE

- A. Grout shall be pre-mixed or job-mixed nonshrink and nonmetallic.
- B. The acceptable types and manufacturers for pre-mixed, non-shrink, non-metallic grout are:
  - 1. **QUIKRETE<sup>®</sup> - Hydraulic Water – Stop Cement #1126**
  - 2. **DAYTON Superior – Re-Crete 20 Minute Set**
  - 3. **Or approved equivalent.**

#### 11.9 GROUT – POLYMER MANHOLE

- A. All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer

## 11.10 RING AND COVER

- A. All rings shall be maximum eight-inch (8") in height.
- B. Standard iron ring and covers shall be HS-20 load capable gray iron conforming to ASTM A48 Class 305B, with a black bituminous finish.
  - 1. **The word "SEWER" shall be cast in the cover.**
  - 2. **Horizontal bearing surfaces of all rings and covers shall be machined to eliminate any rocking action or non-uniform bearing.**
  - 3. **Pick-hole shall be one and on-half inch (1 ½") wide by one-half inch (½") deep.**
  - 4. **Covers shall be bolt down**
  - 5. **Acceptable rings and covers are:**
    - a. ***Castings, Inc. - MH-250-24 Bolt Down CI with rubber gasket***
    - b. ***Or approved equivalent.***
- C. Covers shall be non-perforated checker pattern with maximum 3/16 inch (3/16") raised pattern in non-pedestrian traffic areas and non-perforated, non-skid pattern complying with American with Disabilities Act (ADA) requirements in pedestrian traffic areas. Acceptable ADA covers are:
  - 1. **Castings, Inc. - MH-310-24CI**
  - 2. **Or approved equivalent.**
- D. Manhole covers located within designated 100-year floodplains and areas subject to frequent water inundation shall be the non-perforated, lock down, gasket type cover.
  - 1. **Ring and covers shall be HS-20 load capable gray iron conforming to ASTM A48 Class 30, with black coat finish.**
  - 2. **The word "SEWER" shall be cast in the cover.**
  - 3. **Cover shall not rock under traffic.**

4. **Acceptable manufacturers are:**

- a. ***Pamrex***
- b. ***Rexus***
- c. ***Or approved equivalent.***

**11.11 MANHOLE ENCAPSULATION SYSTEM**

- A. Manhole encapsulation is required when groundwater is present or expected to be present in the area.
- B. Heat-shrinkable sleeves shall be high shrink irradiated and cross-linked polyethylene impermeable backing, coated with protective heat activated adhesive.
- C. A separate closure seal shall be provided to secure the sleeve in place during installation and seal overlap area.
- D. Approved sleeve manufacturers are:
  - 1. **WrapidSeal**
  - 2. **Or approved equivalent.**
- E. Approved primer manufacturers are:
  - 1. **WrapidSeal “G” Primer**
  - 2. **Or approved equivalent.**

**11.12 STEPS**

- A. Steps in manholes shall not be installed unless approved otherwise by the Water and Sewer Department.

**11.13 PREFORMED MASTIC GASKETS**

- A. All preformed mastic gaskets shall conform to Federal specifications SS-S-00210 (210-A). Type I, rope form.
- B. The diameter of the preformed mastic gasket shall be 1.5 inches (1.5”).
- C. The application temperature range shall be between 40°F and 110°F.

- D. Gasket is to be pliable.
- E. Approved gasket manufacturers are:
  - 1. **Hamilton-Kent Manufacturing Co. - Kent Seal**
  - 2. **Con Seal - CS-202**
  - 3. **RAM-NEK – RN101**
  - 4. **Or approved equivalent.**

#### 11.14 MODULAR SEALING UNITS

- A. Link-Seal®
- B. Or approved equivalent.

#### 11.15 DROP MANHOLE BOWL

- A. Reliner®
- B. Or approved equivalent.

#### 11.16 INTERIOR MANHOLE COATING

- A. See construction specifications *Section 02957 A, Sewer Manhole Rehabilitation* and *Section 02957 B, Sewer Manhole Coating* for additional information.
- B. Coating is required for first two (2) manholes after a lift station.
- C. Approved manhole coating manufacturers are:
  - 1. **SewperCoat®**
  - 2. **Or approved equivalent.**

### PART 12 – EXECUTION

#### 12.1 INSPECTION

- A. Manholes and accessories shall be inspected for cracks, abrasions, or other flaws prior to installation.
- B. Damaged or flawed manholes and accessories shall be rejected, marked, and removed from the site.



## 12.2 PREPARATION

- A. Reference construction specification *Section 02315, Excavation and Fill*.

## 12.3 MANHOLE INSTALLATION

- A. Manholes shall be installed in accordance with Standard Drawings and be constructed in accordance with the approved Construction Drawings.
- B. Flat-top manholes are required whenever the distance between the finished ground surface and the manhole barrel section does not allow room for a cone section.
  - 1. **Access holes for flat-top manholes shall be offset from center.**
  - 2. **If the distance from the manhole cover to the invert of the sanitary sewer line main is less than 3 feet, the access hole shall be centered.**
- C. Cast-In-Place Concrete Base
  - 1. **Invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sanitary sewer pipe section.**
  - 2. **Form inverts directly in the concrete of the base, or for a straight through manhole with no other inlets the channel may be constructed by laying a full pipe section through the manhole and cutting out the top half of the pipe after the surrounding concrete has hardened.**
  - 3. **Changes in direction of flow shall be made with a smooth curve having as large a radius as the manhole will permit.**
  - 4. **The floor of the manhole outside of the channels shall have a smooth trowel finish and shall slope toward the channels at one-inch (1") per foot.**
  - 5. **Pipe size changes shall be accomplished by matching the pipe crowns and forming the channel to accommodate the pipe size differential.**

6. **Where shown on the approved Construction Drawings, a piece of pipe of the proper size shall be built into the manhole where future laterals may be connected. The stub-out shall be sealed with a plug at its outer end and an invert shall be built into each manhole for such lateral connections.**
  7. **Manhole bases shall be thoroughly bonded to the barrel of the pipe.**
    - a. ***Install an approved rubber gasket on the pipe barrel.***
    - b. ***All connections with the pipe shall be made without projections or voids.***
    - c. ***Inverts must meet the requirements of the City.***
- D. Manholes shall be constructed at the location and to the elevation indicated on the accepted Construction Drawings, or as stated by the City to accommodate field conditions.
1. **Reference construction specification *Section 02530, Sanitary Utility Sewerage Piping.***
  2. **All buried manhole covers shall be referenced to a minimum of two (2) permanent surface references and recorded on the As-Constructed Record Drawings.**
- E. The manhole shall be set plumb.
- F. Manhole sections shall be joined to each other using performed flexible plastic gaskets on both interior and exterior shiplaps. The manhole section shall be joined to the base using a double row of preformed flexible plastic gaskets.
1. **All joint surfaces shall be kept clean and dry during installation.**
  2. **Gaskets shall be pliable at the time of installation.**
  3. **Primer shall be used on both section/base surfaces unless otherwise directed by the City.**
- G. Adjustment rings, and ring covers shall be joined to the manhole section and to each other using flexible plastic gaskets.

1. **All joint surfaces shall be kept clean, dry, and warm during installation.**
  2. **Manhole section shall be grouted to ring and covers on the inside.**
- H. All lifting holes, joints, and other imperfections shall be filled with non-shrink grout, to provide a smooth finished appearance.

#### 12.4 CONNECTIONS TO EXISTING MANHOLES

- A. Construct in such a manner that the finished work conforms to the requirements specified for new manholes.
- B. Connections shall be made by core-drilling as small a hole as necessary to insert the new pipe and modular sealing unit. Chipping or breaking out manhole walls is not allowed. Use of a rotary hammer is not acceptable.
- C. Grind the existing manhole base to the cross-section of the new pipe and finish with grout to form a smooth continuous invert. Chipping or breaking out the manhole base is not acceptable.
- D. Seal the annular space between the pipe and existing manhole wall with a modular sealing unit and smooth finish inside the manhole wall with non-shrink grout.
- E. Flow is to be maintained through temporary pumping. Prior approval of the proposed pumping plan shall be obtained from the City.

#### 12.5 MANHOLE TESTING

- A. Testing to be completed in compliance with construction specification *Section 01715, Sewer and Manhole Testing*

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 13 – GENERAL

##### 13.1 SCOPE

- A. This section addresses cast-in-place concrete for thrust restraints, sanitary sewer manhole bases, and cut-off walls, including forms, reinforcing steel, finishing and curing, and other appurtenant work.
- B. All other concrete work shall conform to the Design Criteria and Construction Specifications Streets Volume I (*SDC*).

##### 13.2 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. **117, *Specifications for Tolerances for Concrete Construction and Materials*, latest revision.**
  - 2. **301, *Specifications for Structural Concrete*, latest revision.**
  - 3. **305.1, *Hot Weather Concreting*, latest revision.**
  - 4. **306.1, *Cold Weather Concreting*, latest revision.**
  - 5. **309, *Guide for Consolidation of Concrete*, latest revision.**
  - 6. **350.1, *Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures*, latest revision.**
- B. ASTM International (ASTM):
  - 1. **A185, *Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete*, latest revision.**
  - 2. **A615, *Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement*, latest revision.**
  - 3. **A996, *Standard Specification for Rail-Steel and Axle –Steel Deformed Bars for Concrete Reinforcement*, latest revision.**

4. **C31/C31M, Standard Test Practice for Making & Curing Concrete Test Specimens in the Field, latest revision.**
5. **C33, Standard Specification for Concrete Aggregates, latest revision.**
6. **C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens, latest revision.**
7. **C94/C94M, Standard Specification for Ready-Mixed Concrete, latest revision.**
8. **C143/C143M, Standard Test Method for Slump of Hydraulic Cement Concrete, latest revision.**
9. **C150, Standard Specification for Portland Cement, latest revision.**
10. **C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete, latest revision.**
11. **C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method, latest revision.**
12. **C260, Standard Specification for Air-Entraining Admixtures for Concrete, latest revision.**
13. **C494/C494M, Standard Specification for Chemical Admixtures for Concrete, latest revision.**
14. **A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete, latest revision.**
15. **C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete, latest revision.**
16. **C1218/C1218M, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete, latest revision.**

17. **C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method), latest revision.**
18. **C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete, latest revision.**
19. **C1602/1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete, latest revision.**

### 13.3 SUBMITTALS

- A. When requested by the City, submit batch tickets for each load at the time of delivery indicating the following:
  1. **Identification name and number.**
  2. **Date.**
  3. **Quantity delivered.**
  4. **Mix design.**
  5. **Mix time.**
  6. **Time at which the water was added.**
  7. **Amount of water added at job site.**
- B. Mix Designs:
  1. **Submitted to the City for review and approval not less than two (2) weeks prior to first concrete placement.**
  2. **Concrete mix designs shall contain proportions of materials and admixtures to be used on work, signed by mix designer.**
  3. **Documentation of average strength for each proposed mix design in accordance with ACI 301.**
  4. **Letter of Certification that Concrete Producer has verified compatibility of constituent materials in design mix.**

5. **Test Reports:**

- a. ***Cement: Chemical analysis report.***
- b. ***Supplementary Cementitious Materials: Chemical analysis report and report of other specified test analyses.***
- c. ***Water-Soluble Chloride-Ion Content in Hardened Concrete: Unless otherwise permitted, in accordance with ASTM C1218 at an age between 28 and 42 days.***
- d. ***Shrinkage Test Results: In accordance with ASTM C157 as modified herein.***

6. **Aggregates:**

- a. ***Gradation for coarse aggregates. List gradings and percent passing through each sieve.***
- b. ***Gradation for fine aggregates. List gradings and percent passing through each sieve.***
- c. ***Percent of fine aggregate weight to total aggregate weight.***
- d. ***Deleterious substances in fine aggregate per ASTM C33, Table 1.***
- e. ***Deleterious substances in coarse aggregate per ASTM C33, Table 3.***
- f. ***Manufacturer's Letter of Certification that the aggregate conforms to the specified class designation for coarse aggregate.***
- g. ***Test Reports:***
  - i. ***Alkali Aggregate Reactivity: Aggregate shall be classified as nonpotentially reactive in accordance with Article Concrete Mix Design. Include documentation of test results per applicable standards.***

7. **Admixtures:**

- a. ***Manufacturer's catalog cut sheets and product data sheets for each admixture used in proposed mix designs.***
  - b. ***Manufacturer's Letter of Certification of conformance to specified standards.***
- C. Product Data: Specified ancillary materials.
- D. Detailed plan for curing and protection of concrete placed and cured in cold weather. The details shall include, but not be limited to, the following:
  - 1. **Procedures for protecting the subgrade from frost and the accumulation of ice or snow on reinforcement and other metallic embeds or forms prior to placement.**
  - 2. **Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.**
  - 3. **Methods for temperature protection during placement.**
  - 4. **Types of covering, insulation, housing, or heating to be provided.**
  - 5. **Curing methods to be used during and following the protection period.**
  - 6. **Use of strength accelerating admixtures.**
  - 7. **Methods for verification of in-place strength.**
  - 8. **Procedures for measuring and recording concrete temperatures.**
  - 9. **Procedures for preventing drying during dry, windy conditions.**
- E. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F. The plan shall include, but not be limited to, the following:



1. **Procedures for measuring, and recording temperatures of reinforcement and other embedded items prior to concrete placement.**
  2. **Use of retarding admixture.**
  3. **Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.**
  4. **Types of shading and wind protection to be provided.**
  5. **Curing methods (including use of evaporation retardant).**
  6. **Procedures for measuring and recording concrete temperatures.**
  7. **Procedures for preventing drying during dry, windy conditions.**
- F. Manufacturer's application instructions for bonding agent and bond breaker.
- G. Manufacturers' Letter of Certification of conformance to specified standards:
1. **Portland cement.**
  2. **Fly ash.**
  3. **Aggregates.**
  4. **Admixtures.**
  5. **Bonding agent.**
  6. **Bond breaker.**
- H. Statement of Qualification:
1. **Batch Plant: Certification as specified herein.**
  2. **Mix designer.**
  3. **Installer.**

- 4. **Testing Agency.**
  - I. Field test reports.
  - J. Results of tightness tests.
  - K. Concrete Delivery Tickets:
    - 1. **For each batch of concrete before unloading at Site.**
    - 2. **In accordance with ASTM C94/C94M, including requirements 14.2.1. through 14.2.10.**
    - 3. **Indicate amount of mixing water withheld, and maximum amount that may be permitted to be added at Project site.**
  - L. Curing
    - 1. **Manufacturers' data for the following products:**
      - a. ***Evaporation retardant.***
      - b. ***Curing compound.***
      - c. ***Clear sealer.***
      - d. ***Clear floor hardener.***
    - 2. **Curing methods proposed.**
    - 3. **Curing Compound**
      - a. ***Manufacturer's Certificate of Compliance showing moisture retention requirements.***
- M. Submittal Drawing
  - 1. **Submitted to the City for review and approval not less than two (2) weeks prior to placement and must include information on steel placemen, sizing, compressive strength, and grade of steel reinforcement. Steel placement and sizing are to meet the City of Greely Standard Drawing.**

#### 13.4 QUALITY ASSURANCE

- A. See the quality assurance requirements in the City of Greeley Design Criteria and Construction Specifications Streets Volume I.

#### PART 14 – PRODUCTS

##### 14.1 CEMENT

- A. All cement shall be Portland Cement. No other cement shall be used without prior written permission of the City.
- B. Portland Cement shall conform to ASTM C150, Type I/II.

##### 14.2 AGGREGATES

- A. Unless otherwise permitted, furnish from one source for each aggregate type used in a mix design.

- 1. **Normal-Weight Aggregates:**

- a. ***In accordance with ASTM C33, except as modified herein.***
  - i. ***Class Designation: 4S unless otherwise specified.***
- b. ***Free of materials and aggregate types causing pop outs, discoloration, staining, or other defects on surface of concrete.***
- c. ***Alkali Silica Reactivity: See Article Concrete Mix Design.***

- 2. **Fine Aggregates:**

- a. ***Clean, sharp, natural sand.***
- b. ***ASTM C33.***
- c. ***Limit deleterious substances in accordance with ASTM C33, Table 1 and as follows:***
  - i. ***Limit material finer than 75-µm (No. 200) sieve to 5 percent mass of total sample.***
  - ii. ***Limit coal and lignite to 0.5 percent.***

3. **Coarse Aggregate:**

- a. ***Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).***
- b. ***Limit deleterious substances in accordance with ASTM C33, Table 3 for specified class designation.***

**14.3 WATER**

- A. Mixing water for concrete shall be potable. Alternative sources of water may be permitted with prior approval from the City.
  - 1. **If approved by the City, water from alternative sources shall comply with requirements of ASTM C1602/C1602M, and the concentration of chemicals in combined mixing water shall be less than:**
    - a. ***1,000 ppm chloride content.***
    - b. ***3,000 ppm sulfate content as SO<sub>4</sub>***
    - c. ***600 ppm alkalis as (Na<sub>2</sub>O + 0.658 K<sub>2</sub>O).***
    - d. ***Total solids by mass less than 50,000 ppm.***

**14.4 ADMIXTURES**

- A. Admixtures shall be certified to be compatible with each other.
- B. Admixtures shall not contain calcium chloride.
- C. Air-Entraining Admixture
  - 1. **An air entraining agent shall be used in all concrete. All air entraining agents shall conform to ASTM C260.**
  - 2. **Total air content: 5% to 8%**
- D. Water Reducing Admixture

1. **A water reducing admixture may be used, if approved by the City.**
  2. **A water reducing admixture shall conform to ASTM C494 for Type A or Type D chemical admixture.**
  3. **The water reducing admixture shall be compatible with the cement being used and shall not contain any calcium chloride (CaCl<sub>2</sub>).**
- E. Accelerators shall conform to ASTM C494 and ACI 306.
- F. Fly Ash
1. **When fly ash is used in concrete, the cement replacement shall not exceed 20%.**
  2. **Fly ash shall conform to ASTM C618, Class C or F. Class C fly ash will not be permitted where sulfate resistant concrete is required.**
- G. Any admixture including air entraining agents, accelerators, and retarders must be approved by the City.

#### **14.5 REINFORCING MATERIALS**

- A. All deformed reinforcing bars shall conform to ASTM A615 or ASTM A996. All bars shall be Grade 60.
- B. All welded steel wire fabric shall conform to ASTM A1064 and ASTM A185.
- C. Reinforcement supports and spacers shall be plastic coated steel or heavy duty plastic of design and strength to hold reinforcement accurately in place before and during placement of concrete.

#### **14.6 FORMWORK**

- A. Forms
1. **Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the approved Construction Drawings.**

2. **Plywood shall be PSI, waterproof, resin-bonded, exterior type, Douglas Fir.**
3. **Lumber shall be straight, uniform width and thickness, free from knots, offsets, holes, dents and other surface defects.**
4. **Form oil shall be light colored paraffin oil or other non-staining material.**
5. **Forms shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used in accordance with the manufacturer's instructions.**
6. **Commercial formulation form coating compounds shall not bond with, stain, nor adversely affect the concrete surface's bond or adhesion, and shall not impede wetting of surfaces to be cured with water or curing compounds. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.**

**B. Form Ties**

1. **Commercially manufactured, removable or snap-off metal form ties designed to withstand applied stresses, prevent spreading of forms during concrete placement, and prevent concrete from spalling upon removal.**
2. **Use of wire ties is prohibited.**

**14.7 MIX DESIGN**

- A. Concrete shall develop a minimum field compressive strength of 4000 psi after 28 days, unless otherwise specified by the City (i.e. thrust blocks).
- B. The water/cement ratio shall not exceed 0.50 by weight.
  1. **The water/cement ratio may be increased to 0.56, by weight, if a water reducing agent is used.**
  2. **High early or rapid set concrete may be allowed in high traffic situations.**

#### 14.8 Curing Compound:

- A. Water-based, high solids content non-yellowing curing compound meeting requirements of ASTM C309 and ASTM C1315.
  - 1. **Moisture Loss: 0.40 kg/m<sup>2</sup>/72 hours maximum.**
  - 2. **Capable of meeting moisture retention at manufacturer's specified application rate.**
- B. Manufacturers and Products:
  - 1. **BASF; Masterkure.**
  - 2. **Euclid Chemical Co.; Super Diamond Clear VOX.**
  - 3. **WR Meadows, Inc.; VOCOMP-30.**
  - 4. **Vexcon Chemical, Inc.; Starseal 1315.**
  - 5. **Dayton Superior.**
- C. Water: Clean and potable, containing less than 500 ppm of chlorides.

### PART 15 – EXECUTION

#### 15.1 TESTING CONCRETE

- A. Testing procedures and testing frequency shall be in accordance with the *SDC*.
- B. Making and curing concrete cylinders, ASTM C31.
- C. Testing concrete cylinders, ASTM C39.
- D. Slump, ASTM C143.
- E. Slump Tolerance, ACI 117
- F. Air content, ASTM C231.

#### 15.2 MIXING AND TRANSPORTING READY-MIXED CONCRETE

- A. In accordance with ACI 301, except as modified herein.

B. The maximum elapsed time from the time water is added to the mix until the concrete is in place shall not exceed 1 ½ hours when concrete is transported in revolving drum truck bodies.

C. The temperature of the concrete shall never exceed 90° F.

### 15.3 PROTECTION

#### A. Cold Weather Concrete

1. **Concrete shall not be placed unless the air temperature adjacent to the concrete placement is 30° F and rising, unless prior written acceptance for cold weather concrete operations is obtained from the City.**
2. **If cold weather concrete operations are accepted by the City, when daily low temperatures are below 40° F or when temperatures are predicted to be below 40° F within three (3) days of concrete placement, comply with ACI 306.1.**
3. **Water shall not be heated to a temperature greater than 150° F.**
4. **If hot air heaters are used, cover exposed surfaces of concrete with impervious sheet material or curing compound to prevent dehydration of concrete.**
5. **Do not place concrete against frozen ground or against surfaces with frost or ice present.**
6. **Provide maximum and minimum temperature sensors placed on concrete surfaces spaced throughout the work to allow monitoring of concrete surface temperatures representative of the work. Unless otherwise permitted, record surface temperature of concrete at least once every 12 hours during the specified curing period.**

#### B. Hot Weather Concrete

1. **Concrete shall not be placed if the daily high temperature exceeds 90° F unless otherwise accepted by the City.**



2. **When daily high temperature is 90° F or above, or hot weather conditions exist that would impair quality and strength of concrete, comply with ACI 305.1.**
3. **Temperature of concrete immediately before placement in forms shall be between 50° F and 90° F.**
4. **Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.**
5. **To facilitate the placement of concrete in hot weather, the aggregate or the water may be cooled.**

#### 15.4 FORMS

- A. Brace or tie forms to maintain desired position, shape and alignment before, during, and after placement.
- B. Do not remove or disturb forms until the concrete has attained sufficient strength to safely support all dead and live loads.
- C. Remove forms with care to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

#### 15.5 REINFORCING

- A. Prior to pouring concrete, accurately place reinforcing steel. Maintain in proper position while concrete is being placed and vibrated.

#### 15.6 CONCRETE PLACEMENT

- A. In accordance with ACI 301, except as modified herein.
- B. Convey concrete to the point of final deposit by methods which will prevent the separation or loss of concrete components.
- C. Height of concrete freefall shall be limited to four (4) feet.
- D. During and immediately after placement, concrete shall be thoroughly consolidated by mechanical vibrating equipment supplemented by handspading, rodding or tamping worked around reinforcements and embedments, and worked into all corners of the forms. Use equipment and procedures for consolidating concrete in accordance with ACI 309.

E. Notify City at least 1 full working day in advance before starting to place concrete.

F. Hot Weather Placement:

1. **Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:**
  - a. *Maintain concrete temperature below 95 degrees F at time of placement, or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.*
  - b. *Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.*
2. **Cure concrete as specified in Section 3.8, Concrete Curing.**

G. Cold Weather Placement:

1. **Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:**
  - a. *Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.*
  - b. *Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth must be thawed to the acceptance of the City.*
  - c. *Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F. This requirement is applicable to all surfaces including reinforcement and other embedded items.*
  - d. *Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.*

- e. ***Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.***
- f. ***Cure concrete as specified in Section 3.8, Concrete Curing. Protect concrete from freezing until the end of the curing period and until the concrete has attained a compressive strength of 3,500 psi (or the design compressive strength if less than 3,500 psi).***

#### 15.7 FINISHING UNFORMED SURFACES

- A. Screed and give an initial float finish as soon as concrete has stiffened sufficiently for proper working.
- B. Initial floating shall produce a surface of uniform texture and appearance.
- C. Follow with a second floating at the time of initial set. This floating shall produce a finish of uniform texture and color.
- D. In areas where concrete is to remain exposed, the final finish shall be obtained with a light brooming.
- E. Manhole inverts shall be true to line and grade and smooth.

#### 15.8 CURING

- A. Finished concrete shall be cured by protecting it against moisture loss, rapid temperature change, precipitation, flowing water, and mechanical injury for a minimum of seventy-two (72) hours after placement.
- B. Concrete shall be maintained at a minimum of 50° F during the curing period.
- C. Curing compound shall be used on all flat exposed surfaces.
- D. The Contractor shall be responsible for protecting the concrete from traffic and the elements.

#### 15.9 CARE AND REPAIR OF CONCRETE

- A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the City.

- B. All concrete structures shall not have backfill placed against them until the concrete has reached sufficient strength so as not to have any damage caused by the backfill or backfill operations.
- C. Any concrete found to be damaged, or that may have been originally defective, or that becomes defective after any time prior to the final acceptance of the completed work, or that departs from the established line or grade, or that, for any other reason, does not conform to the requirements of the City shall be satisfactorily repaired as directed by the City or removed and replaced with acceptable concrete at no expense to the City.

#### 15.10 FIELD QUALITY CONTROL

- A. General:
  - 1. **Provide adequate facilities for safe storage and proper curing of concrete test specimens onsite for first 24 hours, and for additional time as may be required before transporting to test lab.**
  - 2. **Unless otherwise specified, sample concrete for testing for making test specimens, from the point of delivery.**
  - 3. **When concrete is pumped, sample and test air content at point of delivery and at the point of placement.**
    - a. ***For Each Concrete Mixture: Provided the results of the air content tests for the first load of the day are within the specified limits, testing need only be performed at the point of delivery for subsequent loads of that concrete mixture except that testing should be performed at the point of placement every four hours.***
  - 4. **Evaluation will be in accordance with ACI 301 and Specifications.**
  - 5. **Test specimens shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.**
  - 6. **Frequency of testing may be changed at the discretion of City.**
  - 7. **Pumped Concrete: Take concrete samples for slump (ASTM C143/ C143M) and test specimens (ASTM C31/C31M and**

**ASTM C39/C39M) and shrinkage specimens (ASTM C157/C157M) at placement (discharge) end of line.**

8. **If measured air content at delivery is greater than the specified limit, a check test of air content will be performed immediately on a new sample from delivery unit. If check test fails, the concrete has failed to meet requirements of Contract Documents. If measured air content is less than the lower specified limit, adjustments will be permitted in accordance with ASTM C94/C94M, unless otherwise specified. If the check test of the adjusted mixture fails, the concrete has failed to meet requirements of Contract Documents. Concrete that has failed to meet requirements of Contract Documents shall be rejected.**

**B. Concrete Strength Test:**

1. **Unless otherwise specified, one specimen at age of 7 days for information, and two 6-inch diameter or when permitted three 4-inch diameter test specimen at age of 28 days for acceptance.**
2. **If result of 7-day concrete strength test is less than 50 percent of the specified 28-day strength, extend the period of moist curing specified in Section 3.8, Concrete Curing, by 7 additional days.**
3. **Provide a minimum of one spare test specimen per sample. Spare cylinder shall be tested as directed by City.**

**C. Shrinkage Tests:**

1. **When required to conform to shrinkage limits, collect actual concrete materials being batched and before liquids have been added to the mix. Mix sampled material in a laboratory at proportions matching the batched concrete. Test shrinkage characteristics every 5,000 cubic yards of concrete used on job and every 3 months during construction when compression test cylinders are made.**

2. **Concrete Shrinkage Limits: Test in accordance with ASTM C157/ C157M, with the following modifications:**
- a. *Prisms shall be moist cured for 7 days prior to the 28-day drying period.*
  - b. *Comparator reading at the end of the 7-day moist cure shall be used as the initial length in the length change calculation.*
  - c. *Reported results shall be the average of three prisms.*
  - d. *If drying shrinkage of any specimen departs from the average of that test age by more than 0.004 percent, disregard results obtained from that specimen.*
  - e. *Results at the end of the 28-day drying period shall not exceed 0.040 percent if 3-inch prisms are used, or exceed 0.038 percent if 4-inch prisms are used.*
  - f. *If the 7-day or 14-day shrinkage tests results exceed the shrinkage limits established by the design mix testing, furnish an additional 14 days of water curing beyond the original curing period, for concrete surfaces of hydraulic structures represented by prisms. Modify the concrete mix design to reduce shrinkage prior to casting additional concrete for the work.*

D. High Range Water Reducer (Superplasticizer) Admixture Segregation Test: Test each truck prior to use on job.

- 1. **Segregation Test Objective: Concrete with a 4-inch to 8-inch slump must stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test.**
- 2. **Test Procedure: Make slump test and check for excessive slump and observe to see if mortar or moisture flows from slumped concrete.**
- 3. **Reject concrete if mortar or moisture separates and flows out of mix.**

E. Cold Weather Placement Tests:

1. **During cold weather concreting, cast cylinders for field curing as follows. Use a method that will produce a greater number of specimens:**
  - a. *Six extra test cylinders from the last 100 cubic yards of concrete.*
  - b. *Minimum of three specimens for each 2 hours of placing time or for each 100 cubic yards.*
2. **These specimens shall be in addition to those cast for lab testing.**
3. **Protect test cylinders from weather until they can be placed under the same protection provided for the concrete structure that they represent.**
4. **Keep field test cylinders in the same protective environment as the parts of structure they represent to determine if specified strength has been obtained.**
5. **Test cylinders in accordance with applicable sections of ASTM C31/ C31M and ASTM C39/C39M.**
6. **Use test results to determine the specified strength gain prior to falsework removal or for prestressing.**

F. Tolerances:

1. **Slab Finish Tolerances and Slope Tolerances:**
  - a. *Floor flatness measurements shall be made the day after the floor is finished and before shoring is removed to eliminate effects of shrinkage, curing, and deflection.*
  - b. *Support 10-foot-long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.*

- c. ***Compliance with the designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.***

G. Liquid Tightness Tests:

1. **Purpose: To determine integrity and liquid-tightness of finished exterior and interior concrete surfaces of liquid containment structures.**
2. **All liquid-containing concrete structures are to be tested for liquid- tightness as specified, unless otherwise noted on the Drawings.**
3. **Water for the initial tightness test shall be from a city approved source. Contractor shall provide means to transport water to the structure to be tested. If additional tightness tests are required due to failure to meet criteria, the Contractor shall provide water for the subsequent tests.**
4. **After testing has been completed, dispose of test water in a manner approved by the City. Requirements for Liquid-Tightness Test:**
  - a. ***Perform tightness tests in accordance with ACI 350.1 and as specified herein.***
  - b. ***Do not place backfill, coatings, or other work that will cover concrete surfaces until tightness testing has been completed an approved.***
5. **Measure water surface at two points 180 degrees apart when possible where attachments, such as ladders exist, at 24-hour intervals.**
6. **Acceptance Criteria:**
  - a. ***Volume loss shall not exceed 0.050 percent of contained liquid volume per 24-hour period, adjusted for evaporation, precipitation, and temperature***



- b. ***Acceptance that the structure has passed the tightness test shall be based on the total volume loss at the end of the specified test period.***
- 7. **Repairs When Test Fails: Dewater structure; fill leaking cracks with crack repair epoxy. Patch areas of damp spots previously recorded, and repeat water leakage test in its entirety until the structure successfully passes the test.**

#### **15.11** PROTECTION OF INSTALLED WORK

- A. After curing as specified in Section 3.8, Concrete Curing, and after applying final floor finish, cover slabs with plywood or particle board or plastic sheeting or other material to keep floor clean and protect it from material and damage as a result of other construction work.
- B. Repair areas damaged by construction, using specified repair materials and approved repair methods

**SECTION 03400  
PRECAST CONCRETE**

**PART 16      – GENERAL**

**16.1    SCOPE**

- A.      This section addresses precast concrete products (manholes, vaults, etc.).

**16.2    REFERENCES**

- A.      American Concrete Institute (ACI);
  - 1.      **304R, *Guide for Measuring, Mixing, Transporting, and Placing Concrete*, latest revision.**
  - 2.      **350, *Environmental Structures: Code Requirements*, latest revision.**
- B.      ASTM International (ASTM)
  - 1.      **C31, *Standard Practice for Making and Curing Concrete Test Specimens in the Field*, latest revision.**
  - 2.      **A36, *Standard Specification for Structural Steel*, latest revision.**
- C.      Precast/Prestressed Concrete Institute (PCI)
  - 1.      **MNL-117, *Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products*, latest revision.**
  - 2.      **MNL-120, *Design Handbook for Precast and Prestressed Concrete*, latest revision.**

**16.3    SUBMITTALS**

- A.      Sealer for Exterior Surfaces
  - 1.      **Product data with mixing/application instructions.**
- B.      Calculations and Technical Data

1. **Proposed details and design calculations for stresses in all critical sections of precast members for all loading conditions including transportation, handling, and erection.**

C. Precasting Manufacturers

1. **Experience record on production of precast concrete as shown, with information on precasting plant, that will indicate capability to satisfactorily perform the work.**
2. **Evidence of current PCI plant certification.**

D. Certificate of Compliance

1. **Certify admixtures and concrete do not contain calcium chloride.**

E. Test Reports

1. **For precast manufacturer's concrete test cylinders.**
2. **Inspection of installed panels.**

F. Submittal Drawing

1. **Submitted to the City for review and approval not less than two (2) weeks prior to placement and must include information on steel placement, sizing, compressive strength, and grade of steel reinforcement. Steel placement and sizing are to meet the City of Greeley Standard Drawing.**

## 16.4 QUALITY ASSURANCE

A. Qualifications of Precasting Manufacturers:

1. **Precast Concrete: Product of manufacturer with a minimum of 3 years' experience producing precast concrete products of quality specified.**
2. **Precast Plant: PCI certified plant with current certification.**
3. **Calculations shall be stamped by an engineer registered in the State of Colorado.**

## PART 17     - PRODUCTS

### 17.1    MATERIALS

- A.     Reference construction specification *Section 03300, Cast-In-Place Concrete*, for precast concrete minimum requirements for mix design (cement, aggregate, water, admixtures, and reinforcement).
- B.     Formwork:
  - 1.       **One-piece, full length and without seams.**
- C.     Embedded Items:
  - 1.       **ASTM A36 steel.**
  - 2.       **Anchor Studs: Headed anchor studs (HAS), deformed bar anchors (DBA), or threaded studs as manufactured by Nelson Stud Welding Co., Lorain, OH.**
  - 3.       **Furnish inserts for lifting precast slabs, and as otherwise required.**
- D.     Sealer for Exterior Surfaces:
  - 1.       **Silane Sealer: One-component penetrating sealer, hydrophilic (isopropyl alcohol as a carrier) with 40 percent active ingredients.**
  - 2.       **Manufacturers:**
    - a.       ***Master Builders Co.***
    - b.       ***Euclid Chemical Co.***

### 17.2    DESIGN REQUIREMENTS

- A.     Structural Precast Members
  - 1.       **Meet applicable sections of PCI MNL-120.**
  - 2.       **Design for all loading conditions including transportation, handling, and erection.**

3. **Minimum reinforcing steel cover to be 2 inches conforming to ACI 350.**
4. **Any structure to be installed in a roadway shall be designed for an AASHTO HS-20 loading.**

### 17.3 FABRICATION

- A. Comply with PCI MNL-117.
- B. Reinforcing Steel: Place in position before concrete is cast and keep clean and free from form oil or other substances harmful to bond.
- C. Concrete: Deposit, vibrate, finish, and cure in accordance with recommended practices of ACI 304R.
- D. Sealer:
  1. **Apply to precast panels at precast plant site after sandblasting panels, in accordance with manufacturer's instructions.**
  2. **Protect surface until installed in the Work.**
  3. **Repair damage as approved by manufacturer.**

### 17.4 SOURCE QUALITY CONTROL

- A. Prepare minimum three standard concrete test cylinders for each 50 cubic yards or fraction thereof of concrete placed in the precast work in accordance with ASTM C31.
- B. Test and record concrete strengths.

## PART 18 - EXECUTION

### 18.1 INSPECTION

- A. Examine each precast section upon arrival to the job site for cracks and other unsightly imperfections or structural defects. Record location and condition of damaged sections.
- B. Resolution:
  1. **Repair damage to satisfaction of City.**

2. **Remove panels with damage or repairs not acceptable to City and install new acceptable panels in place of those removed.**
3. **Perform reinspection and obtain acceptance by City.**

## 18.2 INSTALLATION

- A. Set precast sections in accordance with the manufacturer's erection drawings.

## 18.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle all materials to ensure installation in sound and undamaged condition.
- B. Do not deliver precast sections to the job site until the concrete has attained at least 80% of specified design strength.
- C. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transportation, and erection operations only at the lifting or supporting point, or both, as shown on shop drawings.
- D. Transportation and on-site handling shall be performed with acceptable equipment and methods, as well as by qualified personnel.
- E. Care shall be taken to avoid tensional stresses during transportation.
- F. Place units so that identification markings are discernible.
- G. Stack so that lifting devices are acceptable and undamaged.

## 18.4 CLEANING

- A. After installation, clean soiled precast concrete surfaces with detergent and water, using fiber brush and sponge. Rinse thoroughly with clean water immediately after using cleaner.
- B. Use extreme care to prevent damage to precast concrete surfaces and to adjacent materials.

## 18.5 FIELD QUALITY CONTROL

- A. Inspection:
  1. **Inspect panels with City for cracks or damage. Record location and condition of damaged panels.**

B. Resolution:

1. **Repair damage to satisfaction of City.**
2. **Remove panels with damage or repairs not acceptable to City.**
3. **Install new acceptable panels in place of those removed.**
4. **Perform reinspection and obtain acceptance by City.**

## SECTION 15140

### NON-POTABLE IRRIGATION SYSTEM

#### PART 1 – GENERAL

##### 1.1 SCOPE

- A. The purpose of this section is to provide information for the design and layout of a non-potable irrigation system. Non-potable irrigation system design shall be in accordance with the City of Greeley *Non-Potable Water Master Plan*, latest revision, and these Criteria.
- B. This section is not intended to be inclusive of all situations and the Design Engineer may be required to use additional engineering judgment to meet the overall design intent for constructability and long-term operations and maintenance. This Design Criteria typically applies to non-potable irrigation mains eight inches (8) in diameter through twenty-four (24) in diameter. The City of Greeley Water and Sewer Director reserves the right to make final determinations of the system design based on the best interest of the City's system.

##### 1.2 REFERENCES

- A. American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - 1. **C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water**, latest revision.
  - 2. **C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings**, latest revision.
  - 3. **C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water**, latest revision.
  - 4. **C153/A21.53, Ductile-Iron Compact Fittings for Water Service**, latest revision.
- B. ASTM International (ASTM)
  - 1. **A536, Standard Specification for Ductile Iron Castings**, latest revision.
  - 2. **F3125/F3125M, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat**



***Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPA Minimum Tensile Strength, latest revision.***

### 1.3 SUBMITTALS

- A. Shop Fabricated Piping:
  - 1. **Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, color, and other pertinent information.**
  - 2. **Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.**
- B. Hydraulic Thrust Restraint for Restrained Joints: Details including materials, sizes, assembly ratings, and pipe attachment methods.
- C. Dissimilar Buried Pipe Joints: Joint types and assembly drawings.
- D. Pipe Corrosion Protection: Product data.

### 1.4 DESIGN CONSIDERATION

- A. Flow
  - 1. **The non-potable irrigation system shall be designed to transport peak season irrigation demands in accordance with these Criteria.**
  - 2. **All irrigation demands used in the design of non-potable irrigation systems are subject to approval by the City.**
  - 3. **Non-potable Irrigation Application Rates (Design Flow)**
    - a. ***The non-potable irrigation demand criteria presented in the following table are minimum criteria and the City reserves the right to modify the criteria, at any time, for the design of specific projects. Non-potable irrigation application rates include provisions for evapotranspiration and operational efficiency losses in the non-potable irrigation system.***

TABLE 5-1: Non-Potable Irrigation Daily Application Rates

<i>Irrigated Area</i>	<i>Daily Irrigation Application Rate (gpm/acre)</i>
<i>Turf</i>	<i>24 gpm/acre</i>
<i>Trees/Shrubs</i>	<i>16 gpm/acre</i>

- b. *Since irrigation system design is unique in that the rates and methods of irrigation application (i.e. sprinklers vs. drip) and the watering requirement for various plantings (i.e. trees vs. turf) can differ from project to project, the Design Engineer may choose to determine the irrigation demand based on the specific project conditions.*
- c. *The Design Engineer will be required to provide adequate documentation to demonstrate how the irrigation demands for the project were determined. This shall include, but is not limited to, assumptions, design methodologies, references, supporting calculations, evapotranspiration rates, and landscape plans.*
- d. *Irrigation demands determined by the Design Engineer shall account for an 80% irrigation system operational efficiency, eight (8) hour daily watering window, and maximum of five (5) irrigation days per week (this provides a total weekly irrigation window of 40 hours) .*

B. Pressure Requirements

- 1. **The non-potable irrigation system in all areas shall be designed for a maximum pressure of 125 psi and a minimum pressure of 70 psi at each non-potable irrigation service meter.**

C. Hydraulic Design

- 1. **Friction Coefficient**
  - a. *Non-potable irrigation lines shall be designed using a Hazen-Williams friction coefficient “C” equal to 120.*
- 2. **Velocity**

- a. ***All pipes shall be sized for maximum water velocity of no greater than ten (10) feet per second (fps) at peak hour demand plus fire flow.***

3. **Head Loss**

- a. ***Head loss in pipes twelve-inches (12") in diameter or less, at peak hour demand shall not exceed ten (10) feet of head loss per 1,000 linear feet of pipe (10 ft/1,000 ft).***
- b. ***For sixteen-inch (16") diameter pipes, head loss at peak hour demand shall not exceed three (3) feet of head loss per 1,000 linear feet of pipe (3 ft/1,000 ft).***

D. Non-Potable Irrigation Main Size

- 1. **Non-potable irrigation mains are eight-inches (8") through twenty-four-inches (24") in diameter.**

1.5 – DESIGN CRITERIA

A. Depth of Bury

- 1. **The minimum depth of cover shall be four (4) feet and the maximum depth of cover shall be six (6) feet.**
- 2. **When design or constructability constraints are present, deeper or shallower main installation may be permitted only with acceptance from the City. Additional design and installation considerations may be required by the City depending on the situation.**

B. Connections to the Existing Non-Potable Irrigation System

- 1. **When connecting to the existing non-potable irrigation system, ONLY City Water and Sewer Department personnel shall operate existing system valves. The Contractor shall provide at least forty-eight (48) hours notification prior to needing any valve operated, except in the case of emergencies.**

2. **At locations where connections to existing mains are to be made, the Contractor shall locate the existing mains both vertically and horizontally and verify their exact size and material in advance of the time scheduled for making the connections.**
  - a. *Prior to connecting to existing mains, the Contractor shall have all labor, materials, and equipment ready to connect the fitting to the existing main, so as to keep the shutoff time to a minimum.*
  - b. *The Contractor shall notify the City of Greeley 48 hours in advance to examine the existing pipe or appurtenance and specify any necessary adjustments in line, grade, or connection requirements to accomplish the connection. Contractor to make corrections as directed by the City.*
  - c. *Use effective measures to prevent contamination to existing potable water lines.*
3. **The City shall not be responsible for valve water tightness on existing facilities. If existing valves leak, the City Water and Sewer Department may assist in reducing the influx of water, but the Contractor must use methods at his own disposal to dewater the trench and complete any required testing of the non-potable irrigation system.**
4. **All connections shall have valves installed to separate new construction from the existing system. New construction shall not be connected to the existing system until the new system has been tested, and accepted by the City.**

C. Location and Looping of Non-Potable Irrigation Mains

1. **All non-potable irrigation mains shall be located in dedicated street right-of-way or within a dedicated exclusive easement of appropriate width. City approval is required for all other proposed non-potable irrigation main locations.**

2. **The centerline of non-potable irrigation mains shall not be placed closer than three (3) feet to the lip of street gutter without prior acceptance by the City.**
3. **A non-potable irrigation main serving one (1) lot shall extend all the way across the frontage for that lot.**
4. **The non-potable irrigation system design report shall be stamped and certified by Professional Engineer registered in the state of Colorado. The design report shall verify that a proposed non-potable irrigation system can provide the required irrigation demands for a given development, at an acceptable pressure, and meet the overall non-potable irrigation system design requirements set forth in these Criteria.**
5. **Non-potable irrigation mains shall extend to the extremities of the property or the subdivision served. Extensions shall be in appropriate locations to provide adequate connections.**
6. **The City shall determine on a case by case basis if non-potable irrigation system looping is required for a development.**

D. Non-Potable Irrigation System Phased Installation and Stubouts

1. **Non-potable irrigation system phased installation and stubouts shall be in accordance with section 3.6.G of these Criteria.**
2. **Locate temporary blowoff assemblies at the end of each phase or stubout.**

## **PART 2 – PRODUCTS**

### **2.1 PIPE MATERIAL**

- A. Non-potable irrigation mains shall be AWWA C900 DR 18 (235 PSI) polyvinyl chloride (PVC) pressure pipe, purple color. PVC pipe markings shall include the designation “CAUTION NON-POTABLE WATER” OR “CAUTION RECLAIMED WATER” in addition to the standard factory labeling required by AWWA.

- B. Class 50 ANSI A21.51, AWWA C151 ductile iron pipe with exterior metallic zinc coating polywrapped in accordance with AWWA C105 is approved for above grade applications (ie. doglegs to pump stations). Use minimum Class 53 thickness ductile iron pipe for flanged piping. Use mechanical joints conforming to ANSI A 21.10 (AWWA C110) or flanged fittings conforming to ANSI/AWWA C110 and ANSI B16.1 (125#).
- C. AWWA C200 steel water pipe coated and lined in accordance with AWWA C203, AWWA C209, AWWA C214, AWWA C215, AWWA C216, AWWA C116, AWWA C213, AWWA C222, AWWA C205, and/or AWWA C210 is approved for above grade applications (i.e., doglegs to pump stations).

## 2.2 INTAKE PIPE AND INTAKE STRUCTURE

- A. Intake pipe (shall be 24" minimum) shall be AWWA C900 DR14 (200 PSI) polyvinyl chloride (PVC) pressure pipe, color white.
- B. Intake structure shall be self-flushing constructed of phosphorus coated 10 Mesh bronze screen manufactured by Lakos or equal. Intake structure control equipment located within pump station building to include: dielectric nipple, brass piping, brass ball valve, brass pressure regulator, brass wye filter with 20 mesh stainless steel screen, brass unions on each side of wye filter for maintenance purposes, glycerin filled pressure gauges on each side of wye filter, and motorized ball valve controlled by pump station control panel.

## 2.3 MECHANICAL JOINT

- J. General
  - 1. **This specification shall cover mechanical joint DIP in four-inch (4") through twenty-four inch (24") nominal diameters.**
  - 2. **All DIP shall be manufactured in accordance with AWWA C151.**
- K. Pipe joint shall be "mechanical single gasket" type conforming to applicable requirements of AWWA C111.
- L. DIP shall have normal laying lengths of either eighteen (18) feet or twenty (20) feet. Random pipe lengths are not acceptable.
- M. All mechanical joint glands shall be sized and drilled in accordance with AWWA C111.
- N. Iron used in the manufacture of DIP for these specifications shall have:

1. **Minimum tensile strength – 60,000 psi**
  2. **Minimum yield strength – 42,000 psi**
  3. **Minimum elongation – 10%**
- O. DIP shall have standard thickness cement mortar linings in accordance with AWWA C104.
- P. DIP shall have a bituminous coating, minimum one (1) mil thick, on the pipe exterior, unless otherwise specified.
- Q. As shown in AWWA C151, mechanical joint DIP shall conform, at a minimum, to the following pressure classes:

TABLE 2.2-H: Pressure Class and Wall Thickness – Mechanical Joint Pipe

<i>Diameter (inch)</i>	<i>Pressure Class (psi)</i>	<i>Nominal Wall Thickness (inch)</i>
<b>3</b>	<b>350</b>	<b>0.25</b>
<b>4</b>	<b>350</b>	<b>0.25</b>
<b>6</b>	<b>350</b>	<b>0.25</b>
<b>8</b>	<b>350</b>	<b>0.25</b>
<b>12</b>	<b>350</b>	<b>0.28</b>
<b>16</b>	<b>250</b>	<b>0.30</b>
<b>20</b>	<b>250</b>	<b>0.33</b>
<b>24</b>	<b>250</b>	<b>0.33</b>
<i>Higher pressure class pipe will be required when the W&amp;S Dept determines that excessive dead loads, pressures, or other conditions warrant increased wall thickness.</i>		

- R. Corrosion resistant, high strength, low-alloy steel bolts and nuts shall be used where in contact with the soil, immersed, or in splash zones in accordance with ASTM F3125, Type 3. Acceptable bolts and nuts are:
1. **Cor-Ten**
  2. **Usalloy**

1. **Romac Industries, Inc**
3. **Or approved equivalent.**

## 2.4 MECHANICAL JOINT RESTRAINTS

### A. General

1. **Mechanical joint restraints shall be used for restraining fittings, and valves.**
2. **All mechanical joint pipe restraints shall be incorporated in a follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Twist-off nuts, sized same as tee-head bolts, shall be used to ensure proper actuating of restraining devices.**

B. Glands shall be manufactured of ductile-iron conforming to ASTM A536, grade 60-42-10. Restraining devices shall be of ductile-iron heated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C153.

C. Mechanical joint restraint devices shall have the following minimum working pressures and shall not be less than piping working pressure ratings:

1. **350 psi with a minimum safety factor of 2:1, for four-inch (4") through twenty-four inch (24") diameter.**

D. Acceptable manufacturers and styles are:

#### 1. **Mechanical Joint Restraint**

- a. ***EBAA Iron, Inc. – MEGALUG, SERIES 1100***
- b. ***Uni-Flange Corp. – SERIES 1400***
- c. ***Romac Industries, Inc.***

#### 2. **Slip Joint Restraint**

- a. ***EBAA Iron, Inc. – MEGALUG, SERIES 1700***



- b. ***Uni-Flange Corp. – SERIES 1450***
- c. ***Romac Industries, Inc.***

## 2.5 VALVES

### A. GENERAL

1. **All water distribution valves shall open clockwise (right). (Valves on water transmission lines open counter-clockwise (left)).**
2. **All valves shall be the same size as the main unless approved otherwise by the City.**
3. **Valves shall be either mechanical or flanged joint as required.**
  - a. ***Exposed locations shall use flanged joints.***
  - b. ***Buried locations shall use mechanical joints.***
4. **The interior and exterior of all buried valves shall be epoxy coated in accordance with AWWA C550.**
5. **All buried valves shall have a two-inch (2") square-operating nut. The manufacturer shall paint all open right operating nuts red.**
6. **The operating nut on buried valves shall be between four (4) feet and six (6) feet below the finished grade. If, in order to achieve the operating nut depth, it is necessary to use a riser stem, the riser shall be double pinned. The riser stem shall be a solid stem coated to prevent corrosion.**

### B. GATE VALVES

1. **General**
  - a. ***Four-inch (4") through twelve-inch (12") diameter gate valves shall be designed for a minimum working pressure of 200 psi and a test pressure of 400 psi. Sixteen-inch (16") diameter gate valves shall be designed for a minimum working pressure of 150 psi and a 300 psi test pressure.***

- b. ***Sixteen-inch (16") bonnets shall be set vertically.***
- c. ***Non-potable irrigation line gate valves shall be resilient seat gate valves.***

## 2. **Resilient Seat Gate Valves**

- a. ***Resilient seat gate valves shall be manufactured in accordance with AWWA C509.***
- b. ***Valve stems shall be non-rising.***
- c. ***Stem seals shall be provided with two (2) o-ring type stem seals in accordance with AWWA C509.***
- d. ***Acceptable manufacturers of resilient seat gate valves are:***
  - i. ***Mueller***
  - ii. ***Kennedy***
  - iii. ***American AVK Company***

## 2.6 AIR RELEASE, AIR/VACUUM, AND COMBINATION VALVES

- A. Air Release (AR) valves, Air/Vacuum (A/V) valves, and combination air valves shall be manufactured in accordance with AWWA C512.
- B. Air Release and Air/Vacuum Valves
  - 1. **All AR and A/V valves shall be rated a minimum working pressure of 150 psi and a hydrostatic test pressure equal to 150% of the actual rated working pressure of the valve.**
  - 2. **The working parts and seat of the AR and A/V valves shall be brass, stainless steel, or other non-corroding material unless otherwise approved by the City.**
- C. Combination air valves shall have features of both the AR and A/V valve.
- D. The size of the AR valve, A/V valve, or combination air valve shall be as noted on the approved Construction Drawings.
- E. Acceptable manufacturers of Air Release, Air/Vacuum, and Combination Air Valves are:

1. **¾-inch (¾"), one-inch (1"), and two-inch (2") Combination Air Valve – A.R.I. D-040**
2. **Two-inch (2") to ten-inch (10") Combination Air Valve – A.R.I. D060-C HF**
3. **Or approved equivalent.**

## **2.7 VALVE BOX**

- A. Valve boxes shall be cast-iron or ductile iron, buffalo type, two (2) piece boxes with round bases.
  1. **Valve boxes shall have a five and ¼-inch (5-¼") screw type shaft suitable for depth of cover as required.**
  2. **Valve boxes shall be capable of future adjustment for street overlays.**
- B. The word "IRR" shall be cast into the box lid for non-potable irrigation.
- C. Acceptable manufacturers of valve boxes are:
  1. **Tyler 6850 series with drop lid**
  2. **Or approved equivalent.**

## **2.8 CURB STOP**

- A. Curb stop boxes are required with all curb stops.
- B. Acceptable manufacturers and models of ¾-inch (¾") and one-inch (1") curb stop boxes are:

TABLE 2.6-B: ¾" and 1" Curb Stop Boxes

Manufacturer	Model
Mueller (¾")	H-10300 (6 ft)
Mueller (1")	H-10300-99002 (6 ft)
Ford	EM2-50-47-42R or EM2-55-46-48R (6 ft)

***Or approved equivalent.***

- C. Acceptable manufacturers and models of 1 ½"-inch (1 ½") and two-inch (2") curb stop boxes are:

TABLE 2.6-C: 1 ½" and 2" Curb Stop Boxes

Manufacturer	Model
Mueller	H-10300-99002 (6 ft)
Ford	EM2-50-57 (6 ft)

***Or approved equivalent.***

- D. Curb stop boxes for three-inches (3") and larger shall be in street valve box and conform to the valve box information included in this specification.

## 2.9 METER

- A. All water meters shall be purchased from the Water and Sewer Department. No exceptions.

## 2.10 METER SETTERS

- A. Meter setters to be installed as shown in the City of Greeley Standard Drawings.
- B. All ¾-inch (¾") and one-inch (1") meter setters shall have a meter stop inlet valve with a lockwing. The acceptable manufacturers and models of meter setters are:

TABLE 2.8-A: ¾" and 1" Meter Setters

Manufacturer	Model
Mueller	H-1489
Ford	V-82 with lockable wing and flare connection

***No substitutions allowed.***

- C. All 1 ½"-inch (1 ½") and two-inch (2") meter setters shall have a meter stop inlet valve with a lockwing, and a built-in locking by-pass. The acceptable manufacturers and models of meter setters are:

TABLE 2.8-B: 1 ½" and 2" Meter Setters

Manufacturer	Model
Mueller	H-1423 with flair adaptor
Ford (1 ½")	VV76-86-12B-11-66
Ford (2")	VV77-87-12B-11-77

## 2.11 METER PITS AND VAULTS

- A. ¾-inch (¾") meters and one-inch (1") meters:
- Meter pits shall be twenty inches (20") in diameter and shall be constructed of rigid High Density Polyethylene (HDPE).**
  - Meter pit covers shall be constructed of aluminum with cap type top lid and frost-proof rubber inner lids.**
    - The minimum allowable opening for meter pit covers shall be eleven-inches (11") diameter.***
    - All meter pit covers shall have a 27/32-inch worm-lock with a Standard Waterworks pentagon head.***
- B. 1 ½ -inch (1 ½") and two-inch (2") meters:
- Meter pits shall be forty-eight inches (48") diameter.**

2. **Meter vaults shall be a pre-cast concrete manhole in accordance with construction specification *Section 03400, Precast Concrete*. All vault openings shall have modular sealing units and be grouted with non-shrink grout between the modular sealing unit and the vault inside and outside wall.**
  3. **Meter vault covers shall be a cast iron ring and aluminum manhole cover with a twenty-four-inch (24") diameter opening unless approved otherwise, in writing, by the City Water and Sewer Department. All meter vault covers shall have the word "IRR" cast in the lid.**
  4. **Reference City of Greeley Standard Drawings.**
- C. Three-inch (3") and larger meters:
1. **Meter vaults shall be a pre-cast concrete in accordance with construction specification *Section 03400, Precast Concrete*.**
  2. **All vault openings shall be link-sealed.**
  3. **All joints shall be watertight.**
  4. **Meter vault covers shall be a cast iron ring and cast iron or aluminum manholes cover with a thirty-six inch (36") diameter opening unless approved otherwise by the City. All non-potable irrigation meter vault covers shall have the word "IRR" cast in the lid.**
  5. **Include gravel sump**
  6. **Reference City of Greeley Standard Drawings for vault size and layout.**

## **2.12** TRACER WIRE AND TEST STATIONS

- A. Copper: 12-gauge stranded or solid, watertight insulation for direct bury.
- B. Connector: solderless, 3M Direct Bury splice kit, or approved equivalent.

- C. Test station to be flush-to-grade type complete with insulated terminal block with four (4) terminals.
- D. Cover shall be lockable, cast-iron, with "NON-POTABLE TEST" cast in the cover.
- E. Test station section to be four-inch (4") inside diameter with an eighteen-inch (18") long flared plastic shaft to prevent removal.

### **PART 3— EXECUTION**

#### **3.1 THRUST RESTRAINT**

- A. Anchorage and Blocking
  - 1. **Reference City of Greeley Standard Drawings.**
  - 2. **Concrete thrust blocks and anchors for preventing movement shall be provided at all mechanical joint plugs, tees, crosses, reducers, valves, bends, and changes in direction of 11-¼° or more.**
  - 3. **The minimum size of thrust blocks and thrust anchors shall be determined from the table provided on the City of Greeley Standard Drawings.**
  - 4. **The concrete thrust block-bearing surface shall be excavated into undisturbed soil.**
    - a. *All loose soil shall be disposed of, and the location where the thrust block is to be poured shall be carefully shaped to provide a uniform bearing surface of the required size.*
    - b. *The concrete thrust block bottom shall be flat, and sides shall be vertical.*
    - c. *If soil is to be disturbed, making a concrete thrust block or thrust anchor unusable, alternate restraining systems must be approved for use by the Water and Sewer Department prior to pipeline installation.*
  - 5. **The concrete thrust block shall be formed to provide access to fittings, valves, and hydrants. Care shall be taken not to**

**block outlets or to cover bolts, nuts, clamps, or other fittings to make them inaccessible.**

6. **The concrete thrust block shall be extended from the fitting or valve to be blocked to undisturbed earth. Concrete thrust blocks shall be constructed so that joints and drain holes are clear and accessible.**
7. **Concrete shall be separated from fittings, valves, and hydrants by eight (8) mil polyethylene film.**
8. **The City shall be notified a minimum twenty-four (24) hours prior to concrete being placed.**

**B. Restraining Devices**

1. **If concrete thrust blocks cannot be used for any reason, or if otherwise required, push-on and mechanical joints may be restrained with mechanical restraint systems.**
2. **The Design Engineer shall determine the length of pipe to be restrained for each situation where mechanical restraint systems are to be installed. Refer to Construction Drawings or coordinate with City as necessary for location.**

**3.2 NON-POTABLE IRRIGATION MAIN AND SERVICE ENCASEMENTS**

- A. Refer to construction specification *Section 02445, Casing Pipe – Borings and Encasements* for typical non-potable irrigation main and service encasement requirements.

**3.3 NON-POTABLE IRRIGATION MAIN BORINGS**

- A. Refer to construction specification *Section 02445, Casing Pipe – Borings and Encasements* for non-potable irrigation main boring requirements.

**3.4 NON-POTABLE IRRIGATION SERVICES**

**A. General**

1. **Non-potable irrigation service lines shall not be installed in trenches with other conduits/utilities. A service line shall be**



**separated from other conduits a minimum ten (10) feet horizontally and eighteen-inches (18") vertically.**

- 2. There shall be no physical connections between the non-potable irrigation system and the potable water system.**
- 3. Non-potable irrigation services not utilized shall be abandoned. Refer to appendix section A9 – Policies Impacting Design and Construction for abandonment procedures.**
- 4. The contractor shall mark the location of non-potable irrigation services with a stamped "IRR" four-inches (4") high, three-inches (3") wide into the face of the curb and gutter.**

### **3.5 IRRIGATION SERVICES**

- A. Non-potable service lines shall be greater than 1 ½" in diameter.
- B. Non-potable irrigation services 2" in diameter shall be Municipex®, Uponor AquaPEX®, three-inches (3") in diameter shall be AWWA C900-16 polyvinyl chloride (PVC).
- C. The non-potable irrigation service for a given lot must be tapped on the non-potable irrigation main within the confines of the extended property lines unless excepted by the City for the irrigation of multiple outlots. Refer to appendix section A7 – Compound Tap Exemption Policy for Irrigation of Multiple Outlots. Otherwise, irrigation systems from a single non-potable irrigation service shall only be allowed for use on that single property. Refer to City of Greeley Charter and Code, Title 14: Public Services, Section 14.04.200 for compound tap restrictions.
- D. Pressure boosters are allowed if required. Booster pumps must be prefabricated units with variable speed controls. Provide submittal cut sheets for City approval prior to ordering booster pump.
- E. Non-potable irrigation services shall not be located under driveways, trees, or other permanent structure.
- F. Non-potable irrigation services shall be located a minimum five (5) feet inside the property being served.
- G. Non-potable irrigation service taps shall be separated by at least two (2) feet, measured along the non-potable irrigation main length, including when taps are

on opposite sides of the non-potable irrigation main. Non-potable irrigation service taps shall also be a minimum two (2) feet from all joints, fittings, or valves.

- H. The corporation stop, curbstop, meter, that portion of the service line between the corporation stop and the meter, and five (5) feet past the meter shall all be the same diameter.
- I. Non-potable irrigation service curb stops shall be located  $\pm$  one (1) foot from the property line or easement boundary. Non-potable irrigation service vaults shall be located as close as possible beyond the curb stop. See City of Greeley Standard Drawings for additional service and meter installation requirements.
- J. Non-potable irrigation service vaults shall normally be located after the curbstop in a landscaped area. Meter vaults shall not be installed in any street, parking area, driveway, or sidewalk unless otherwise approved by the City. Meter vault shall be rated for HS-20 traffic loadings unless otherwise permitted by the City. Curbstops in paved areas shall be in a street valve box.
- K. There shall be no major landscaping (trees, boulders, or shrubs with mature growth greater than three (3) feet), buildings, or other permanent structures within ten (10) feet of the meter vault.

### 3.6 PIPE INSTALLATION

- A. Pipe Laying
  - 1. **Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.**
  - 2. **Measure for grade at top of pipe.**
  - 3. **Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.**
  - 4. **Lay pipe with the bells pointing in the direction the work is progressing.**
  - 5. **Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:**
    - a. ***Shorter pipe lengths.***

- b. *Special mitered joints.*
  - c. *Standard or special fabricated bends.*
6. **After joint has been made, check pipe alignment and grade.**
  7. **Place sufficient pipe zone material to secure pipe from movement before next joint is installed.**
  8. **Take effective measures to prevent opening of joints during bedding and backfilling operations.**
  9. **Complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade as each length of pipe is placed in the trench. Make adjustments in line and grade by scraping away or filling pipe bedding under the entire length of the pipe, except at bells, and not by wedging, blocking, or mounding up the pipe or bells.**
  10. **Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints. Do not disturb the pipe after the jointing has been completed.**
  11. **Install the pipeline so that a positive or negative grade is maintained between high and low points.**
  12. **The minimum and maximum depth of cover three and one-half (3 ½) feet and six (6) feet respectively, for non-potable irrigation mains, unless otherwise indicated on the Construction Drawings.**
  13. **Tracing wire shall be installed with PVC pipe, ductile iron pipe (DIP), and steel pipe.**
  14. **As required for non-potable irrigation main construction, install underground marking tape in accordance with City of Greeley Standard Drawings. Tape installation shall be continuous along the pipe.**

B. Valves

1. **With the exception of tapping valves, flanged valves shall not be buried.**
2. **Valves shall be installed in such a manner that the operating nut is perpendicular to the pipe.**
3. **Buried valves shall be supported on concrete as shown in the City of Greeley Standard Drawings.**

C. Valve Boxes

1. **All buried valves shall be provided with a valve box, including fire hydrant valves, unless indicated otherwise on the approved Construction Drawings.**
2. **Install the valve box so that no stress is transmitted to the valve.**
3. **Set the valve box plumb and directly over the valve's operating nut. Valve operators that are mounted to one (1) side of the valve shall be located to the south or west of the valve.**
4. **The soil around the valve box shall be carefully compacted around the barrel, with hand equipment, to minimize misalignment and settling of the backfill.**

D. Air Release, Air/Vacuum, and Combination Air Valves

1. **AR, A/V, and combination air valves shall be installed at the locations shown on the Construction Drawings.**
2. **Air relief and vacuum relief valves shall be installed in accordance with City of Greeley Standard Drawings.**

E. Curb Stops

1. **Reference City of Greeley Standard Drawings for curb stop location.**
2. **The Contractor shall adjust the curb stop box to ½-inch (1/2") above final grade prior to final inspections.**

3. **Curb stop boxes shall not be placed in driveways or sidewalks.**
4. **Curb stop boxes shall be plumb.**
5. **Contractor shall demonstrate to the City that curb stops are operable prior to City acceptance.**

F. Meter Pits and Vaults

1. **Meter pits or vaults shall not be installed in any street, parking area, driveway, or sidewalk unless prior written permission is obtained from the Water and Sewer Department. If a meter pit or vault is permitted to be located in any traffic area, the pit/vault shall be required to be designed to withstand HS-20 traffic loading.**
2. **There shall be no major landscaping (trees, boulder, shrubs over three (3) feet in mature height, etc.) or structure (retaining wall, etc.) within ten (10) feet of the meter pit or vault. All shrubs less than three (3') feet in mature height shall be located no closer than five (5) feet to a meter pit or vault.**
3. **The finished ground around the meter pit or vault shall slope away from the lid at a minimum grade of two percent (2%).**
4. **There shall be no plumbing connections inside the meter pit or vault.**
5. **All tees, connections, and couplings shall be a minimum five feet (5') from the meter pit or vault wall, and be on the outlet side.**
  - a. ***There shall be no tees, connections, or couplings installed between the curb stop and the meter setter or meter horn.***
  - b. ***All pipes coming into any meter vault or pit three-inches (3") or larger shall be flanged pipe only.***

6. **The meter pit or vault shall be adjusted to ½-inch (1/2") above final grade if the surrounding grade is changed.**

G. **Non-Potable Irrigation Mains and Services in Relation to Other Utilities**

1. **Non-potable irrigation mains and services shall have a minimum ten (10) feet horizontal and eighteen-inches (18") vertical separation from all utilities measured from outside diameter.**
2. **Where non-potable irrigation lines cross above or below potable water lines with less than eighteen-inches (18") clearance, pipe encasement shall be designed and constructed so as to protect the potable water line.**
3. **Non-potable irrigation main crossings under any open irrigation ditch shall have a minimum five (5) feet of cover and shall be encased.**
4. **Dry utility crossings shall be encased in high density polyethylene pipe (HDPE), Standard Dimension Ratio (SDR) 11 from edge to edge of the easement or right-of-way, or ten (10) feet on either side of the non-potable irrigation main, whichever is greater. Right angle utility crossings are permitted above and below the non-potable irrigation main. Parallel installation of other utilities in exclusive non-potable irrigation easements is not permitted.**
5. **Bored utility crossings shall have a minimum twenty-four inches (24") of vertical clearance from the outside diameter of the utility casing to the outside diameter of the non-potable irrigation line if the bored utility crosses above the non-potable irrigation line and a minimum thirty-six inches (36") of vertical clearance from the outside diameter of the utility casing to the outside diameter of the non-potable irrigation line if the bored utility crosses below the non-potable irrigation line.**
6. **If there are horizontal or vertical clearance conflicts between the non-potable irrigation line and a utility, the City may**

**require that the non-potable irrigation main be lowered, raised, or realigned in order to maintain the required clearances.**

7. **For a non-potable irrigation line crossing situation not specifically mentioned in this section, the crossing requirements provided in these Criteria shall be applied to that particular situation to the best extent possible.**

#### H. Tracer Wire

1. **Tape to top centerline of pipe every three (3') to four (4') feet with adhesive tape or plastic tie straps such that wire remains in place during embedding of pipe.**
2. **Tracing wire shall be brought to the surface on the inside of a test station behind every fire hydrant. Provide a two (2) foot loop of wire at each test station.**
3. **Tracer wire shall be installed per City of Greeley Standard Drawings.**

#### I. Test Station

1. **Test stations shall be installed per City of Greeley Standard Drawings.**

### 3.7 UNDERGROUND MARKING TAPE AND IDENTIFICATION

- A. Underground marking take shall be installed above non-potable irrigation mains when purple colored pipe or appurtenances are not used for construction.

1. **Buried appurtenances not available from the manufacturer in the purple color (ie. valves, fittings) shall be identified in the field by securing marking tape to the surface of the item.**
2. **Accessible appurtenances not available from the manufacturer in the purple color (ie. valve boxes, meter covers), shall be primed and painted with two (2) coats of an approved rust inhibitive paint.**

- B. At a minimum, underground marking tape for the non-potable system shall be colored purple, three-inches (3") wide, four (4) mils thick, non-detectable polyethylene. The marking tape shall be solid colored with black letters stating "CAUTION – BURIED NON-POTABLE WATER LINE BELOW" or "CAUTION – BURIED RECLAIMED WATER LINE BELOW".
- C. Marking tape to be installed in accordance with City of Greeley Standard Drawings. Marking tape shall meet APWA Uniform Color Code specifications.
- D. Approved signs and labels shall be posted bearing the warning "CAUTION – BURIED NON-POTABLE WATER LINE BELOW" or "CAUTION – BURIED RECLAIMED WATER LINE BELOW". See the City of Greeley Standard Details an example of an approved sign. Coordinate signage requirements with the City of Greeley during design process.

### 3.8 NON-POTABLE IRRIGATION WATER STORAGE FACILITIES (PONDS)

- A. General
  - 1. **All water to be stored in the non-potable irrigation pond and the pond location shall be approved by the Water and Sewer Department prior to proceeding with facility design.**
  - 2. **The Design Engineer shall determine the high and low operating levels, required design storage volume, pond surface area, evaporation rates, and the location of the pump station intake pipe. The Design Engineer shall provide supporting calculations, design methodologies, and references documentation used to establish the design parameters. All information shall be included in the non-potable irrigation system design report.**
  - 3. **If topography allows it, the Design Engineer shall design gravity fed drain pipe from the water source to the irrigation pond. If topography does not allow gravity drainage from the water source to the irrigation pond, the Design Engineer must design lift station to be reviewed by the City.**
  - 4. **Signage must be provided on site indicating non-potable water is utilized for irrigation. Obtain signage approval by the City.**



## B. Volume Design

1. **Non-potable irrigation ponds shall be sized to accommodate a minimum four (4) days of supply during peak irrigation periods. Volume design shall consider losses due to seepage, evaporation, and pond volume that cannot be utilized (i.e. below the pump station intake).**

**Pond side slopes shall be 4:1 safety bench for 12-feet horizontally and 3:1 slope thereafter to achieve maximum depth of pond.**

2. **Fencing must be installed around the pond for safety purposes. Fencing materials must match architectural components of development or HOA fencing requirements.**
3. **The non-potable irrigation pond shall be designed with either an overflow spillway if topography allows or an overflow structure hydraulically connected to storm sewer.**
  - a. ***Spillway or overflow structure must be designed for a 6-inch per hour storm event applied to the catchment area the pond intercepts.***
  - b. ***The Design Engineer shall provide necessary design information and construction details on the Construction Drawing for the irrigation pond overflow/spillway.***
4. **If the non-potable irrigation pond is intended to also function as a stormwater detention facility, with approval from the City, the Design Engineer shall include the additional detention storage volume over and above that required for irrigation operations. Refer to the SDDC, for stormwater detention pond design requirements.**

## C. Non-Potable Irrigation Pond Liner

1. **All non-potable irrigation ponds shall be designed with an approved liner treatment to reduce seepage losses. Field conditions, constructability, ground water, storage volume fluctuations, costs, warranty, and operation and maintenance**

shall be considered in the selection and design of the pond liner system. Approved pond liner materials include: 30 MIL PVC, 30 MIL HDPE, 45 MIL EPDM, 36 MIL RPP, 30 MIL RPE. A layer of 8 oz. geotextile must be included on top and bottom of pond liner material for protection purposes.

2. The Design Engineer shall specify a suitable pond liner alternative depending on the project conditions. The pond liner treatment is subject to approval by the City.
3. If high groundwater is present, a trench drain system shall be designed beneath the liner for construction purposes and to provide a means for relieving groundwater pressure and air buildup once the pond is in operation. The trench drain shall be discharge away from the pond facility.
4. **Additional Pond Liner Information:**
  - a. *Lining installation in areas where groundwater pressure can occur should be avoided. The bottom of the liner should be above the water table to prevent bulging in the liner.*
  - b. *Site structures such as piping, concrete, and drains shall be completed prior to lining installation.*
  - c. *The design and construction requirements for special liner installations such as anchor trenches, pipe protrusions through the liner, liner vents, batten attachments to concrete structures, seaming methods/testing, subgrade preparation, and cover treatment over the liner shall be in accordance with the manufacturer's recommendations or specifications.*
  - d. *At a minimum the liner must be covered with twelve-inches (12") of clean soil. The depth and type of liner cover will vary based on project conditions or as recommended by the manufacturer.*
  - e. *Construction details for special installation items shall be provided by the Design Engineer to be included on the Construction Drawings.*

- f. ***There shall be no major landscaping (trees, shrubs) with mature height greater than three (3) feet planted within ten (10) feet of the liner anchor trench.***

D. Shoreline Protection

1. **Non-potable irrigation ponds shall be designed with a perimeter shoreline treatment to protect against wave action erosion. Due to the numerous shoreline treatments available (i.e. riprap, boulders, perimeter concrete walls, geotextile products, riparian plantings) the Design Engineer shall specify a suitable shoreline treatment depending on the project conditions. Shoreline treatment for erosion protection is subject to approval by the City.**
2. **The Design Engineer shall make special considerations regarding the selection, design, and installation of shoreline protection to ensure that the liner warranty is not invalidated. Coordination with the liner manufacturer is required.**
3. **Areas subject to scouring water velocities, such as at the discharge conveyance into the pond or beneath the pond fill line/service, shall be adequately protected against erosion and wash out (i.e. concrete splash pad, grouted riprap, large boulders).**
4. **Appropriate construction details for shoreline and erosion protection shall be provided by the Design Engineer to be included on the Construction Drawings.**

3.9 SHOULDER MONTH WATER SUPPLY

- A. All non-potable irrigation systems require a back up potable water tap (shoulder tap) for providing irrigation water when it is in demand but non-potable water is unavailable (“shoulder months”).
- B. Shoulder month water supplies must be approved by the City.
- C. Shoulder month water shall be discharged into the non-potable irrigation system’s water storage facility (pond). A two (2) foot air gap shall be provided

between the shoulder tap discharge and the maximum operating or overflow elevation of the pond water surface, whichever is greater.

- D. The shoulder tap shall be metered and sized by the Design Engineer to sustain the daily irrigation demands. Only City personnel may operate the shoulder tap.

### 3.10 WATER WELLS

- A. Under certain circumstances the City may accept water supplies taken from wells located on lands being developed. The Water and Sewer Department will evaluate each of these proposals on a case by case basis.

### 3.11 NON-POTABLE IRRIGATION PUMPING SYSTEMS

- A. General

1. **The non-potable irrigation pump station location shall be approved by the Water and Sewer Department prior to proceeding with facility design.**
  - a. *The non-potable irrigation pump station shall be located on property deeded to the City.*
  - b. *The non-potable irrigation pump station site shall be sized with flexibility to upsize capacity in the future (if applicable) in the case of planned future development.*
  - c. *Pump station must allow convenient access for repair, maintenance, and overhaul.*
  - d. *Non-potable irrigation pump stations shall be accessible from public right-of-way via all-weather access.*
2. **For systems requiring 200 gpm or more:**
  - a. *Non-potable irrigation pump station manufacturer must be SynchroFlo - no exceptions. The Criteria provided here offer guidelines for the design of non-potable irrigation pumping systems. Each pumping system is unique and requires special design, therefore, it is the Design Engineer's responsibility to design a fully operational system for the given conditions and provide necessary construction details and specifications to accompany the design.*

3. **For systems requiring less than 200 gpm:**
  - a. ***Non-potable irrigation station manufacturer must be SynchroFlo or Quantum Pumps, if approved. The Criteria provided here offer guidelines for the design of non-potable irrigation pumping systems. Each pumping system is unique and requires special design, therefore, it is the Design Engineer's responsibility to design a fully operational system for the given conditions and provide necessary construction details and specifications to accompany the design.***
4. **Refer to construction specification *Section 08200, Irrigation Pump Station* for additional non-potable irrigation pump system requirements.**

B. Pump System Design

1. **The pump system shall be designed with multiple, variable frequency drive (VFD), vertical turbine pumps to provide irrigation flows at varying demands and constant discharge pressure.**
2. **Prefabricated pumping stations shall have a capacity of not less than one-hundred-twenty percent (120%) of the projected irrigation demand with a discharge pressure in conformance with section 1.4.B of these Criteria.**
3. **Pump efficiency shall be a minimum eighty percent (80%) at the specified operating point.**
4. **The pumping system shall be designed to function in an outdoor environment and to have enclosures and covers as required for proper operation and maintenance of the system.**
5. **The pump system design shall include a skid assembly to support all pump components during shipping and to serve as the installed mounting base. The base shall be of sufficient size and strength to resist twisting and bending from**

**hydraulic forces and support the full weight of all components (ie. pumps, motors, piping, valves, etc.).**

- 6. The pump system shall include pressure maintenance pump for sustaining the pressure in the non-potable irrigation system during non-irrigated times and shall operate no more than every 15-minutes to maximize pump life. If the pressure maintenance pump operates more frequently (ie. due to mainline leaks) then allow larger pressure differential (in pump controls) until pressure maintenance pump requires operation to recover lost water pressure. .**
- 7. Additional pump system design components shall include, but not be limited to, motors, valves, gauges, mounting and support structures, power and electrical equipment, control systems, operator interface devices, alarms, data acquisition and telemetry, monitoring devices, building requirements, installation and operation instructions, and recommended maintenance.**
- 8. The Construction Drawings for the irrigation pumping system shall show a typical layout, elevation and plan views, and critical dimensions for the pump system, building, wet well, etc. The pump system manufacturer is responsible for the layout and design of the pump system supplied and any special coordination issues that affect the critical dimensions, layout or orientation of the pump system.**

### **3.12 AERATION SYSTEMS**

- A. The Criteria provided here offer generic guidelines for the design of non-potable irrigation pond aeration systems. Each aeration system is unique and requires special design, therefore, it is the Design Engineer's responsibility to design a fully operational system for the given conditions and provide necessary construction details and specifications to accompany the design.**
- B. Refer to construction specification *Section 11230, Aeration System* for additional non-potable pond aeration system requirements.**
- C. Aeration System Design**

1. **Coordinate the aeration system design and construction with the non-potable irrigation pump station design. House and incorporate aeration system components within the irrigation pump station building.**
2. **Aeration system design components shall include, but are not be limited to, air compressors, aftercoolers, condensate separators, electrical controls, valves, pipe manifolds, flow meters, gauges, aeration pods, housing requirements, installation and operational instructions, and recommended maintenance.**
3. **The Construction Drawings for the aeration system shall show a typical layout, elevation and plan views, and critical dimension for the aeration system design and construction. The aeration system manufacturer is responsible for the layout and design of the aeration system supplied and any special coordination issues that affect the critical dimensions, layout or orientation of the aeration system.**
4. **Aeration system must provide a minimum of four (4) pond volume turnovers in a 18-hour period everyday during operation.**
5. **Aeration System supplier is Cascade Industries - no exceptions.**

### **3.13** WATER DEDICATION REQUIREMENTS FOR NON-POTABLE IRRIGATION

- A. A total water dedication of three (3) ac-ft per acre for irrigated landscape will be required for new developments.
- B. Contact the Water and Sewer Department and refer to City of Greeley Charter and Code, Title 14: Public Service regarding water dedication requirements.

### **3.14** MASTER EQUIPMENT TABLE

- A. The following table summarizes the main non-potable irrigation infrastructure items. If Contractor elects an alternative, obtain approval from City prior to ordering equipment.

<b>Item</b>	<b>Manufacturer/Model</b>	<b>Related Specification Section</b>
Pond Liner	30 MIL PVC, 30 MIL HDPE, 45 MIL EPDM, 36 MIL RPP, 30 MIL RPE	02662
Intake Structure	Lakos or Equal. Self Flushing, Phosphorus Coated 10 Mesh Bronze Screen.	02840
Intake Pipe	C900-16 PVC, HDPE DR11	02840
Aeration System	Cascade Industries Pre-Packaged Aeration System	02830
Pump Station	SynchroFlo Industries Pre-Packaged Pump Station (200 gpm or more) Synchro Flo or Quantum Pumps (if approved) (less than 200 gpm)	08200
Flow Meter	Magnetic meter by Badger Meter	15140
Piping	C900-16 DR18 Size Dependent, Purple, Gasketed. Fittings: Ductile Iron	02811
Gate Valves	Mueller, American Flow Control, M&H, Clow, Kennedy, AVK	02811
Air Vacuum Relief Valves	APCO 200 A.2, ARI D-040	02811
Flush Hydrants	Kupferle KUP 9800A	02811