January 12, 2017

Mr. Peter S. Hays
Division of Reclamation, Mining & Safety
1313 Sherman Street, Room 215
Denver, CO 80203

Re: Permit M-1992-069 – 83rd Joint Venture Pit
July 12, 2016 Inspection (Signature Date December 14, 2016)
Corrective Action Response

Dear Peter:

As requested in the Division's report of its July 12, 2016 inspection of the 83rd Joint Venture site, Aggregate Industries (AI) had the Wright Water Engineer's, Inc. (WWE) September 2, 2016 report entitled "Engineering Evaluation of Nature and Causes of Erosion in Agricultural Field Adjacent to Boyd Irrigation Company Pipeline and Damage to Pipeline" reviewed by AI's consultants, Tetra Tech. Enclosed is Tetra Tech's letter dated January 11, 2017 regarding their review and evaluation of the WWE report and the March 2011 Preliminary 90% Design Documents for the Boyd Freeman Ditch as referenced in the Tetra Tech letter.

In addition to complying with approved slope reclamation prior to the 2010 flood event, AI believes it would be beneficial for the Division to understand some background related to the relocated Boyd Freeman Ditch through the 83rd Joint Venture site (also referred to as the F Street Hill Property). AI constructed the replacement ditch along the alignment shown in Exhibit F of the approved Reclamation Plan. As discussed during the meeting between the Division and AI on August 26, 2016, AI coordinated with the City of Greeley/Boyd Irrigation Company (City/Boyd) over a period of years regarding replacement of the ditch. AI was constructing a ditch that would deliver historic capacity; however, completion of the ditch was deferred while City/Boyd determined what ditch improvements they might want to incorporate to accommodate additional flows.

Ultimately, the majority of the ditch was constructed as an open ditch that would accommodate historical capacity; however, in order to accommodate an access road along the ditch at the east end of the north boundary of the site, AI proposed to install a piped section. The piped section was upgraded per City/Boyd's request to accommodate greater ditch flows. Enclosed are letters dated February 2, 2006, March 3, 2006 and March 13, 2006 between AI and City/Boyd regarding the requested upgrade. This final section of the ditch was completed in May, 2006, as

Aggregate Industires
West Central Region, Inc.
1687 Cole Boulevard, Suite 300
Golden, CO 80401

Telephone: 303-985-1070

evidenced by the May 11, 2006 invoice AI submitted to City/Boyd for costs associated with the upgrade. No other improvements throughout the rest of the relocated ditch were requested by the City/Boyd.

Please advise me if there is additional information or documentation that would assist the Division in its review of this matter. We would also be happy to meet again to further discuss. You can contact me at connie.davis@aggregate-us.com or (970) 396-5252.

Very truly yours,

Connie N. Davis

Connie N. Davis
Land Manager

Enclosures

Cc: Tetra Tech *(via e-mail)*
Timothy J. Flanagan *(via e-mail)*

TETRA TECH

January 11, 2017

Ms. Connie Davis
Aggregate Industries - WCR, Inc.
1687 Cole Blvd., Ste. 300
Golden, CO 80401

RE: **Colorado Division of Reclamation and Mining Safety Facility Inspection on July 12, 2016 (signature date December 14, 2016) and Wright Water Engineers, Inc. Letter to City of Greeley dated September 2, 2016**

Dear Ms. Davis:

As you requested we have performed and review and evaluation of the above reference documents. Our work focused on the "Problem/Possible Violation" and "Corrective Actions" presented in the Division of Reclamation and Mining Safety Inspection Report:

- *PROBLEM/POSSIBLE VIOLATION: Problem: The City of Greeley submitted a report titled "Engineering Evaluation of Nature and Causes of Erosion in Agricultural Field Adjacent to Boyd Irrigation Company Pipeline and Damage to Pipeline" by Wright Water Engineers, Inc. (WWE) dated September 2, 2016. A copy of the report was forwarded to the Operator on September 7, 2016. Aggregate Industries (AI) and their consultant are reviewing the WWE report and are preparing a response to the report.*
- *CORRECTIVE ACTIONS: The Division awaits a response from the Operator to the WWE report and has imposed a 30-day deadline for receipt of the Operator's response.*

We began our work by reviewing the AI permit for the facility, specifically looking at the grading and revegetating of the pit slope in the area of the breach. The permit stipulates that the reclaimed slope shall be graded to a slope no steeper than 3 horizontal to one vertical (3:1). Topographic data is presented on Sheet 9 of the Anderson Consulting Engineers March 2011 Preliminary 90% Design Documents for the Boyd Freeman Ditch...Improvements (2011 Ditch Improvements). The contours indicate a graded slope no steeper than 3:1 and the topographic elevations of the top of the slope are consistent with the land west of the pit. Consequently the grading plan is in compliance with the permit. Observations in the field also indicate reclamation slopes flatter than 3:1. The permit also requires revegetating of the slopes. Reviews of aerial photograph ground level photos and field observations indicate that the slopes in the area of the breach were well vegetated prior to the breach.

The WWE report documents that the northwest portion of the pit and the area of the breach is within the 100-year flood plain. We agree with their delineation of the 100-year flood plain and AI was aware of the condition. The pit is no closer to the Cache la Poudre River than approximately 1,200 feet. Consequently, there was no requirement in the permit for armoring of the slopes of the pit or construction of spillways.
The WWE report concludes that sheet flow across the F-Street Agricultural Field became concentrated in the area of the breach. The concentrated flows resulted in erosion that began with the 2013 flood and was reactivated in the 2014 flood. We agree that the increased flow velocities led to the erosion of the reclamation slope, hence the breach of the pipeline and erosion of the F- Street Agricultural Field.

Given that AI's reclamation was in compliance with the permit raises the question, why did the breach occur where it did? Our review of the aerial photography available from Google Earth indicated that the breach occurred just east of a small pond. Review of the 2011 Ditch Improvements design drawings indicates that a 15-inch diameter corrugated metal culvert (CMP) was present in the area of the breach. The culvert likely acted as an overflow/spillway for the pond. The design called for the removal and reinstallation of the culvert. The 2011 Ditch Improvements also called for the placement of fill in the area of the 2013 breach, see sheet 4. The specification for the backfill was a non-plastic material that would be highly susceptible to erosion.

In our review of the 2011 Ditch Improvements design we noticed that the design called for 48-inch diameter SDR 35 PVC pipe. This is a pipe that is used for gravity flow sewers. The design of the 2011 Ditch Improvements is an inverted siphon pipeline, a pressure pipe design, not gravity. Our field observation and photographs of the failed pipe revealed that the as built pipe is actually a corrugated plastic pipe, trade name Duramax. This pipe is also gravity sewer pipe not intended for use in pressure applications. All pipes of this size, regardless of gravity or pressure conditions, should have joint restraint, thrust blocks and be properly backfilled. Those details are not provided in the 2011 Improvements Design document available to us. The actual pipe installed if not properly backfilled and joint restrained would be susceptible to leakage at the joints that can lead to erosion around the pipe and subsequent settlement above the pipe. The leakage condition was observed by DRMS during the DRMS inspection. See page 2 of 7 the last paragraph second sentence. "*The pipeline was not operational at the time of the inspection due to leaking joints in the pipeline.*"

In summary, we believe AI is in compliance with their permit. The origin of the 2013 erosion that led to the breach and damage to the pipeline, could have been caused by three modes of failure: 1. Simple sheet flow down the reclamation slope, 2. Leaky joints in the 48-inch inverted siphon that resulted in settlement above the pipeline, or 3. The removal of the 15-inch CMP that resulted in uncontrolled overtopping of the reclamation slope.

We recommend that the design of the 48-inch inverted siphon be reviewed to insure the integrity of the pipeline and protection of reclamation slope. The reclamation slope in the area of the breech should be armored to protect from future floods.

Sincerely,

TETRA TECH

By _____
Tom Hesemann P.G., C.E.G.
SVP, Water, Energy & Infrastructure

By _____
William J Rapp III, P.E.
Eng. Project Mgr. II Civil P.M.

Boyd Irrigation Company

February 2, 2006

Aggregate Industries
Attn.: Connie Davis
P.O. Box 337231
Greeley, Colorado 80633

Re: Boyd-Freeman Ditch Replacement at F Street (Hill) Property

Dear Connie;

This letter is to confirm your discussion with Tracy Kittell on January 31, 2006 in regards to the installation of pipe in place of an open ditch for a section of the Boyd-Freeman Ditch. It is my understanding that a portion of the ditch needs to be placed in a pipe instead of an open ditch due to space restrictions that will not allow a stable ditch section plus an access road. The section of the ditch you are proposing to pipe starts at the upstream end of the 30-inch diameter concrete pipe that has recently been installed under the railroad bridge and continues approximately 1300 feet upstream at a 0.2% grade. The contractor is proposing to use corrugated, smooth bore polyethylene pipe. If any of this is incorrect please let me know as soon as possible.

Since pipe is going to be used in place of an open ditch there are several items that need to be addressed for construction:

1. To convey 11 cubic feet per second (cfs), City of Greeley's prorate portion of the ditch decree, the pipe diameter will need to be 24-inches (Attachment 1). The City would like to reserve the ability to convey up to 20 cfs which would require 30-inch diameter pipe. The City is willing to reimburse Aggregate Industries for the pipe material cost difference between 24-inch and 30-inch diameter pipe per the City's over-sizing policy.

2. The pipe needs to be installed per the attached Trench Cross-Section Detail and Trenching, Backfilling, and Compaction specification.

3. Six foot diameter Manholes will need to be installed approximately every 400 feet and at horizontal alignment changes for maintenance purposes. Manholes need to be installed per the attached Manhole details and specifications.

4. The connection to the existing concrete pipe needs to be accomplished using a cast-in-place concrete box with a poured channel. The box needs to be reinforced and a manhole cover shall be installed in the roof of this structure.

5. The transition from the ditch to the pipe needs to be protected with rip-rap per the attached detail. This rip-rap needs to go approximately XX feet up stream of the pipe and be placed on the ditch side slopes as well as the bottom. A three foot deep, one foot thick concrete cut-off wall needs to be installed on the entrance to the pipe to be sure water does not flow under the pipe and potentially erode the soil and cause a failure of the pipe. A trash rack will also need to be installed at the entrance of the pipe.

To help keep your costs to a minimum the Boyd Irrigation Company would be willing to advise you and/or your contractor on the construction of the pipeline. Should you desire to utilize this offer please contact Tracy Kittell as he is representing the Boyd Irrigation Company on this project. I need to point out that the irrigation company's representative will not direct the contractor and Aggregate Industries is responsible for all costs associated with this project with exception of over-sizing the pipe should the City of Greeley decide on this option. Should you have any questions or need additional information please don't hesitate to contact me.

Sincerely,

M E Howell

Martin Howell, President
Boyd Irrigation Company

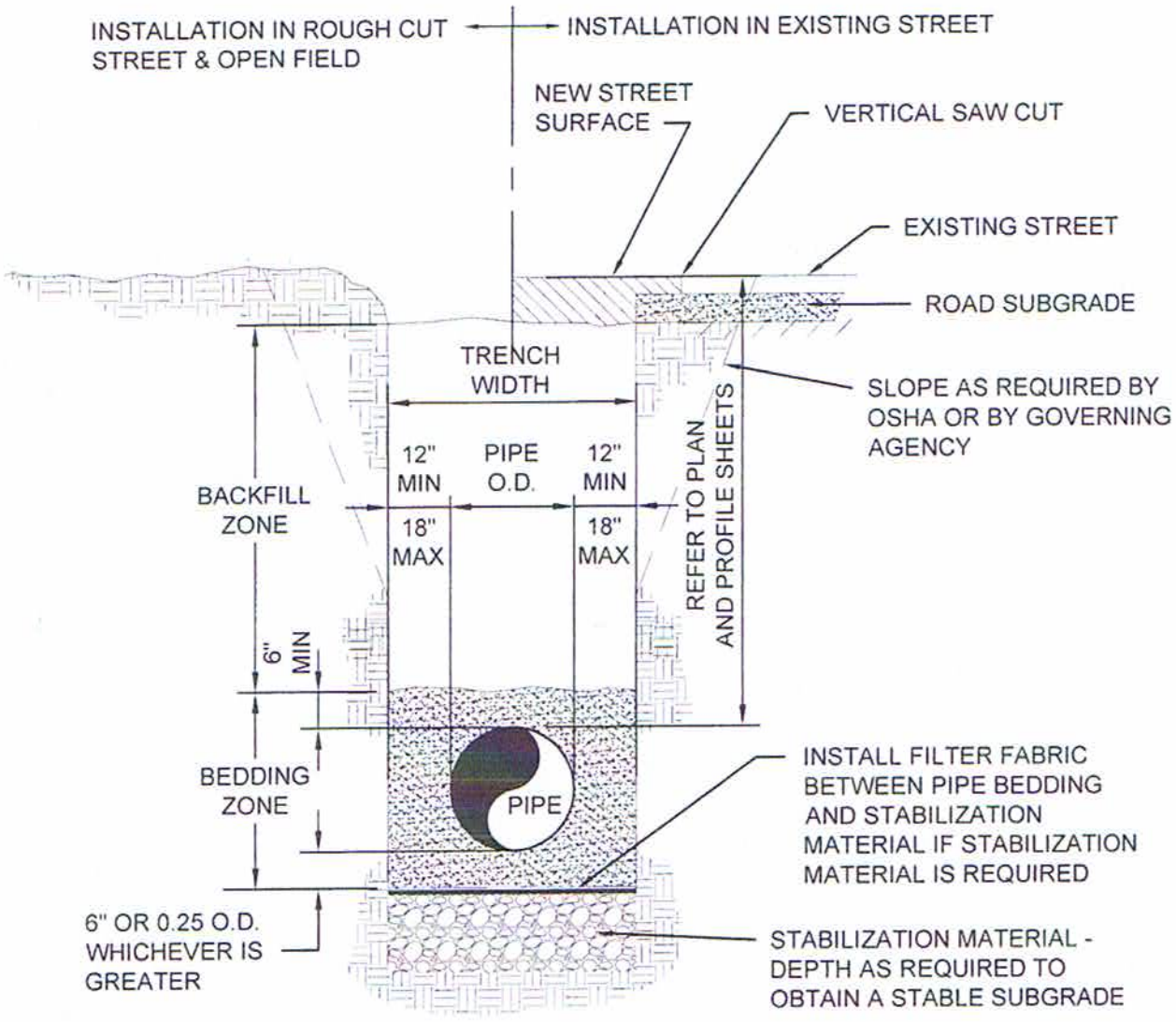
Encl.:

cc: Carl Hill, 83 Joint Venture
Gary Tuttle, LaFarge North America
City of Greeley Water and Sewer Department

ATTACHMENT 1

Worksheet for Circular Pipe - 1

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Full Flow Capacity	
Input Data		
Roughness Coefficient:	0.011	
Channel Slope:	0.20	%
Diameter:	24	in
Results		
Discharge:	11.96	ft^3/s
Normal Depth:	24.00	in
Flow Area:	3.14	ft^2
Wetted Perimeter:	6.28	ft
Top Width:	0.00	ft
Critical Depth:	1.24	ft
Percent Full:	100.0	%
Critical Slope:	0.00399	ft/ft
Velocity:	3.81	ft/s
Velocity Head:	0.23	ft
Specific Energy:	2.23	ft
Froude Number:	0.00	
Maximum Discharge:	12.86	ft^3/s
Discharge Full:	11.96	ft^3/s
Slope Full:	0.00200	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	in
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	in
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s



NOTES:

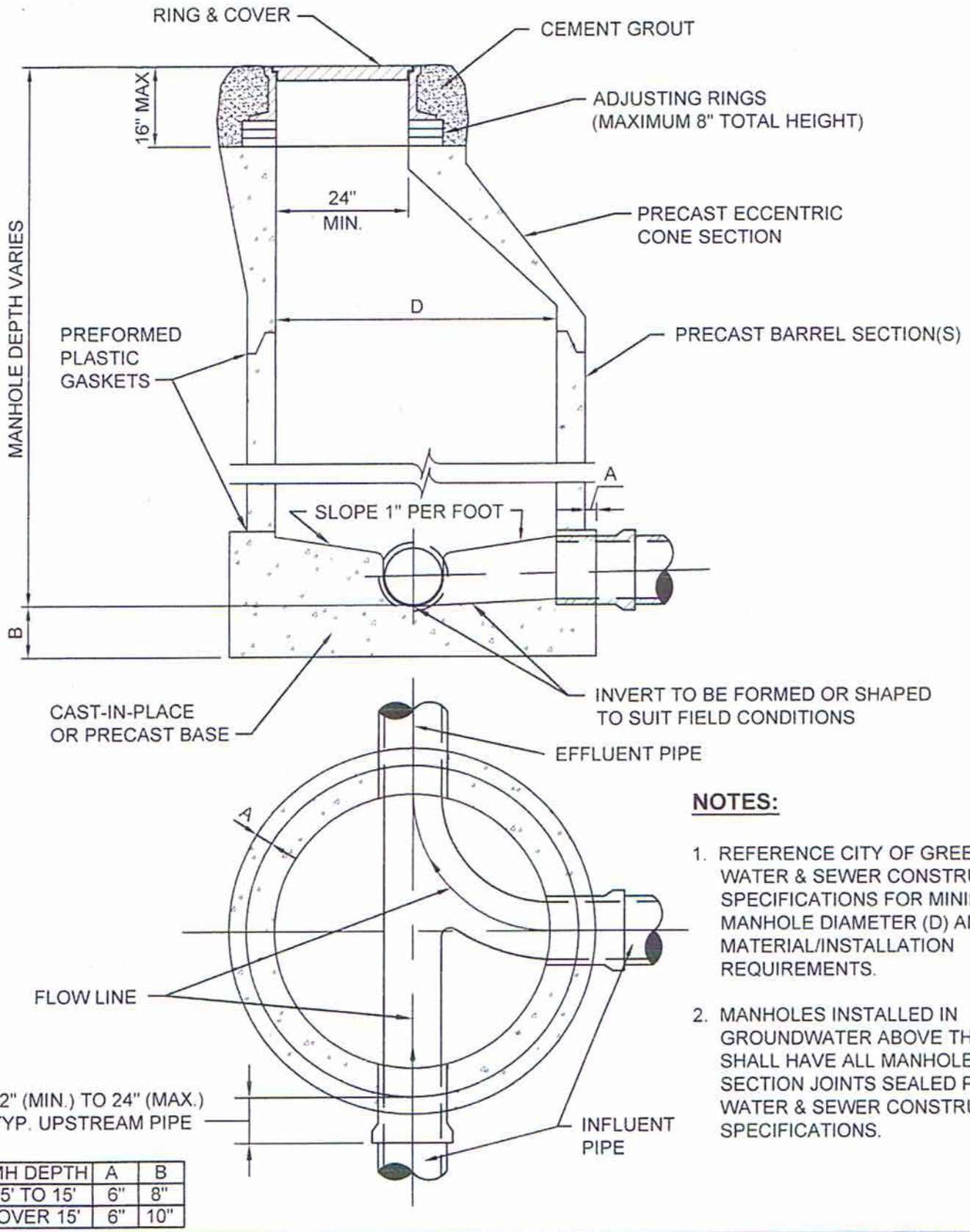
1. REFER TO CITY OF GREELEY WATER AND SEWER CONSTRUCTION STANDARDS AND FOR STABILIZATION, FILTER FABRIC, BEDDING, AND BACKFILL MATERIAL AND COMPACTION SPECIFICATIONS. FOR ANY CONFLICT BETWEEN WATER AND SEWER AND PUBLIC WORKS BACKFILL MATERIAL SPECIFICATIONS AND COMPACTION REQUIREMENTS, THE MORE STRINGENT SPECIFICATION SHALL PREVAIL.
2. REFERENCE CITY OF GREELEY PUBLIC WORKS EXISTING STREET PAVEMENT PATCH DETAIL ASPHALT & CONCRETE (DETAIL S-31) FOR "STREET CUT" REQUIREMENTS IN CITY RIGHT-OF-WAYS.
2. AN OVER EXCAVATED TRENCH SHALL BE REFILLED AND COMPACTED (PER SPECIFICATIONS) UNDER THE DIRECTION OF THE CITY OF GREELEY, CONSTRUCTION SERVICES.
3. UNDER NO CIRCUMSTANCES SHALL PIPE BE LAID IN A PROPOSED FILL AREA PRIOR TO IT BEING COMPLETELY FILLED TO PROPOSED GRADES AND COMPACTED PER CITY OF GREELEY SPECIFICATIONS.
4. COMPACTION TESTING METHODS AND FREQUENCY SHALL BE PERFORMED IN ACCORDANCE WITH CITY OF GREELEY CONSTRUCTION SERVICES REQUIREMENTS.
5. TRENCHES SHALL BE SHORED, BRACED, OR SHEETED AS NECESSARY FOR THE SAFETY AND PROTECTION OF PERSONNEL AND OTHER UTILITIES.

TRENCH CROSS-SECTION

DETAIL NO. WS-2

DATE: JANUARY 2006

SCALE: NTS



MH DEPTH	A	B
5' TO 15'	6"	8"
OVER 15'	6"	10"

NOTES:

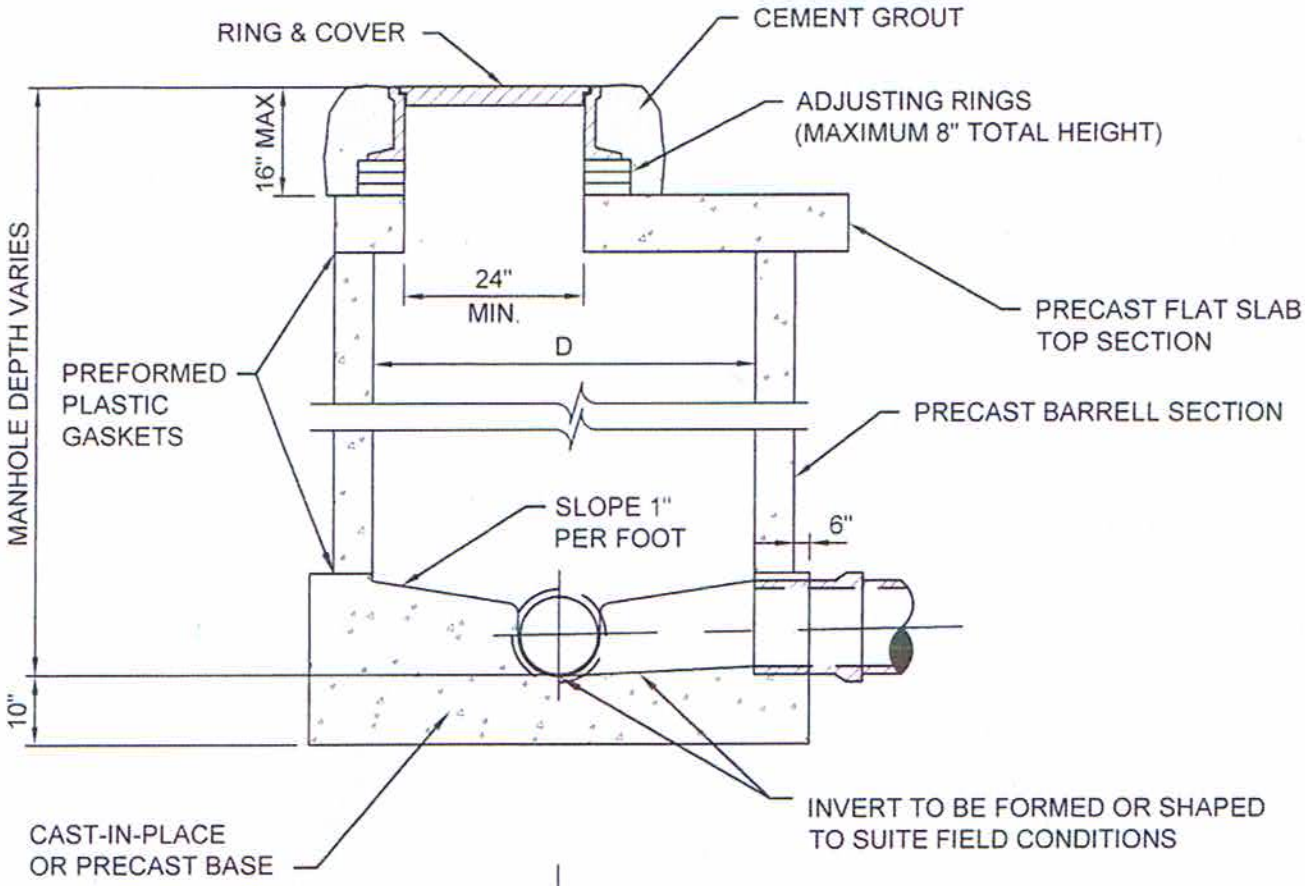
1. REFERENCE CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS FOR MINIMUM MANHOLE DIAMETER (D) AND MATERIAL/INSTALLATION REQUIREMENTS.
2. MANHOLES INSTALLED IN GROUNDWATER ABOVE THE BASE SHALL HAVE ALL MANHOLE SECTION JOINTS SEALED PER WATER & SEWER CONSTRUCTION SPECIFICATIONS.

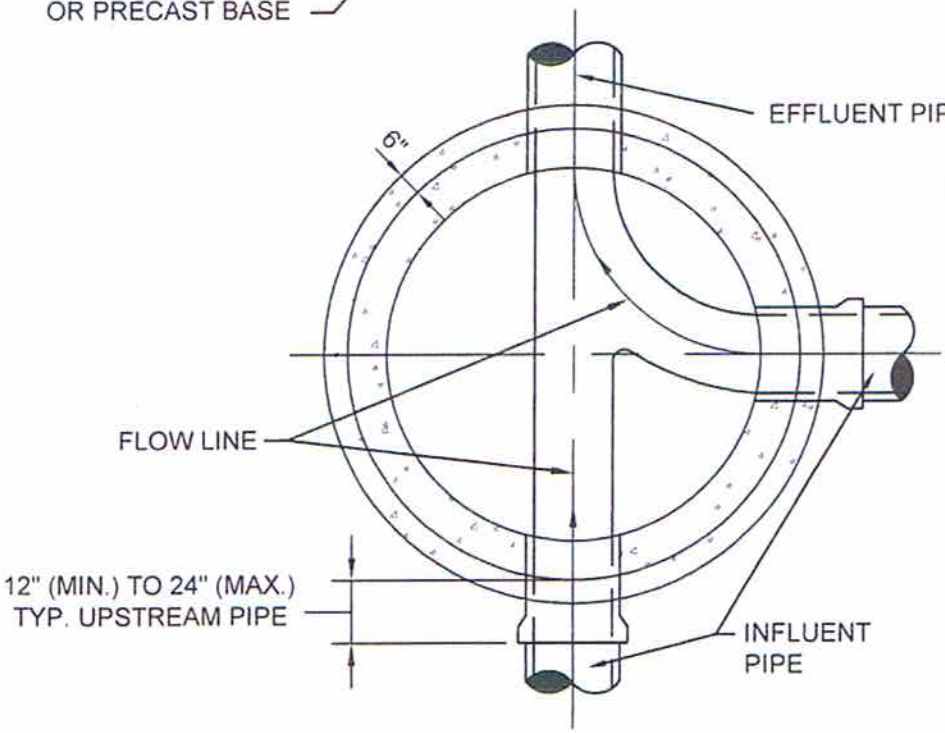
STANDARD MANHOLE

DETAIL NO. SS-1

DATE: JANUARY 2006

SCALE: NTS





NOTES:

1. REFERENCE CITY OF GREELEY WATER & SEWER CONSTRUCTION SPECIFICATIONS FOR MINIMUM MANHOLE DIAMETER (D) AND MATERIAL/INSTALLATION REQUIREMENTS.
2. MANHOLES INSTALLED IN GROUNDWATER ABOVE THE BASE SHALL HAVE ALL MANHOLE SECTION JOINTS SEALED PER WATER & SEWER CONSTRUCTION SPECIFICATIONS.

SHALLOW MANHOLE

DETAIL NO. SS-3

DATE: JANUARY 2006

SCALE: NTS

SECTION 02320
TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 SCOPE

A. This section covers excavation and trenching, including drainage, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines and appurtenances.

1.02 QUALITY ASSURANCE

A. Soil compaction tests shall be performed in accordance with:

1. AASHTO T99 Method A The Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 in.) Drop, latest revision.

2. ASTM D698 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600kN-m/m^3)), latest revision.

3. ASTM D2922 Standard Test Methods for Density of Soils and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth), latest revision.

4. ASTM D3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth), latest revision.

B. Construction Staking

1. Construction staking shall be performed under the direct supervision of a Professional Land Surveyor licensed in the State of Colorado.

2. Adequate staking shall be provided to establish acceptable horizontal and vertical control.

3. Offsets shall be staked so that vertical and horizontal alignment may be checked by the OWNER'S representative.

4. All survey notes and construction staking notes shall be entered into bound, hard cover field books and shall be made available to the city upon request.

5. All survey data, which is developed by the CONTRACTOR or the ENGINEER in performing surveys which are required by the work, shall be available to the City for examination and reproduction throughout the construction and warranty periods.

6. The ENGINEER and OWNER'S representative shall be informed of all field changes to the approved Construction Drawings. Acceptance for the changes shall be required from both the ENGINEER and OWNER'S representative prior to the changes being made in the field.

1.03 JOB CONDITIONS

A. Drainage and Groundwater

1. Maintain excavations and trenches free from water during construction.

2. Remove water encountered in the trench to the extent necessary to provide a firm subgrade, to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.

3. Divert surface runoff and use sumps, gravel blankets, well points, drain lines or other means necessary to accomplish the above.

4. Maintain the excavation or trench free from water until the structure, or pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

   a. Piping used to drain water from the trench shall not be left in the trench when backfilled.

5. Groundwater barriers shall be installed if deemed necessary by the City.

6. Groundwater shall be prevented from entering into previously constructed pipe.

7. The pipe under construction shall not be used for dewatering.

8. CONTRACTOR shall obtain all necessary permits and authorization in writing prior to starting dewatering operations.

   a. If groundwater will be discharged into an irrigation ditch, pond, stream, or waterway, or will drain into an irrigation ditch, pond, stream, or waterway, a Colorado Department of Public Health and Environment dewatering permit will be required.

      (1) Permit applications may take up to 30 days to be reviewed by the State.

      (2) CONTRACTOR is required to complete and process the Discharge Monitoring Report (DMR) that is typically a part of the dewatering permit.

   b. Upon finishing the work, the CONTRACTOR shall be responsible for completing a Colorado Department of Public Health and Environment Discharge Termination Notice.

c. Copies of all Colorado Department of Public Health and Environment permits shall be submitted to the City Department of Public Works prior to the start and at the end of dewatering operations.

B. Blasting

1. Blasting is not permitted within the jurisdiction of the City unless authorized by the Director of Public works.

C. Sequencing

1. Perform pipeline installation within 300 linear feet of trench excavation.

   a. This distance may be amended, with the City's acceptance, based upon job conditions.

2. Perform trench backfill within 300 linear feet of pipe installation.

   a. This distance may be amended, with the City's acceptance, based upon job conditions.

3. Backfill shall be completed, at the end of each day, to the extent that no damage from hydrostatic pressure, floatation, or other cause will result.

4. Perform clean-up within 500 linear feet of trench excavation unless prior approval is given by the City.

5. Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the time duration of that opening is to be minimized. The City shall direct the amount of open trench that is acceptable for the condition encountered.

6. Maintain access to private residence and businesses.

D. Underground Obstructions

1. The ENGINEER and/or CONTRACTOR shall field verify all As-Built Record drawing information obtained from the City.

2. CONTRACTOR shall notify each utility owner and request utilities to be field located by surface reference.

3. 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.

   a. The size, location, and elevation of underground utilities and obstructions shall be recorded on the As-Built drawings.

b. In the event there is a conflict, the CONTRACTOR shall notify the ENGINEER, OWNER'S representative, and affected utility company.

c. In the event there is a conflict, the proposed work may be modified, only after a proposed solution is presented and accepted by the Water and Sewer Director.

4. Maintain, protect and support by shoring, bracing or other means existing utilities, appurtenances and structures.

5. Take such protective measures as the utilities may direct where protection, alternations or moving of the utilities is required.

E. Weather

1. Do not place pipe bedding or pipe 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.

1.04 Maintenance and Correction

A. The CONTRACTOR, or owner, shall be responsible for maintaining and repair of all trench settlement which occurs within the two-year warranty period, and make necessary repairs to pavement, sidewalks, or other structures which may be damaged as a result of trench settlement.

PART 2 MATERIALS

2.01 GENERAL

A. All material shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, broken asphalt and concrete, and any other 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. All imported material shall have a liquid limit not greater than 30 and a plasticity index not greater than 6.

2.02 STABILIZATION MATERIAL

A. Top six-inches (6") of pipe subgrade - If the existing soil in the trench bottom is judged to be unsuitable by the OWNER'S representativeand/or the ENGINEER, the top six-inches (6") of the pipe subgrade shall be removed at a minimum and replaced with a stabilization material. If deemed necessary by the City, additional material from the trench bottom, over the six-inches (6") required, may be required to be removed and replaced with a stabilization material.

1. Stabilization material is crusher-run rock, conforming to ASTM D448, or CDOT #357.

SIZE	PERCENT PASSING
2 ½"	100
2"	95-100
1"	35-70
½"	10-30
#4	0-5

a. Or preapproved substitute.

B. Geotextile fabric shall be used in conjunction with stabilization material unless prior written approval is received from the City.

1. Geotextile fabric shall conform to CDOT, Section 712.08, Class A Table 712-2.

2. Acceptable types of geotextile fabric and their manufacturers are:

a. Bidim C-28 and C-34.

b. Fibretex Grade 150, by "Crown Zelerbach".

c. Mirafi 500 X, by "Celanese".

d. True Tex MG-100, by "True Temper".

e. Or an approved equivalent.

C. Subgrade below top six-inches (6") - Same as top six-inches (6") except that broken concrete and rock may be included in sizes permitting compaction as specified without discernible voids.

2.03 BEDDING ZONE MATERIALS

A. The bedding zone shall extend from either four-inches (4") or 0.25 O.D., whichever is greater below the invert of the pipe to an elevation six-inches above the top of pipe.

B. Bedding and Pipe Zone materials:

1. Angular crushed rock, conforming to CDOT #67.

SIZE	PERCENT PASSING
1-inch	100
¾-inch	90-100
3/8-inch	20-55
No. 4	0-10
No. 8	0-5

C. Concrete

1. Thrust blocks and structural concrete.

a. Compressive strength: 3500 psi at 28 days minimum.

b. Class B concrete, reference Colorado Department of Transportation, Division of Highways, State of Colorado "Standard Specifications for Road and Bridge Construction" section 601.

2. Flow fill (non-shrinkable trench backfill)

a. Non-shrinkable trench backfill shall meet the requirements of City of Greeley Street Construction Specifications, latest edition, Section 02223, Structure Backfill, Part 2.2.

D. Ground Water Barrier Material

1. Soil Classification

a. GC - clayey gravels, gravel-sand-clay mixtures.

b. SC - clayey sands, sand-clay mixtures.

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.

2.04 TRENCH BACKFILL MATERIAL

A. Trench backfill material shall be placed from the top of the pipe to six-inches (6") below the ground surface, or bottom of topsoil layer, or to the bottom of the pavement subgrade, whichever is applicable.

B. Trench backfill material shall be soil free from any rocks or stones which are larger than six-inches (6"), in any dimension.

1. Material shall not be lumpy or hard but shall be finely divided.

2. Trench backfill material within a street or alley right-of-way shall conform to the requirements of City of Greeley Street Construction Specifications, latest edition, Section 02595, Street Cut and Excavation Repair, Part 3.2.B.

PART 3 EXECUTION

3.01 PREPARATION

A. Topsoil shall be stripped from areas which are to be disturbed by construction and stockpiled.

1. Top soil shall be segregated from non-organic trench material and debris.

3.02 TRENCHING

A. Excavate trenches by open cut methods, except where boring or tunneling is indicated in the Construction Documents, required by jurisdictional agencies or desired by CONTRACTOR and approved by the City to avoid removal of obstructions.

B. Do not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, or other property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

C. Use mechanical equipment so designed and operated that the rough trench excavation bottom elevation can be controlled with uniform trench widths and vertical sidewalls from an elevation one foot above the top of the installed pipe to the bottom of the trench, and trench alignment 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.

1. CONTRACTOR shall follow the most current regulations concerning excavations set forth by OSHA; 29 CFR Part 1926.

D. Excavation In Rock

1. Over excavate a minimum of six inches below the bottom of the pipe.

2. Backfill with Granular Material.

E. Preparation of Trench Bottom

1. Grade trench bottoms uniformly to provide clearance for each section of pipe.

2. Remove loose materials, water and foreign objects.

3. Provide firm subgrade suitable for application of bedding material.

4. Wherever unstable material is encountered in the bottom of the trench, over-excavate such material to a depth suitable for construction of a stable

subgrade, as determined by the City. Backfill over excavation with Stabilization Material and compact. A layer of geotextile fabric shall be placed between the stabilization material and the bedding material.

F. Stockpiling Excavated Materials

1. Pile suitable material for backfilling in an orderly manner a sufficient distance from banks of the trench to avoid overloading and to prevent slides or cave-ins.

   a. CONTRACTOR shall follow the most current regulations concerning excavations set forth by OSHA.

2. Remove and dispose of excess excavated materials not suitable or not required for backfilling.

3. Do not stockpile excavated material against existing structures or appurtenances.

G. Trench Widths

1. Trench width shall be maintained to within three-inches (3") of that specified on plans or otherwise directed by the City.

   a. The trench wall shall not be undercut in order to obtain clearance.

3.03 PIPE BEDDING

A. Bedding classes: Place pipe bedding in accordance with the details shown on the Construction Drawings. Provide higher class bedding where unexpected trench conditions are encountered.

B. 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.

   a. Pipe shall not be supported by the bells.

2. Deposit bedding material and compact uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

3. Compact granular bedding material by vibrating, slicing with a shovel, or bent tee-bar.

3.04 GROUND WATER BARRIERS

A. Ground water barriers shall be constructed in such a manner to impede passage of water through bedding material.

1. Ground barriers shall be approximately four feet (4') long, keyed at least one foot (1') into the trench wall and bottom, and spaced 10 feet upstream of each manhole for gravity sanitary sewers or every 400 feet on water lines and sanitary sewer force mains.

2. Ground water barriers shall extend to a point two feet (2') above the existing ground water level or one foot (1') above the bedding material which ever is greater.

B. Over Depth Excavation

1. Restore over excavated subgrades to proper elevation with compacted stabilization material or compacted granular material.

3.05 BACKFILLING AND COMPACTION

A. Backfill trench promptly after completion of pipe bedding.

B. Deposit backfill material in uniform layers not exceeding eight inches in uncompacted thickness. Increased layer thickness may be acceptable provided it is demonstrated that the specified compacted density will be obtained.

C. Use methods and equipment appropriate for the backfill material. Do not use equipment or methods that will transmit damaging shocks to the pipe.

1. Do not perform compaction by jetting or water settling.

D. Import material for trench backfill if compaction can not be obtained with job excavated material or required by the City.

E. Rock and bedrock encountered in the excavation shall be separated from other excavated material and legally disposed of properly by CONTRACTOR.

F. Replace topsoil after construction and grading to the depth of stripping over all areas disturbed by construction operations and which will not receive other surface treatment.

G. Obtaining a proper site for disposal of excavated rock and bedrock material, excess excavated materials, and material not suitable for backfilling is the responsibility of CONTRACTOR.

3.06 FIELD QUALITY

A. Field Compaction/Moisture Control.

1. Field quality control compaction tests shall be conducted to determine compliance of compaction methods with specified density in accordance with ASTM D2922 (AASHTO T238) - Tests for Density of Soil and Soil - Aggregate In-Place by Nuclear Methods.

B. Compaction shall be to the following minimum densities, reference ASTM D698 or AASHTO T99 Method A unless otherwise indicated.

1. Ground water barrier material: 95%

2. Pipe bedding.

   a. Compacted granular material: 80% (ASTM D4253, D4254)

3. Trench backfill.

   a. Within right-of-way and under areas of permanent surface improvements: Reference City of Greeley Street Construction Specifications, latest edition, Section 02595, Street Cut and Excavation Repair, Part 3.2.

   b. Under footings, foundations or structures: 100%.

   c. Seeded areas: 80%.

   d. Al other locations: 95%.

   e. Do not compact topsoil.

4. Where granular materials are used in lieu of cohesive soils reduce the above percentages by 15% to arrive at the relative density and ASTM D4253 and D4254 shall apply.

C. Moisture Content

1. All compacted backfill shall be within 2% (+/-) of the optimum moisture content of the soil as determined by AASHTO T99 or ASTM D698.

2. Water shall be added to the material, or the material shall be harrowed, disced, bladed, or otherwise worked to insure a uniform moisture content, as specified.

D. Moisture/density tests shall be performed at a depth of two feet (2') above the top of the pipe bedding and in two foot (2') increments up to the final grade, or as determined by the City.

E. Moisture/density tests shall be performed at a minimum of 200 linear feet (200'), as measured along the center line of the pipe, or as determined by the City.

F. Water services shall have a minimum of one density test per service.

G. Sanitary sewer services shall have a minimum of two density tests per service or at the City Inspector's discretion.

H. Moisture/density tests in the vicinity of vaults, valve boxes, and manholes shall be

performed at a minimum of one foot (1') away from the vault/manhole sections or valve box.

1. Tests shall be performed in random directions from the vault, manhole, or valve box, on separate lifts.

2. A minimum of one (1) test shall be performed, on opposite sides of the structure, for every two feet (2') of backfill material.

I. Quality control moisture/density tests are the responsibility of the CONTRACTOR and shall be performed by a private Geotechnical Consultant.

1. Test reports shall be submitted to the City by the CONTRACTOR or the Geotechnical consultant within twenty-four (24) hours of the test, or by the end of the next working day.

a. Copies of the field work sheets are acceptable until final reports are submitted.

2. Summarized test results shall be submitted to the City prior to the initial acceptance of the water or sanitary sewer system.

3.07 COMPACTION TEST FAILURE

A. If the required state of 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. In cases where there is a failure to achieve the required state of compaction or moisture the City may require that the backfill be removed and recompacted or replaced.

B. Irrigation pipeline/manhole testing may be required after recompaction if the testing had been performed prior to recompaction.

1. Irrigation pipeline testing shall be performed between manholes on both sides of area of recompaction.

2. Irrigation manhole testing shall be performed if recompaction occur in the vicinity of the manhole.

END OF SECTION

SECTION 02375
RIPRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work of this section shall include excavation, grading and installation of all riprap, and bedding placed at the locations shown on the Drawings. The materials to be used for the construction of such structures shall be as specified herein.

1.02 RELATED SECTIONS

A. Section 02240 – Water Control and Dewatering

B. Section 02315 – Excavation and Embankment

1.03 SUBMITTALS

A. The CONTRACTOR shall cooperate with the ENGINEER in obtaining and providing samples of all specified materials. The CONTRACTOR shall submit certified laboratory test certificates for all items required in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Riprap:

Riprap used shall be the type designated on the Drawings and shall conform to the following:

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	d_{50} * (Inches)
Type VL (Class 6)	70 - 100	12	6
	50 - 70	9	
	35 - 50	6	
	2 - 10	2	
Type L (Class 9)	70 - 100	15	9
	50 - 70	12	
	35 - 50	9	
	2 - 10	3	
Type M (Class 12)	70 - 100	21	12
	50 - 70	18	
	35 - 50	12	
	2 - 10	4	

Type H (Class 18)	70 - 100	30	18
	50 - 70	24	
	35 - 50	18	
	2 - 10	6	
Type VH (Class 24)	70 - 100	42	24
	50 - 70	33	
	35 - 50	24	
	2 - 10	9	

* d_{50} = Mean Particle Size

1. The riprap designation and total thickness of riprap shall be as shown on the Drawings. The maximum stone size shall not be larger than the thickness of the riprap.

2. The specific gravity of the riprap shall be 2.65 or greater.

3. Neither width nor thickness of a single stone of riprap shall be less than 1/3 of its length.

4. Broken concrete or asphalt pavement shall not be acceptable for use in the work. Rounded riprap (river rock) is not acceptable unless specifically designated on the Drawings.

5. The color of the riprap shall be as approved by the OWNER prior to delivery to the project site. Color shall be consistent on the entire project and shall match the color of rock to be used for all other portions of the work. Color required for this project shall be green-gray rock.

6. Minimum density for acceptable riprap shall be 165 pounds per cubic foot. The specific gravity shall be according to the bulk-saturated, surface-dry basis, AASHTO T85.

7. The riprap shall have a percentage loss of not more than 40 percent after 500 revolutions when tested in the Los Angeles machine in accordance with AASHTO Test T96.

8. The riprap shall have a percentage loss of not more than 10 percent after 5 cycles when tested in accordance with AASHTO Test T104 for ledge rock using sodium sulfate.

9. The riprap shall have a percentage loss of not more than 10 percent after 12 cycles of freezing and thawing when tested in accordance with AASHTO Test T103 for ledge rock, procedure A.

10. Rock shall be free of calcite intrusions.

11. Each load of riprap shall be reasonably well graded from the smallest to the largest size specified. Stones smaller than the 2-10 percent size will not be permitted in an amount exceeding 10 percent by weight of each load.

Control of gradation will be by visual inspection. However in the event the ENGINEER determines the riprap to be unacceptable, the ENGINEER will pick 2 random truck loads to be dumped and checked for gradation. Mechanical equipment and labor needed to assist in checking gradation shall be provided by the CONTRACTOR at no additional cost.

B. Bedding:

1. Gradation for Granular Bedding

U.S. Standard Sieve Size	Percent by Weight Passing Square Mesh Sieves Type I	Type II
3 Inch		90 - 100
1-½ Inch		
¾ Inch		20 - 90
3/8 Inch	100	
No. 4	95 – 100	0 - 20
No. 16	45 - 80	
No. 50	10 - 30	
No. 100	2 - 10	
No. 200	0 - 2	0 - 3

Granular bedding designation and total thickness of bedding shall be as shown on the Drawings. Granular bedding shall meet the same requirements for specific gravity, absorption, abrasion, sodium sulfate soundness, and freeze-thaw durability as required for riprap and specified above.

C. Geotextile Fabric:

Where soil conditions dictate, geotextile fabric shall be placed directly on excavated slopes, channel beds, etc. prior to the placement of any riprap bedding or riprap. The extent and location of geotextile placement will be shown on the Drawings.

Geotextile fabric shall be Trevira S1120 or approved equivalent under all riprap.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Channel slopes, bottoms, or other areas that are to be protected with riprap shall be free of brush, trees, stumps, and other objectionable material and be graded to a smooth compacted surface. The CONTRACTOR shall excavate areas to receive

riprap to the subgrade for granular bedding. The subgrade for bedding materials shall be stable. If unsuitable materials are encountered, they shall be removed and replaced as Muck Excavation in accordance with Section 02315 of the Specifications. Unsuitable materials shall be disposed of from the site by the CONTRACTOR at his expense. After an acceptable subgrade for granular bedding material is established, the bedding shall be immediately placed and leveled to the subgrade elevation. Immediately following this, the riprap shall be placed. If bedding material is disturbed for any reason, it shall be replaced and graded at the CONTRACTOR's expense. In-place bedding materials shall not be contaminated with soils, debris or vegetation before the riprap is placed. If contaminated, the bedding material shall be removed and replaced at the CONTRACTOR's expense.

3.02 PLACEMENT

A. Following acceptable placement of geotextile fabric, granular bedding, riprap placement shall commence as follows:

1. Machine Placed Riprap: Riprap shall be placed on the prepared slope or channel bottom areas in a manner which will produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids. Riprap shall be machine placed, unless otherwise stipulated in the Drawings or Specifications.

When riprap is placed on slopes, placement shall commence at the bottom of the slopes working up the slope. Place the riprap in a stepped fashion with the bottom of the uphill riprap below the top of the downhill riprap by half of the height of the riprap minimum.

The entire mass of riprap shall be placed on either channel slopes or bottoms so as to be in conformance with the required gradation mixtures and to lines, grades, and thickness shown on the Drawings. Riprap shall be placed to its 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.

All material going into riprap protection for channel slopes or bottoms shall be so placed and distributed that there will be no large accumulations of either the larger or smaller sizes of stone. Some hand placement may be required to achieve this distribution.

It is the intent of these Specifications to produce a fairly compact riprap protection in which all sizes of material are placed in their proper proportions. Unless otherwise authorized by the ENGINEER, the riprap protection shall be placed in conjunction with the construction of embankments or channel bottoms with only sufficient delay in construction of the riprap protection, as may be necessary, to allow for proper construction of the portion of the embankment and channel bottom which is to be protected. The 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 the OWNER. If the bedding materials are removed or disturbed, such material shall be replaced prior to replacing the displaced riprap.

2. Hand Placed Riprap: Hand placed riprap shall be performed during machine placement of riprap and shall conform to all the requirements of Section 02375 PART 2 above. Hand placed riprap shall also be required when the depth of riprap is less than 2 times the nominal stone size, or when required by the Drawings or Specifications.

   After the riprap has been placed, hand placing or rearranging of individual stones by mechanical equipment shall be required to the extent necessary to secure a flat uniform surface and the specified depth of riprap, to the lines and grades as shown on the Drawings.

3. Soil Replacement In and Over Riprap: Where riprap is designated to be buried, place onsite excavated material that is free from trash and organic matter in riprap voids by washing and rodding. Prevent excessive washing of material into stream. When voids are filled and the surface accepted by the OWNER'S representative, place a nominal 6 inches of soil over the area, or as designated on the Drawings. Fine grade, seed, and mulch per the Specifications.

4. Rejection of Work and Materials: The OWNER'S representativeshall reject placed riprap which does not conform to this Section and the CONTRACTOR shall immediately remove and relay the riprap to conform with said sections.

   Riprap shall be rejected, which is either delivered to the job site or placed, that does not conform to this Section. Rejected riprap shall be removed from the project site by the CONTRACTOR and at his expense.

5. Geotextile fabric shall be installed according to the manufacturer's specifications. Material proposed for use shall be submitted and approved by the ENGINEER prior to installation.

END OF SECTION

SECTION 02605
MANHOLES

PART 1 GENERAL

1.01 SCOPE

A. This section addresses sanitary sewer manholes, and includes the acceptable products, materials, and construction practices which may be used in the construction and installation of manholes.

B. Manholes shall be furnished with all accessories, including steps, base, cone section, and ring and cover.

C. Manholes shall be installed wherever there is a change in size, direction, slope, at junctions, and intervals of not more that four hundred feet (400') for 10-inch and smaller diameter pipe and five hundred feet (500') for pipe diameters greater than 10-inches.

1.02 QUALITY ASSURANCE

A. Standards (as applicable)

1. ASTM A185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement, latest revision.

2. ASTM A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, latest revision.

3. ASTM A996, Standard Specification for Rail-Steel and Axel-Steel Deformed Bars for Concrete Reinforcement, latest revision.

4. ASTM B108, Standard specification for Aluminum-Alloy Permanent Mold Castings, latest revision.

5. ASTM B179, Standard specification for Aluminum alloys in Ingot and molten forms for Castings from All Castings Processes, latest revision.

6. ASTM C33, Standard Specification for Concrete Aggregates, latest revision.

7. ASTM C144, Standard Specification for Aggregate for Masonry Mortar, latest revision.

8. ASTM C150, Standard Specification for Portland Cement, latest revision.

9. ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes, latest revision.

10. ASTM C478, Standard Specification for Precast Reinforcement Concrete Manhole Sections, latest revision.

11. ASTM C497, Standard Test Method for Concrete Pipe, Manhole Sections, or Tile, latest revision.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Manholes shall be handled, stored, and protected in such a manner as to prevent damage to materials.

B. All joint surfaces shall be free from dirt, oil, and grease at the time of installation.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE MANHOLES

A. Precast manhole bases, risers, and cone sections shall be manufactured in accordance with ASTM C478, and shall be made with Type I/II cement.

1. All cone sections shall be the eccentric type.

B. Concrete and Reinforcing Materials

1. All reinforcing materials shall conform to ASTM A615, ASTM A617, or ASTM A185.

2. Reference Section 03400, Precast Concrete.

2.02 CAST-IN-PLACE MANHOLES

A. Cement used in cast-in-place manholes shall conform to ASTM C150, Type I/II.

B. All fine and course aggregate shall conform to ASTM C33.

C. All deformed reinforcing bars shall conform to ASTM A615, or ASTM A996.

1. All bars shall be either Grade 40 or 60.

D. All welded steel wire fabric shall conform to ASTM A185.

E. Concrete used in cast-in-place manholes shall have a minimum of six (6) sacks per cubic yard, and shall develop a minimum compressive strength of 3500 psi after 28 days.

1. Concrete shall have a maximum allowable water/cement ration of 0.50, by weight.

F. Reference Section 03310, Structural Concrete.

2.03 MORTAR

A. Mortar shall be Sand-Cement grout, using the following ratio of ingredients:

1. One part Portland Cement; conforming to ASTM C150, Type I/II.

2. Two parts sand; conforming to ASTM C144.

3. One-half part hydrated lime; conforming to ASTM C207, Type S.

2.04 GROUT

A. Grout shall be one of the following:

1. Pre-mixed, nonmetallic grout; the acceptable types and manufacturers of which are listed below:

a. Master Builders; "Embeco Mortar".

b. Sonneborn; "Ferrolith G-D.S. Redi-Mixed".

c. Or approved equivalent.

2. Job-mixed grout, using the following ratio of ingredients:

a. One part Portland Cement; conforming to ASTM C207, Type I/II.

b. One part sand; conforming to ASTM C 144.

c. One part shrinkage correcting aggregate; the acceptable types and manufacturers are:

(1) Master Builders; "Embeco Aggregate".

(2) Sonneborn; "Ferrolith G-D.S".

(3) Or approved equivalent.

2.05 RING AND COVER

A. All rings shall be maximum eight-inches (8") in height.

B. Iron ring and covers shall be gray iron conforming to ASTM A48, with a coal-tar epoxy finish.

1. Covers shall be non-perforated.

2. Ring and cover shall be a hinged gasket manhole lid with locking device..

3. Acceptable rings and covers are:

a. Pamrex.

b. Rexus

c. Or approved equivalent.

2.06 STEPS

A. Steps in manholes shall be installed.

1. Manhole steps shall be made of a minimum 3/8-inch diameter grade 60 steel reinforcing rod completely encapsulated in a copolymer polypropolyene plastic, conforming to ASTM C478 and ASTM C497.

2. Acceptable steps and their manufacturers are:

a. M. A. Industries; PS-2-PFS.

b. M. A. industries; PS-2PF.

c. Or approved equivalent.

2.07 PREFORMED PLASTIC GASKETS

A. All preformed plastic gaskets shall conform to Federal specification SS-S-00210 (GSA-FSS). Type I, rope form..

B. The diameter of the preformed plastic gasket shall be 1 .5-inches (1.5").

C. Acceptable gaskets and their manufacturers are:

1. Hamilton-Kent Manufacturing Co.; Kent Seal.

2. Con Seal; CS-202.

3. Or approved equivalent.

PART 3 EXECUTION

3.01 INSPECTION

A. Manholes shall be inspected for cracks, abrasions, or other flaws prior to installation.

1. Damaged or flawed manholes shall be rejected and not used.

a. Mark defective manholes and store them on site at a separate location away from the work until after acceptance of the piping system at which time it shall be removed from the site.

3.02 PREPARATION

A. Reference Section 02320, Trenching, Backfilling and Compaction.

3.03 Manhole Construction

A. Standard manholes shall be installed in accordance with Standard Drawings.

B. Flat-top manholes shall be installed in accordance with Standard Drawings.

1. 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.

2. Access holes for flat-top manholes shall be offset from center.

a. If the distance from the manhole cover to the invert of the sanitary sewer line main is less that 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 section pipe through the manhole and by 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.

a. 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. Provide a rubber gasket on the pipe barrel for PVC pipe.

b. All connections with the pipe shall be made without projections or voids.

8. Inverts must meet the requirements of the City.

D. Drop Manholes

1. Where difference in elevation between the incoming sanitary sewer pipe invert and the outgoing manhole invert is less than twenty-four inches (24"), the channel invert through the manhole shall be formed to make a smooth transition between the incoming and outgoing inverts.

2. Where the difference in elevation is twenty-four inches (24") or more, provide an inside drop pipe for the sanitary sewer entering the manhole.

   a. The inside drop shall be the same diameter as the incoming pipe diameter.

   b. Manhole diameter per diameter of inside drop shall be:

Drop Diameter	Manhole Diameter
8-inch and below	5 feet
10-inch to 15-inch	6 feet
18-inch and above	Contact Water & Sewer Dept.

3. The inside drop shall be manufactured by Reliner or approved equivalent.

4. Reference City of Greeley Water and Sewer Standard Drawings.

E. Manholes shall be constructed at the location and to the elevation indicated on the accepted Construction Drawings, or as stated by the Water and Sewer Department to accommodate field conditions.

1. All buried manhole covers shall be referenced to a minimum of two permanent surface references and recorded on the As-Built Record Drawings.

F. The manhole shall be set plumb.

1. Precast concrete adjustment rings shall be used to bring the ring and cover to grade.

   a. the total height from the top of the cone section to the finished grade shall not exceed 16-inches.

   b. the adjustment rings shall be flush with the inside of the manhole and grouted.

G. Step Spacing (If Required)

1. Manhole steps shall be placed 12-inches on center.

2. The maximum distance from the cover of the manhole to the top most step

shall be 28-inches.

3. The maximum distance from the bench of the manhole to the lowest step shall be 18-inches.

H. Manhole sections shall be joined to each other using preformed 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.

I. Adjustment shims, and ring and 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 sections shall be grouted to ring and covers on the inside.

J. All lifting holes, joints, and other imperfections shall be filled with an approved non-shrink grout, to provide a smooth finished appearance.

END OF SECTION

March 3, 2006

AGGREGATE
INDUSTRIES

Mr. Martin Howell, President
Boyd Irrigation Company
c/o Greeley Water & Sewer Department
1100 10th Street, Suite 300
Greeley, CO 80631

Re: Boyd-Freeman Ditch Replacement at F Street (Hill) Property

Dear Martin:

In response to your letter of February 2, 2006 regarding Aggregate Industries' relocation of the Boyd-Freeman Ditch through the above-referenced property, Aggregate Industries (AI) would first clarify that its responsibility for ditch replacement is limited to constructing a ditch which will deliver historic capacity.

Prior to recent up-stream ditch improvements, the Boyd Freeman Ditch entered the Hill F Street property through a 15-inch culvert on the west boundary of the property, and the extents of the Boyd Freeman Ditch which flowed through the Hill F Street property were narrow, shallow open ditches capable of carrying no more than the flows passing into the property through the 15-inch pipe. A lateral off of the main ditch flowed north and exited the property approximately 1100 feet east of the west boundary of the Hill F Street property. The main ditch flowed south, then east to the east end of the property, then north. The ditch exited at the northeast corner of the property, flowed through a small wood box culvert under the railroad and north onto what is now the LaFarge mining operation through another culvert pipe under a road north of the railroad.

AI's open ditch replacement was designed based on the historical information noted above. When AI became aware that an open ditch replacement could not accommodate an access road for approximately the last 1300 feet to the new outlet structure recently installed by the City of Greeley, it was determined that a pipe would be required along this section. Based upon the historical 15-inch inlet at the west property boundary, AI was prepared to install a 15-inch pipe; however, based upon the size of the City's new outlet structure, AI requested a meeting with Tracey Kittell on January 31 to determine if the City would prefer to upgrade to a 24-inch pipe.

According to your February 2 letter, the City would like to upgrade the pipe to a 30-inch diameter and proposes to reimburse AI for the pipe material cost difference between 24-inch and 30-inch diameter pipe. While AI understands the desire of the City to accommodate greater ditch flows, all costs associated with improvements to the ditch through the Hill F Street property to

Aggregate Industries
West Central Region, Inc.
1707 Cole Blvd., Suite 100
Golden, CO 80401

Telephone: 303-985-1070

Connie N. Davis, Land Resources
P. O. Box 337231, Greeley, CO 80633
(970) 336-6526

accommodate flows greater than those historically conveyed through the property are costs to be borne either by the ditch company or the members of the ditch company who desire the improvement.

It is my understanding that the City has assumed it had 11 cfs to take out at the east end of the property based upon a 24-inch culvert pipe at the railroad bridge north of the Hill property. Upon that basis it has apparently been presumed that AI is responsible for a minimum 24-inch pipe. As noted above, the historic exit point is east of the railroad bridge and the size of the culverts would indicate that less than 11 cfs was taken out at that point. I believe that the 24-inch pipe upon which the City's 11 cfs delivery assumption has been made was pipe used for discharging water from the mine operation.

It is AI's position that a 15-inch pipe is sufficient to carry the historical flow that the ditch on the F Street property carried. AI's cost for installing the 15-inch pipe is $40,636. This cost includes pipe bedding per bedding spec 6-inches over the 15-inch pipe, installation of three (3) 4-foot manholes, and grouting and sealing to connect the pipe to the new outlet structure. Upgrading to a 24-inch pipe, requiring a minimum increase to 5-foot manholes and additional pipe bedding, increases the cost to $52,968. This cost again assumes a grout and seal pipe connection to the existing structure. Increasing the pipe to 30-inch, together with additional pipe bedding, 6-foot manholes and the City's preferred 3-sided junction box connection to the existing structure increases the cost to $78,847.

As soon as AI receives direction from the ditch company as to how to proceed, together with a written commitment from either the ditch company or the City of Greeley to reimburse to AI all costs associated with upgrades which exceed AI's share of responsibility in the amount of $40,636, AI will request that it's contractor order the materials and schedule completion of the work at the earliest possible date.

I would be happy to meet with you on site regarding this matter, or if you have any questions or need additional information, please contact me at (970) 336-6526.

Very truly yours,

Connie N. Davis

Connie N. Davis
Land Resources Assistant

cc: Aggregate Industries-WCR, Inc. – File No. 35.15.08

Connie N. Davis, Land Resources
P. O. Box 337231, Greeley, CO 80633
(970) 336-6526

City of Greeley

Water and Sewer Department

1100 10th Street, 3rd Floor • Greeley, CO 80631 • (970) 350-9818

March 13, 2006

Connie N. Davis
Land Resources Assistant
Aggregate Industries – WCR, Inc.
P.O. Box 337231
Greeley, CO 80633

Re: Boyd-Freeman Ditch Replacement at F Street (Hill) Property

Dear Connie:

In response to your March 3, 2006 letter regarding relocation of the Boyd-Freeman Ditch through the Hill Property, please consider this letter as the City's authorization to conduct the additional work necessary to upgrade piping from 15-inch to 30-inch across the Hill property and to invoice the City (send the invoices to my attention) for the costs of the upgrade.

The City will reimburse Aggregate Industries for the upgrade based on an approximate cost of $38,211 (difference between $78,847 for 30-inch pipe and $40,636 for 15-inch pipe). This reimbursement is based on the assumption that Aggregate Industries will warrant the completed work for one year after construction completion.

Please notify me prior to commencing construction and if it appears that the costs for the upgrade will increase significantly.

Thank you for your collaboration on this project and please do not hesitate to contact me at (970) 350-9818 if you have any issues.

Sincerely,

Martin Howell, P.E.
Water Resource Administrator II

cc: Stuart Larman, P.E. Water & Sewer Engineering and Planning Manager

INVOICE

Invoice Date: 05/11/06

Bill to:

Mr. Martin Howell
Water and Sewer Department
City of Greeley
1100 10th Street, Suite 300
Greeley, CO 80631
(970) 350-9818

Project:

Boyd-Freeman Ditch Replacement at F Street (Hill) Property

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	Costs associated with upgrade of pipe section from 15" pipe to 30" pipe including the following: Connect to existing structure (build 3-sided junction box); install 1250 feet 30" Hdpe storm pipe (per bedding spec 6"over pipe); install 3 6-foot manholes per 400 feet)	1	lump sum	38,211.00	$38,211.00
	TOTAL				$38,211.00

Payment due in full upon receipt

Please remit to:

Aggregate Industries-WCR, Inc.
Attn: Connie Davis
P. O. Box 337231
Greeley, CO 80633