

MT. CRESTED BUTTE
WATER & SANITATION DISTRICT

STANDARDS AND SPECIFICATIONS
FOR WASTE WATER SYSTEM CONSTRUCTION

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SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE

- A. The purpose of this document is to present the Mt. Crested Butte Water and Sanitation District's criteria for the construction of 6 inch through 12 inch water mains, water services, and all appurtenances associated with these mains and services. It is for the use of owners, developers, design engineers, and contractors for the design and construction of said mains, services, and appurtenances.
- B. These Specifications are intended to be sufficiently detailed to provide adequate definition of the work to be performed and to insure the quality of that work.
 - 1. The contractor shall make himself thoroughly familiar with the provisions and the content of these Specifications.
- C. The Specifications are composed of written Material Specifications and Standard Drawings. The interpretation of these Specifications shall be made by the District.
 - 1. Every attempt will be made to avoid conflicts between standards, and drawings during design. However, when a conflict occurs an interpretation shall be made by the District.

1.2 SPECIFICATION DOCUMENTS

- A. Definitions
 - 1. DISTRICT ENGINEER- Wherever the term Engineer or District Engineer is used, it shall mean the authorized representative of Mount Crested Butte Water and Sanitation District.
 - 2. DISTRICT- Mount Crested Butte Water and Sanitation District.
 - 3. PROVIDE- furnish and install complete in space.
 - 4. REMOVE- remove and dispose.
 - 5. OR EQUAL- as approved equal by District Engineer.
 - 6. OWNER- the developer, corporation, association partnership, or individual who has entered into an Agreement with the District and has entered into an . . . Agreement with the Contractor to perform the work.
 - 7. DESIGN ENGINEER- the partnership, corporation, or individual who is registered as a professional engineer, according to Colorado statutes, and who is hired by the Owner, and is empowered to act as his agent for the project.
 - 8. CONSULTANT- the partnership, corporation, or individual who is hired by the Owner and is empowered to act as his agent for the project.
 - 9. CONTRACTOR- the corporations, association, partnership, or individual who has entered into an Agreement with the Owner to perform the work.
 - 10. CONSTRUCTION DRAWINGS- detailed and working drawings, including plan, profile, and detail sheets of proposed utility improvements, approved by the Engineer.
 - 11. DRAWINGS OF RECORD- detailed drawings which have been prepared by the Design Engineer, and show actual construction and contain field dimensions, elevations, details, changes made to the construction drawings by modification, details which were not included on the construction drawings, and horizontal and vertical locations of underground utilities.

12. SHALL- a mandatory condition.
13. WORK- the entire completed construction or the various separately identifiable parts required to be furnished for the project. Work is the result of performing services, furnishing the labor and furnishing and incorporation materials and equipment into the construction.
14. ABILITY- that which a person can do on the basis of present development and training.
15. COMPETENT- a person who has the natural powers, physical or mental, or meet the demands of a situation or work; the word is widely used to describe the ability to meet all requirements, natural, legal or other of a given task.
16. QUALIFIED- acquired abilities; skill, knowledge, experience, that fits a person for a position, office or profession.
17. ACI- American Concrete Institute.
18. ASTM- American Society for Testing and Materials.
19. ANSI- American National Standards Institute.
20. AASHTO- American Association of State Highway and Transportation Officials.
21. CDOT STANDARDS- Colorado Department of Transportation Standards Specifications for Road and Bridge Construction.
22. OSHA- Occupational Safety and Health Administration.

B. Interpretation

1. These Specifications contain many command sentences which are directed at the Contractor unless otherwise stated.
2. The Contractor shall request clarification, in writing, of all apparent conflicts by contacting the District.

1.3 NOTIFICATIONS

- A. Contact Mount Crested Butte Water and Sanitation District, all other utilities and concerned agencies at least 48 hours (exclusive of holidays and weekends) prior to working in areas near underground utilities or pole lines.
- B. Have all utilities field located.
- C. Inspections and testing: Give the District Engineer 24 hours (exclusive of holidays and weekends) notice prior to inspections and testing.
- D. Contractor shall notify the Town of Mt. Crested Butte a minimum of one week prior to beginning work in any street.
 1. Approved traffic control plans are required prior to beginning work in any public right-of-way.

1.4 SPECIAL REQUIREMENTS

- A. All work must be inspected, tested and accepted by the District prior to connecting to the existing system.
 1. Provide all plugs and other items required to isolated new construction in order to accomplish a total separation of new construction.
- B. All items and work not covered by these Specifications shall be discussed with the District and receive District approval prior to commencing the work.
- C. All work must be acceptable to the District.

- D. District furnished material
 - 1. If District furnishes any materials, the Contractor shall be responsible for such materials once they have been provided by the District.
 - 2. Contractor shall replace such materials if damaged or stolen at his own expense.
- E. Contractor shall warrant all work for a period of two years after final completion and initial acceptance of the work.
 - 1. Contractor may perform such maintenance and repairs by subcontract.
 - a. If the Contractor choose to subcontract the warranty work, he shall submit to the engineer a copy of the subcontract or the work authorization as evidence of the Contractors faithful intention to perform any repairs which may become necessary during the two (2) year warranty period.
- D. Field changes from the approved plans shall not be permitted without prior permission from the District.

1.5 SAFETY AND PROTECTION

- A. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. All employees on the Work and other persons who may be affected thereby.
 - 2. All the Work, materials and equipment to be incorporated therein, whether in storage on or off the site.
 - 3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- B. Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
 - 1. All work done in the District shall be governed by OSHA regulations appropriate for that work.

1.6 ACCEPTANCE OF CONSTRUCTION

- A. Prior to acceptance of mains, laterals, special structures and appurtenances constructed, extended or modified under Section 5 et. al., the landowners, subdividers or developers of the property served or encumbered by such facilities shall:
 - 1. Deed the lines and appurtenances to the District, free and clear of all liens and encumbrances. Convey to te District all water and sewer facilities constructed along with adequate and necessary easements and rights of way for the purpose of construction, maintenance and repair for the water facilities and sewer facilities.
 - 2. Provide as-built drawings in the form of three (3) sets of "D" size; scale, 1" = 50' and one or more CDs of spatial data in digital format as per District specifications, compatible with the Districts CAD mapping system.

3. Provide a maintenance bond for eighteen (18) months following the date of the completion of the project, in an amount prescribed by the District determined to be adequate to cover potential maintenance costs for the new facilities and paper / CAD formatted as per 5.2.2.
4. Provide to the District or the District's attorney, all deeds, easements and other documents, as required, for recording with the clerk and recorder of Gunnison County, Colorado. The costs of recording will be borne by the Landowners, subdividers or developers.
5. In no event will the District accept any construction, extension or modification until a minimum of eighteen (18) months has elapsed, following the completion of the facilities,, without significant occurrence of maintenance or repair problems. If significant maintenance or repair problems occur, the acceptance period will be extended for successive periods of one (1) year, until a full year will have elapsed without such repair and maintenance problems.

END OF SECTION

WASTEWATER SYSTEM CONSTRUCTION

SECTION 01020

GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The requirements outlined herein apply to consulting engineers and developers seeking approval of civil construction plans.
- B. All plans and calculations submitted to the District for review must be prepared by, or under the direct supervision of, a Professional Engineer duly registered and licensed to practice engineering in the State of Colorado. All plans and calculations should indicate this by being signed by a licensed professional engineer along with their registration number and seal.
- C. Approval by the District shall in no way relieve the Design Engineer of the responsibility for errors or omissions in the design, plans or field surveys. Any errors shall be corrected by the Design Engineer to the satisfaction of the District at no cost or expense to the District.
- D. District's review and approval will only be to determine if the plans and construction conform to the District's requirements. District's review and approval will not relieve Design Engineer and Contractor from responsibility for any variation from the District requirements. The District's review and approval shall not constitute any assumption of responsibility or liability for the design or construction.

PART 2 – SUBMITTAL

2.1 PRELIMINARY SUBMITTAL

- A. Three (3) copies of the preliminary plans, accompanied by one (1) copy of the AutoCAD files, version 2007 or older, request for review and recommendations, and such other information as the District may deem necessary shall be submitted to the District for review. Concurrently, preliminary plans will be sent to the District's Consulting Engineers in a form and quantity they shall determine. After review is complete, comments for revision will be sent to Design Engineer.
- B. Three (3) copies of the revised construction plans, accompanied by one (1) copy of the AutoCAD files, version 2007 or older, shall be resubmitted until approved.

2.2 FINAL SUBMITTAL

- A. Upon approval from the District, three (3) copies of the final plans, one of which is to be 3 mil, minimum, reproducible, double-matte mylar, and one (1) copy of the AutoCAD files, version 2004 or older, shall be submitted to the District. All plan sets submitted must be signed and sealed by a Colorado Registered Professional Engineer.

- B. Prior to final acceptance of the project, as-built drawings shall be submitted to the District. As-built drawings shall include all plan revisions and field changes made during construction.

2.3 REJECTING A SUBMITTAL

- A. When items required by these Standards are not submitted or not fully addressed within the plan set, the District may choose to reject the entire plan set and return it to the Design Engineer for completion, prior to any further review.

PART 3 – CONSTRUCTION DRAWINGS REQUIREMENTS

3.1 GENERAL

- A. All construction plan submitted to the District for review shall be on 24" x 36" sheets with scribed lettering and include but not be limited to the following.
 - 1. **TITLE BLOCK** - The subdivision name and filing number; site plan name and its Town file number (if applicable); the type of improvement; name, address, including zip code, telephone number of the Consultant; name, address, including zip code and telephone number of contact for the Owner; sheet number (consecutive, beginning with the cover sheet); revision box shall be included in the title block. Where the plans do not relate to a specific subdivision, the name of the street or channel, as well as the limits of the project, shall be clearly indicated. The title block shall be located in the extreme lower right-hand corner of each sheet.
 - 2. **SCALE** - The scales listed are minimum. Larger scales may be required where necessary to clearly show details. Use a standard engineering scale. All plan drawings shall have the proper bar scale legibly shown on the plan sheet.

All plan and profile drawings:
Horizontal 1" = 30'. Vertical 1" = 10'

Overall utility plan:
1" = 100'
 - 3. **DATE OF PLAN** -The original date of the plan and any subsequent revision.
 - 4. **NORTH ARROW** - North arrow shall point towards the top of applicable sheet.
 - 5. **SEAL AND SIGNATURE** - The seal and signature of the Professional Engineer, registered in the state of Colorado, under whose supervision the plans were prepared.
 - 6. **BENCH MARK** - The benchmark description and number shall be placed on each sheet that shows any form of vertical design.
 - 7. **KEY MAP** -Key map at minimum scale of 1" = 500' shall show the location and name of all roadways within and adjacent to the proposed development with the area design pertains to defined. The map shall be oriented north. Key map shall be placed on all sheets except cover sheet and detail sheet(s). If the proposed improvements are shown on a single sheet, no key map is required.

3.2 COVER SHEET

- A. Cover sheet shall include but not be limited to the following.
 - 1. NOTES - Cover sheet shall include but not be limited to the following notes:
 - a. All waterline and sewer line construction shall conform to the MCBWSD Standards.
 - b. MCBWSD shall be notified of construction activities related to water and sewer forty-eight (48) hours before commencement.
 - 2. VICINITY MAP - A vicinity map should show the location and name of all major roads within 1 mile of the proposed development at a minimum scale of 1" = 2000' with north arrow. The development area shall be indicated. The map shall be oriented north.
 - 3. INDEX - Each cover sheet shall include index of all sheets within the plan set.
 - 4. LEGEND - Each cover sheet shall show legend of symbols pertaining to the plan set.

3.3 OVERALL UTILITY PLAN

- A. An overall utility plan of the proposed development, including all off-site construction areas shall include but not be limited to the following.
 - 1. In plan view depict the entire development and include all exterior boundaries of the project, rights of ways, easements, lot lines, lot and block numbers, roadways and roadways names, handicapped ramps, sidewalks, curb and gutter, retaining walls, bike paths, street lightning, existing and proposed contours.
 - 2. Existing and proposed water distribution facilities with all related appurtenances, fire hydrants and service lines including but not limited to the size and material of waterlines.
 - 3. Existing and proposed sanitary sewer facilities with all service lines including but not limited to length, size, material, slope of the pipe; manhole numbers, rim elevations, inverts of all pipes entering and exiting a manhole. Pipe length shall represent distance between sanitary sewer manholes measured between centerlines of the manholes.
 - 4. Existing and proposed storm sewer facilities including inlet locations.
 - 5. Any other public or private utilities within proposed development.
 - 6. Phase lines and phase labels (if applicable).

3.4 PLAN DRAWINGS

- A. The plan shall include but not be limited to the following.
 - 1. Property lines, right-of-way lines, and easements. Type and dimension of an easement shall be clearly labeled.
 - 2. Roadways and roadway names.

3. Proposed and existing utilities and structures including, but not limited to: water valves, fire hydrants, thrust blocks, service lines, sanitary sewer manholes, sanitary sewer lift stations, storm drainage facilities, telephone, gas, electric, cable TV lines, ditches or swales, curbs and gutters, pavement limits, bridges or culverts, guardrails, fences, retaining walls etc.
4. Stationing shall be continuous for the entire length of the utility. Centerline of roadway shall be the basis for stationing whenever possible.
5. All sanitary sewer manholes shall be labeled. Label shall include manhole number, station, offset (if centerline of roadway is used as basis for stationing). If sanitary sewer line is located outside of public right-of-way or centerline of roadway is not used as basis for stationing, include northern and easting coordinates. Center line of the manhole shall be used when labeling sanitary sewer manholes.
6. Label length, size, material, and slope of sewer line. Pipe length shall represent distance between sanitary sewer manholes measured between centerlines of the manholes.
7. Label length, size, and material of sanitary sewer force main between fittings/deflection points.
8. Only segments of sanitary sewer force main can be curved. Curve data shall be provided for such segments. Curve data shall include:
 - a. Curve length
 - b. Curve radius
 - c. Curve angle in the following format XX degrees XX minutes XX seconds.
9. Existing and proposed contours.
10. Match lines and sheet numbers.

3.5 PROFILE DRAWINGS

- A. Profile is required on all public and private sanitary sewer mains and service lines 6" and larger. Profile is also required on all sanitary sewer force mains regardless of the size of the force main.

The profile shall include but not be limited to the following

1. Original ground (dashed) and design grade (solid). Both grades are to be plainly labeled, existing and proposed.
2. All design elevations shall be invert of pipe. Top of pipe is acceptable for existing utilities.
3. Stationing shall be continuous for the entire length of the utility. Centerline of roadway shall be the basis for stationing whenever possible.
4. Type, size and location of all existing utilities, particularly where crossed, with as-built elevations, stations and clearance between utilities. It is contractor's responsibility to field verify the existence and location of all existing underground

utilities prior to construction. Contractor shall exercise care when working in order to protect all underground interference and shall be fully responsible for any and all damage caused by his operation.

5. Type, size and location of all proposed utilities, particularly where crossed, with elevations, stations and clearance between utilities.
6. Sanitary sewer manhole number, station, rim elevation, inverts of all pipes entering and exiting a manhole, length, size, material, and slope of the pipe between manholes. Pipe length and slope shall represent horizontal distance between invert out of upstream manhole and invert in of downstream manhole.
7. The following note shall appear on all sanitary sewer plan and profile drawings:
Plan view distance between manholes is measured centerline to centerline of the manholes. Profile distance and slope between manholes is measured horizontally from invert out of upstream manhole to invert in of downstream manhole.
8. Label station and elevation of grade breaks, beginning and end of vertical curves of sanitary sewer force main.
9. Match lines and sheet numbers.

3.6 DETAILS

- A. Detail sheet(s) shall include but not be limited to details of any critical connections, crossings, and any other details that are deemed necessary by the District.

3.7 PRIVATE IMPROVEMENTS

- A. Private improvements such shall be clearly shown and labeled as such on each sheet. The note below shall appear on each sheet of the development plans where private improvements occur.
The District shall not be liable for the maintenance of *_____
(* Insert name of specific private improvement).
These facilities may not meet District standards and are to remain in private maintenance.

PART 4 – DRAFTING STANDARDS

4.1 LETTERING

- A. Letter height shall not be less than 0.10" (No. 100 Leroy template). All lettering shall be done with ink. When lettering sizes are less than 0.14" (No. 140 Leroy template), lettering shall be in upper case only. Fonts allowed shall include standard Leroy lettering fonts or fonts included with AutoCAD licenses.

4.2 LINE WIDTH AND COLOR

- A. Proposed and existing features shall be represented on drawings using black lines with a minimum line width of 0.01".
- B. Different line weight/type shall be used to distinguish between existing contours,

proposed contour, existing utilities, and proposed utilities.

4.3 LAYERING

4.3.1 SEWER SYSTEM LAYERING

Layer Name	Layer Color	Line Type
ADDRESS	4 (cyan)	CONTINUOUS
BLOCK-NUMBER	7 (white)	CONTINUOUS
BOUNDARY- DISTRICT	253	CONTINUOUS
BOUNDARY- SUBDIVISION	1 (red)	CONTINUOUS
BOUNDARY-TOWN	253	DASHED
DRIVE-WAY	7 (white)	CONTINUOUS
ESMT-UTILITY	1 (red)	DASHED2
ESMT-UTILITY-TEXT	7 (white)	CONTINUOUS
FLOW-DIRECTION	6 (magenta)	CONTINUOUS
LOT-LINE	7 (white)	CONTINUOUS
LOT-NUMBER	7 (white)	CONTINUOUS
PAVEMENT-EDGE	1 (red)	CONTINUOUS
ROW	3 (green)	CONTINUOUS
SAN-SEWER-MAIN	4 (cyan)	CONTINUOUS
SAN-SEWER-CLEANOUT	4 (cyan)	CONTINUOUS
SAN-SEWER-FORCEMAIN	3 (green)	CONTINUOUS
SAN-SEWER-MANHOLE	4 (cyan)	CONTINUOUS
SAN-SEWER-MANHOLE-ELEV	7 (white)	CONTINUOUS
SAN-SEWER-MANHOLE-NUMBER	7 (white)	CONTINUOUS
SAN-SEWER-PRETAP	3 (green)	CONTINUOUS
SAN-SEWER-TEXT	7 (white)	CONTINUOUS
SECTION-CORNER	2 (yellow)	CONTINUOUS
SECTION-LINE	2 (yellow)	CONTINUOUS
STREET-NAME	3 (green)	CONTINUOUS
VALLEY-PAN	253	CONTINUOUS

SECTION 01570

TRAFFIC REGULATION

1.1 GENERAL

- A. Conformance: "Manual on Uniform Traffic control Devices", U.S. Department of Transportation, or applicable statutory requirements of authority having jurisdiction.
- B. Operations on or about traffic areas and provisions for regulating traffic will be subject to the regulations of governmental agencies having jurisdiction over the affected areas.
- C. Keep traffic areas and rights-of-way free of excavated material, construction equipment, pipe, and other materials and equipment.
- D. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
- E. Conduct operations in a manner to avoid unnecessary interference with public and private roads, walkways, drives and parking lots.
 - 1. Provide and maintain temporary approaches or crossings and intersections with roads, streets, businesses, parking lots, residences, garages, etc.
- F. Permits shall be obtained from all government agencies having jurisdiction over the affected areas.

1.2 FLAGMEN

- A. Required to provide for public safety and the regulation of traffic.
- B. Properly equipped and certified.

1.3 WARNING SIGNS AND LIGHTS

- A. Protect all roadways by effective barricades on which are placed acceptable warning signs.
- B. Provide suitable barricades and warning signs for open trenches, other excavations and obstructions.
- C. Illuminate, by means of warning lights, all barricades and obstructions from sunset to sunrise.

1.4 MAINTENANCE OF OPERATION

- A. All Roadways
 - 1. Conduct operations so that only one side of the existing roadway will be denied to traffic at any time.
 - 2. In making open cut street crossings, do not block more than one-half of the street at a time.

1.5 DETOURS

- A. Where required that traffic be maintained in a public street, road or highway and the traffic cannot be maintained on the alignment of the original roadway during the performance of the Work, construct and maintain a detour around the construction work, where suitable R.O.W. exists.
- B. Include with each detour all necessary bridges, barricades, guard rails, approaches, lights, signals, signs, flagmen, and all devices and precautions necessary for protection of the Project and safety of the public.

1.6 TEMPORARY BRIDGES

- A. Whenever it is necessary to cross, obstruct or close public or private roads, walkways or drives, provide suitable and safe bridges, detours or other temporary expedients for the accommodation of public and private travel. Such facilities will not be required when Contractor has obtained permission from the owner of private property, or from the authority having jurisdiction over public property involved to obstruct traffic at the designated point.
 - 1. Provide substantial guard rails and suitably protected approaches.
 - 2. Foot bridges will not be less than 4 feet wide, provided with handrails and uprights of dressed lumber.
- B. Maintain in place as long as conditions require their use for the convenience and safety of the public:
 - 1. Bridges may be relocated or temporarily removed for such periods as required when necessary for the proper execution of the Work in the immediate vicinity of a bridge.

1.7 PARKING

- A. Provide suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Project so as to avoid interference with public traffic, Owner's operations or construction activities.

1.8 ROADWAY USAGE BETWEEN OPERATIONS

- A. At all times when Work is not actually in progress, Contractor shall make passable and shall open to traffic such portions of the Project and temporary roadways or portions thereof as may be agreed upon between Contractor and Owner, and all authorities having jurisdiction over any properties involved.

END OF SECTION

SECTION 01600

MATERIAL, EQUIPMENT AND WORKMANSHIP

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section concerns the material, equipment, and workmanship needed to complete the construction of the water main and all associated appurtenances.

1.2 MATERIALS AND EQUIPMENT

- A. Contractor shall furnish all materials, equipment, labor, and all other facilities and incidentals necessary for the execution, testing and completion of the work.
- B. Materials and equipments shall be of good quality and new, except as otherwise provided in these specifications.

- 1. The Contractor shall furnish satisfactory evidence (including manufacturer's certification) as to the kind and quality of materials and equipment, and their compliance with these specifications.
 - a. The Engineer may test any manufacturer's material he deems necessary.
 - b. It is the Contractor's responsibility to insure the manufacturer's materials meet these specifications.

- C. All materials and equipment shall be installed and used in accordance with the instructions of the applicable manufacturer, fabricator, supplier, or distributor.

- D. The materials and equipment in these specifications are representative of a quality of performance, operation and construction which acceptable of the District.

- E. The District shall evaluate all written requests for products substitution, and shall do so in a timely manner.

- 1. Requests for product substitution shall include detailed product literature and a description of benefits which might be achieved by this substitution.

- F. By approving materials or equipment for installation, the District assumes no responsibility for injury or claims resulting from failure of the materials or equipment to comply with applicable National, State, and local safety codes or requirements, or the safety requirements of a recognized agency; or failure due to faulty design concepts, or defective workmanship.

1.3 WORKMANSHIP

- A. Contractor shall provide competent, disciplined, suitable qualified personnel to lay out the work and perform the construction.

- 1. Any workmen deemed not qualified to perform the task he is assigned, in

the opinion of the Engineer, shall not be allowed to perform that task.

- B. The construction standards, tests and methods outlined in these specifications are considered adequate to produce the product desired by the District.
 - 1. The District may evaluate alternative methods of construction upon written request, and shall do so in a timely manner.
 - a. Requests for alternative methods of construction shall include detailed descriptions of the equipment, methods and controls needed for the alternative, and a description of the benefits which might be achieved by this substitution.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENT

1.1 MAINTENANCE OF DOCUMENTS

- A. Store documents apart from documents used for construction.
- B. File submitted documents in accordance with the specification's section numbers.
- C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

1.2 RECORDING

- A. Label each document "PROJECT BOUND" in neat large printed letters.
- B. Record information concurrently with construction progress.
 - 1. Do not cover Work until required information is recorded.
- C. Marking of Project Records.
 - 1. Legible and with a dark pen or pencil.
 - 2. Ink shall not be water based or subject to easy smearing.
- D. Mark Drawings to record actual construction.
 - 1. Field dimensions, elevations and details.
 - 2. Changes made by a Notification.
 - 3. Details not on original Drawings.
 - 4. Horizontal and vertical locations of underground utilities and appurtenances, referenced to a minimum of two permanent surface improvements.
 - 5. Depths of various elements of work in relation to project datum.

1.3 SUBMISSION

- A. Accompany submittal with transmittal letter in duplicate containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name, address and telephone number.
 - 4. Title and number of each Record Document.
 - 5. Signature of Contractor or his authorized representative.
- B. The District requires a set of Drawings of Record on 3 mil, minimum, reproducible, double-matte mylar prior to acceptance of the project.

END OF SECTION

SECTION 02000

WASTEWATER SYSTEM DESIGN CRITERIA

1. DESIGN FLOW RATES

A. Residential

1. Basis for developing design flow rates for wastewater distribution system.

Table 1

Property Description	SFD		Number of Units		People per Unit		Average Day Demand (gallons/ person/ day)		Peak Day Factor		Wastewater Peak Daily Flow (gpd)
Single Family	1*	x	Number of Units	x	3.5	x	74	x	2.5	=	
Multi-Family	1*	x	Number of Units	x	1.8	x	74	x	2.5	=	
Townhouse	1*	x	Number of Units	x	1.8	x	74	x	2.5	=	
Apartment	1*	x	Number of Units	x	1.8	x	74	x	2.5	=	
Duplex	1*	x	Number of Units	x	1.8	x	74	x	2.5	=	

*Include supplemental single (SFD) family dwelling values per the supplemental SFD schedule. Does not include irrigation requirements.

2. Wastewater loading supplemental SFD schedule.

Description	SFD Value
Residence: for every additional 500 SF of floor space above 2000 SF, or fraction of	0.24

3. Residential Remodel SFD Schedule

Base SFD Schedule.

Property Description	SFD Value
Single Family Residence Unit	1
Multi-Family Residence Unit	1

Supplemental SFD schedule.

Additional fixture unit / room	SFD Value
Toilet	0.11
Lavatory	0.03
Tub	0.06
Shower stall	0.06
Tub/shower	0.06
Sink (excluding kitchen)	0.03
Kitchen	0.16
Bedroom	0.20
Hot tub (single family)	0.05
Hot tub (multi-family)	0.10

B. Commercial

1. Industrial and commercial area flows will be determined using an equivalent SFD schedule as Determined by the District based on type of business.

Property SFD Schedule

Property Description	Units	SFD Value / unit
Restaurant / Bar	Seat	0.04
Hotel / Motel / Lodge room w/o kitchen	Room	0.35
room w/ kitchen	Room	0.50
accessory area	1000 SF	0.26
hot tub	Each	0.10
swimming pool	1000 SF	0.36
Retail, Office, Commercial	1000 SF	0.50
Public Restroom	Toilet or Urinal	0.20
Laundry 20 lb or less capacity	machine or hook-up	0.50
20.1 – 30 lb capacity	hook-up	0.85
30 lb or more capacity	machine or hook-up	1.30
Service Stations per pump	each	0.20
nozzle	each	1.50
or per pump	each	1.50
island		
plus car wash		
bay		

2. HYDRAULIC DESIGN

2.1 PIPE SIZES

- A. Minimum sanitary sewer main size shall be eight (8) inches.

2.2 DESIGN VELOCITIES AND GRADES

- A. All sanitary sewer mains shall be designed to insure that the average day flows velocities within the pipe will be two (2) feet per second as a minimum (this velocity will prevent deposition of solids that may cause odors) and ten (10) feet per second as a maximum. Sanitary sewer minimum grade shall be half (0.5) percent, or one (1) percent for terminal lines. The maximum grade shall be thirty (30) percent, with grades outside of this range requiring specific approval by the District.

2.3. UNDERDRAIN SYSTEMS

- A. Underdrains are not a part of the sanitary sewer system and they shall not connect to the sanitary sewer system at any time.

3. LAYOUT

3.1 DEPTH

- A. All sanitary sewer mains including service lines shall have at least seven (7) feet of ground cover from the top of the pipe to the finished ground surface.

3.2 ALIGNMENT

- A. All sanitary sewer mains shall be laid, when possible, on south or west side of the street, from the point of beginning to where the line ends. Curvilinear gravity sanitary sewer mains shall not be allowed.
- B. Minimum horizontal separation between sanitary sewer mains and portable water mains measured edge to edge shall be ten (10) feet.
- C. Minimum vertical separation between sanitary sewer mains and portable water mains measured edge to edge shall be eighteen (18) inches.
- D. No sanitary sewer main shall be located closer than three (3) feet from the lip of a cross pan, gutter, storm drain manhole or other structure.
- E. No sanitary sewer main shall be laid parallel to or under any bearing wall that might thereby be weakened.

3.3 SERVICES

3.3.1 GRAVITY SERVICES

- A. Location and Alignment of Service.
 - 1. Sewer service lines shall be located so as to take the most direct route (preferably perpendicular to the main) from the sewer main or pre-tap to the structure. *No acute angles are allowed between the service line and downstream pipe.* Sewer service lines shall not be located under any driveway or service road *and shall not*

be closer than five (5) feet to the property corner. All sewer lines shall have minimum seven(7) feet of cover wherever possible. No service lines shall be laid parallel to any bearing wall that might thereby be weakened. The sewer service line shall be laid at a uniform grade and in a straight alignment. Any variances to this policy shall be reviewed by the *District* and decided on a case by case basis.

2. Each building and each subdivided lot shall be served by a separate service line. No compound services are allowed.
 3. Service lines shall be designed with a minimum fall of one quarter (1/4) inch per foot and maximum velocity of ten (10) feet per second. No 90° bends, or greater degree, allowed on service lines. 45° bends are the maximum allowed.
 4. Sanitary sewer services and underdrain shall be located on the down-hill side from water services.
 5. Minimum horizontal distance between sanitary sewer services serving different lots/buildings shall be five (5) feet. No shared trenches for service lines are allowed.
- B. Service Line Separation.
1. Ten (10) feet of separation must be maintained between parallel water and sewer service lines. At locations where water and sewer lines cross, sewer service line joints within a ten (10) foot distance of the water line must be encased in accordance with Colorado Department of Public Health and Environment *and District* standards.
- C. Pre-taps.
1. Where the sewer main has been pre-tapped (a service line has been extended to the lot property line and terminated with cap), the service line from the building shall connect to the sewer line pre-tap. The owner or contractor must locate the pre-tap. Reference Detail Drawing S-6.
- D. Direct Tap to the Main.
1. Where sewer pre-taps are not present, service line construction will require tapping a District main, which is permitted only between April 15 to October 15 annually. Permits for excavation within any Right Of Way of the Town of Mt. Crested Butte or Gunnison County are the sole responsibility of the contractor.
- E. Specifications.
1. Service lines up to six (6) inches in diameter shall be connected to the main by a saddle tap. The saddle tap will be located not less than ten (10) feet away from any manhole. Connections into manholes will not be allowed. Service lines eight (8) inches in diameter or larger, will make connection into an existing manhole or a new manhole constructed by the owner. Service lines shall be constructed of PVC pipe, SDR 35, unless as otherwise specified.
 2. Minimum size allowable for a service line shall be four (4) inches.
 3. Accessible clean-outs will be constructed every one hundred (100) feet *and at every bend in the service line*, or as otherwise approved by the District.

- F. Inspections.
 - 1. The applicant for *sewer* service or their representative shall notify the District when the service line/tap connection is ready for inspection. Appointments for inspection and connection should be scheduled forty-eight (48) hours in advance (not to include weekends). Under supervision of a District representative, the sewer service line will be inspected and tested.

- G. Responsibility.
 - 1. Sewer service billing begins upon successful test completion of the sewer service line pretap (where installed) construction. The property owner shall be responsible for all fees, and charges due the District. The entire sewer service line from the District main to the building belongs to the Property owner, who is responsible for installation, repairs, and maintenance of the service line. Sewage lift stations located within a structure or upon private property, and connected to the service line, will belong to the property owner, who is responsible for installation, repairs, and maintenance of the sewage lift station.

3.3.2 PRESSURE SERVICES FOR INDIVIDUAL RESIDENCE.

- A. If use of gravity sanitary sewer service is impractical, pressure service shall be used.
- B. Pressure sanitary sewer services are considered private improvements and are to remain in private maintenance.
- C. If several adjacent lots are served using pressure services, individual service lines can share a trench with each other, however they must be in a separate trench from the District's force main.
- D. Minimum horizontal separation between private sewer pressure service and District's force main shall be five (5) feet.

3.4 FUTURE CONNECTIONS

- A. When a sewer line under construction is anticipated to be extended at a future date, the end of the line shall have a manhole and a plugged stub out installed in the direction(s) of extension. No services shall be placed on an extension of the upstream side of a manhole.

3.5 MANHOLE SIZE AND SPACING

- A. Manholes shall be located at the end of each sewer line, at all changes in grade, pipe size, and alignment.
- B. Sanitary sewer lines shall be designed so the minimum angle between any upstream and downstream line is ninety (90) degrees.
- C. Minimum inside drop in a manhole from the upstream invert to the downstream invert shall be three tenth (0.3) of a foot, if the angle between upstream and downstream line is between ninety (90) degrees and one hundred thirty five (135) degrees. Minimum inside drop from the upstream invert to the downstream invert shall be two tenth (0.2) of a foot, if the angle between upstream and downstream line is between one hundred

thirty five (135) degrees and one hundred eighty (180) degrees.

- D. Manholes shall be four (4) feet in diameter for pipe lines eight (8) inch through twelve (12) inch in diameter, and shall be located no more than four hundred (400) feet apart. Larger pipe will require five (5) foot diameter manholes spaced every five hundred (500) feet.
- E. No sanitary sewer manhole shall be located closer than five (5) feet from the lip of a cross pan, gutter, storm drain manhole or other structure.
- F. Manholes should be located in areas which are not subject to flooding from surface runoff. No manholes may be located in areas where ponding or storm detention basins are to be used. Manholes shall be located in areas which allow direct access via all-weather drives by maintenance vehicles.
- G. All sanitary sewer manholes or appurtenances subject to inflow from surface waters and those with top elevations lower than the 100-year flood elevation must be equipped with an approved insert for protection against inflow. The 100-year flood elevation shall be defined on the plans.
- H. If slope of finished ground is greater than 1H:1V, retaining wall shall be constructed per Detail Drawing No.S-14, and inverted mount manhole rings shall be used.

3.6 DROP MANHOLES

- A. All manholes in which the drop is three (3) feet or greater shall be constructed with an outside drop. The maximum allowable drop in a drop manhole shall be ten (10) feet.
- B. Minimum diameter of inside drop manhole shall be five (5) feet.

4. ENCASEMENT OF SANITARY SEWER.

- A. Sanitary sewer joints shall be encased where sanitary sewer main comes closer than 10' horizontally to a water main.
- B. If sanitary sewer main and water main cross, and sanitary sewer main is above the water main or less than 18" below the water main, construct the crossing using one length of sanitary sewer pipe at least 18' long centered over or under the water main. Encase sanitary sewer pipe joints.
- C. If sanitary sewer main and water service cross, and sanitary sewer main is above the water service or less than 18" below the water service, construct the crossing using one length of sanitary sewer pipe at least 18' long centered over or under the water service. Encase sanitary sewer pipe joints.
- D. If sanitary sewer service and water main cross, construct the crossing using one length of sanitary sewer pipe at least 18' long centered over or under the water main. No encasement of sanitary sewer pipe joints is needed.

5. EASEMENTS

- A. Easements are required wherever sanitary sewer main is not located in public right-of-

way.

- B. Easement width shall be calculated using the following formula.

$W = O.D. + 20" + 3*(D-12")$, where

W – easement width.

O.D. – pipe outside diameter.

D – depth of cover measured from the top of the pipe to the finished ground surface.

(NOTE: Formula is based on 1.5H:1V trench side slope. Trench walls are vertical from the bottom of the trench to the point 1' above of the top of pipe (according to Section 02221, 3.2-D). 20" came from Section 02221, 3.2-B.)

- C. No sanitary sewer main shall be located less than ten (10) feet from the edge of an easement, measured from the centerline of the pipe, without written approval from the District.
- D. Permanent sanitary sewer main easement shall be minimum twenty (20) feet in width.
- E. Construction sanitary sewer main easement shall be minimum forty (40) feet in width.

6. CUT OFF WALL

- A. Cut-off walls are only required as noted in the contract documents and as specifically requested by the District Engineer to prevent migration of water through the pipe bedding zone. The District Engineer may specify alternate locations from those shown in the plans. Concrete cut-offs are the preferred installation method. Refer to Detail Drawing S-2 for typical locations and installation details.

7. UNDERDRAIN

- A. Underdrain pipe shall be constructed using polyvinyl chloride (PVC) provided with joints that prevent any shifting or misalignment of the line and allow adequate infiltration or exfiltration, or pipe specifically manufactured for underdrain that does not allow soil infiltration. The underdrain system shall in no case be constructed with sealed joints. Underdrain system is considered private improvements and is to remain in private maintenance.
- B. If PVC pipe is used in underdrain construction, it shall be perforated and conform to ASTM 3034-SDR 35. Perforated PVC shall have perforations located in the lower quadrant. PVC underdrain shall be wrapped per geotechnical engineers recommendations and in no case will the soil be allowed to enter the pipe. This shall be accomplished by utilizing Mirafi 140N fabric. The pipe shall be installed without gaskets and in compliance with ASTM D2321. The system shall not be watertight. Non-perforated pipe shall be installed within five (5) feet on any sanitary sewer manhole.
- C. The trench shall be sub-excavated to a minimum depth of one (1) foot below the flow line of the sanitary sewer main per Detail Drawing No. 10. The underdrain pipe shall be placed on the bottom of the trench approximately six (6) inches from the trench sidewall, and the trench backfilled with tamped granular bedding material to one (1) foot above the main.
- D. The invert of the underdrain pipe shall be parallel to and one (1) foot below the flow line

of the sanitary sewer main. The underdrain shall end in a storm sewer or drainage course. At no time shall an underdrain be unable to drain. The underdrain connection shall be properly grouted into a storm sewer pipe or inlet. When emptying into a drainage course, the outlet shall be protected with an approved outlet structure or headwall.

- E. If PVC pipe is used in underdrain construction two way clean outs shall be installed along the line. Clean outs shall in no case be installed within a sanitary sewer manhole but are allowed on the outside of a manhole. Clean outs shall not be the responsibility of the District to maintain. Clean outs shall be constructed so that no surface load will be transferred to the main or riser pipe and shall be left below the pavement surface when located in the public right-of-way.

8. SANITARY SEWER FORCE MAIN

8.1 DESIGN FLOW RATES

- A. Design flow rate shall be determined using such factors as minimum, average, and peak inflows as well as minimum, average, and maximum pumping rates. Methods shall include the use of peaking factors for the contributing area, and allowances for future commercial, industrial, residential and other types of development.

8.2 DESIGN VELOCITIES AND GRADES

- A. The flow velocity of the sewage in the force main shall be three (3) feet per second as a minimum and eight (8) feet per second as a maximum.
- B. Force main shall have a positive slope from the pumping station to the point of discharge unless unusual conditions make it impractical.

8.3 PIPE SIZES

- A. Force main shall have an internal diameter of at least four (4) inches.
- B. Variances shall be approved by the District on a case-by-case basis.

8.4 PIPE MATERIALS

- A. Reference Section 02615 Ductile Iron Pipe and Section 02623 Polyvinyl Chloride (PVC) Pressure Pipe.

8.5 DEPTH

- A. Force main shall have at least seven (7) feet of ground cover from the top of the pipe to finished ground surface.
- B. Extra depth of bury shall be provided in lieu of air relief/vacuum relief valve wherever feasible.
- C. Force main shall be designed such that it is below the hydraulic grade line.

8.6 ALIGNMENT

- A. Permissible deflection at joints.
1. Install pipe to allow for expansion and contraction without stressing pipe or joints. **No deflection is allowed at pipe bends. Maximum deflection of joints shall not exceed 50-percent of AWWA C600 requirements as listed below:**

DUCTILE IRON PIPE

		Maximum	Radius of Curvature
	<u>Pipe Size</u>	<u>Deflection</u>	<u>L=18'</u> <u>L=20'3" - 12"</u>
5°	205'	230'	

PVC PIPE

		Maximum	Radius of Curvature
	<u>Pipe Size</u>	<u>Deflection</u>	<u>L=18'</u> <u>L=20'</u>
4" - 12"	5°	205'	230'

- B. Minimum horizontal separation between force main and potable water main measured edge to edge shall be ten (10) feet.
- C. Minimum vertical separation between force main and potable water main measured edge to edge shall be eighteen (18) inches.
- D. No force main shall be located closer than three (3) feet from the lip of a cross pan, gutter, storm drain manhole or other structure.
- E. No force main shall be laid parallel to or under any bearing wall that might thereby be weakened.

8.7 AIR RELIEF/VACUUM RELIEF VALVE

- A. Sewage air/vacuum relief valves shall be installed at the high points of the force main within a standard four (4) foot manhole of a comparable sized approved vault.
- B. Air/vacuum relief valves shall be fitted with an activated carbon canister to adsorb odor prior to releasing the air to the surrounding area.
- C. Vehicular access to valves shall be provided for maintenance.

8.8 TRACING WIRE

- A. The force main shall be installed with tracing wire for tracing purposes. The color of the wire shall be yellow for identification purposes.
- B. Tracing wire shall be 10 gauge THHN or THWN solid copper wire. The wire shall be drawn snug and taped to the top of the pipe with two (2) inch wire tape at approximately four (4) foot intervals. Care shall be taken to avoid nicks and breaks in the wire or coating during installation.
- C. Splices and repairs shall be made using a properly sized copper split bolt connector and encapsulating the connection with a ROYSTON epoxy splice kit or TAECOAT gray "pads".

- D. Tracing wire shall be brought to grade in six (6) inch water valve boxes or other approved structures at both ends of the force main, at all air relief/vacuum relief valves and intervals of not less than five hundred (500) feet. If water valve boxes are used, the lids shall have no words on them. Valve boxes located outside of paved areas shall have a six (6) inch concrete collar. Provide FRC marker post to mark the tracing wire box locations outside of paved areas.
- E. Tracing wire shall be securely affixed to the body of the valve and coiled around the body of the valve with minimum excess length of twenty four (24) inches.
- F. Minimum twenty four (24) inches of slack shall be provided, coiled in each tracing wire structure.
- G. Tracing wire shall be tested during installation. District shall be notified so that the entire length of tracing wire, including connections, can be inspected during installation and prior to backfilling.

8.9 FORCE MAIN TERMINATION

- A. The force main shall continue until it discharges into gravity sewer. Termination manhole shall be a standard precast manhole.
- B. The force main shall connect into the manhole at the same elevation as the gravity sewer and along an alignment which minimize the turbulence created in the sewage as it discharges from the force main.
- C. The force main shall enter the manhole at positive grade in order to avoid siphon in the line.
- D. Details showing force main connection to the gravity sewer manhole shall be provided.

8.10 REDUNDANT FORCE MAIN

- A. Developer shall provide a redundant force main.
- B. Variances shall be approved by the District on a case-by-case basis.

8.11 TESTING AND START-UP

- A. Force mains shall undergo hydrostatic pressure testing for at least two hours at two times the working pressure. Test results shall be documented and demonstrate holding pressure within the criteria and specifications described. The start-up and testing plan shall be submitted to the District for review prior to commencing the start up.

9 SANITARY SEWER LIFT STATION

9.1 GENERAL

A. DESCRIPTION

1. All sewage lift stations constructed in the District or areas serviced by the District shall conform to this Section.
 - a. All references to the District in this section may refer to the District or the District's Engineer.

B. TYPE OF LIFT STATIONS

1. Sewage lift stations shall be wet well stations with submersible grinder pumps, unless otherwise approved.

C. CDPHE

1. All lift stations with capacities at 2,000 gallons per day (gpd) or greater are subject to Colorado Department of Health and Environment (CDPHE) Regulation 22 and State of Colorado Design Criteria for Domestic Wastewater Treatment Works, WPC-DR-1.

D. COST RESPONSIBILITIES

1. The Developer shall be solely responsible for all costs associated with the planning, permitting design and construction of the lift station and force mains. This includes the cost of any easements, land acquisition, District review costs, documents associated with permitting approval through CDPHE, and any other cost associated with the project.
2. The Developer shall employ the services of an Engineer licensed in Colorado that has successfully designed and permitted at least two lift stations of similar size as proposed, within the State of Colorado.

E. QUALITY ASSURANCE

1. The entire system shall be designed and stamped by an engineer(s) licensed in the State of Colorado. Unless noted otherwise, the materials used and methods of construction shall conform to the District's Standards and Specifications. The District reserves the right to specify specific makes and models of equipment, and other requirements during the design or construction phase of any lift station. Where CDPHE's and the District's Criteria differ, the more restrictive of the conditions shall apply. The final design documents shall be submitted to all applicable Federal, State, and local agencies for their review and approval. All Federal, State, and local permits and approvals must be obtained prior to plan approval by the District. If exceptions in design are to be made from CDPHE standards, Developer shall be responsible for obtaining approval from permitting agencies and provide approvals to District's Engineer in a transmittal with design document.

9.2 REVIEW SUBMITTALS

A. PLANNING AND PERMITTING

1. The lift station and force main design shall adhere to State and regional approval processes and the Developer shall keep informed and notify the District of major milestones during the design and approval processes. The Developer shall adhere to the following submittal requirements.
2. The Developer and their Engineer shall adhere to the following procedures through the planning and design phases:
 - a. Coordinate a conceptual project meeting with the District to provide justification for the project and initial design considerations including site location, force main alignments, land acquisition requirements, preliminary design criteria, project schedule, and permitting requirements.
 - i) Drawings for lift station shall include a site plan drawn to scale of not less than 1" = 10' and shall contain existing and proposed contours.
 - b. Upon initial conceptual acceptance for consideration of the need for a lift station, provide written project justification for the project and design considerations including site location, force main alignments, land acquisition requirements, preliminary design criteria, project schedule, and permitting requirements. Attend follow up meeting following completion of the review of conceptual documents.
 - c. It is the expectation that the Developer will keep the District informed of the project's progress from design through construction approval. This includes notifying the District of the major project milestones associated with the CDPHE review and approval process and allowing for District review of major reports and documents. Major milestones may include, but are not limited to:
 - i) Signed and approved Site Application submitted to CDPHE
 - ii) Basis of Design Report (BDR) submittal to CDPHE
 - iii) Design approval from CDPHE
 - iv) Funding requests
 - v) Public meetings/outreach
 - d. Upon the District's review and acceptance of the conceptual design, the applicant may proceed with the Lift Station Site Application process in accordance with CDPHE Regulation 22.
 - i) The Site Application shall be submitted to local agencies following review and acceptance by the District.
 - ii) Following local agencies approval of the Site Application, the applicant shall submit the Site Application and required counterparts in accordance with Regulation 22 to CDPHE for review and approval.
 - iii) A complete Site Application shall be submitted to the District.
 - e. The Lift Station BDR shall be reviewed by the District prior to submitting the BDR to CDPHE for review and approval. The BDR shall include a 60 percent design package only be submitted to CDPHE upon District approval of 60 percent design package. A complete BDR shall be submitted to the District.

- f. Prepare and deliver final design plans and technical specifications for the District's review and approval.
- g. Applicant shall coordinate with the District through the construction bidding process.
- h. Applicant shall coordinate construction inspections with District.
- i. Applicant shall submit all construction submittals for review including shop drawings, product data, and operation and maintenance manuals.
- j. Applicant shall coordinate with the District for start-up testing and required training.
- k. Applicant shall submit final record drawings to the District in AutoCAD and pdf format.

B. SHOP DRAWINGS AND PRODUCT DATA

- 1. Submit detailed shop drawings. Submit complete fabrication, assembly foundation, and installation drawing for all pumps, motors, and accessories to illustrate construction and assembly of components.
- 2. Product data to be submitted to verify compliance with specifications shall include, but not limited to, the following:
 - a. General
 - i) Spare parts list, list of lubricants, and recommended spare parts
 - ii) Installation assembly/disassembly and repair instructions
 - iii) Layout dimensions
 - iv) Protective coating system
 - v) Test certificates and results
 - b. Pump
 - i) Manufacturer name
 - ii) Type and model
 - iii) Diameter of suction end of pump
 - iv) Diameter of discharge end of pump
 - v) Type of drive design
 - vi) Shaft design
 - vii) Type of bearings, bearings manufacturer, and bearing life calculations
 - viii) Guide rail details, dimensions, and support connection
 - ix) Provisions for removing rotor and stator assembly and changing bearings
 - x) Weights
 - a) Pump (with rotating assembly)
 - b) Total each unit
 - c) Base support
 - d) Guide rails
 - e) Motor and speed reducer
 - xi) Complete performance curves showing capacity versus head, NPSH required, operating speed, pump efficiency, and bhp
 - xii) Type of coupling
 - xiii) Data on shop painting and coating system data
 - xiv) Nameplate data:
 - a) Name of manufacturer

- b) Type and model
 - 1) Design rotative speed
 - 2) Type of shaft and bearing
 - 3) Type and construction of pump seals
 - 4) Date of manufacturing
- c. Motor
 - i) Manufacturer name and serial number
 - ii) Type and model
 - iii) Rated size (hp) and horsepower output
 - iv) Temperature rise and method indicated
 - v) Maximum ambient temperature
 - vi) Insulation class
 - vii) Rpm at rated load
 - viii) Locked rotor amperes or code letter
 - ix) Service factor
 - x) Type of shaft and bearings
 - xi) Maximum noise level of pump/motor unit (dBA)
 - xii) Efficiency at full load and rated pump conditions
 - xiii) Enclosure and shaft dimensions
 - xiv) Weight
 - xv) Bearing information
 - xvi) Rated load current (amperes)
 - xvii) Power voltage, phase, and frequency
 - xviii) Nameplate data:
 - a) Name of manufacturer
 - b) Type and model
 - c) Type of bearings
 - d) Rated hp size
 - e) Full load current
 - f) Motor performance data
 - g) Date of manufacturing

9.3 DESIGN CRITERIA

A. GENERAL

1. The lift station and force main shall meet the criteria of the CDPHE design standards. Early in the design process, the District shall be contacted in order to coordinate the required flows and service area of the lift station. Design shall be based on a hydraulic analysis of the required flows, pipeline velocities, and receiving gravity sewer capacities. The Developer is responsible for all costs related to existing sewer capacity analysis by the District Engineer.
2. Organic and other applicable wastewater constituent loadings shall be considered and evaluated based on existing and projected land-use. It is the Developer's responsibility to calculate based on most current available information, flows and constituent loadings for accessing available sewer and wastewater treatment capacities.

3. Environmental assessments and/or environmental reviews may be required as a preliminary investigation to determine if a particular parcel of real property is subject to recognized environmental constraints such as, and not limited to the following: floodplain areas, wetlands, endangered species, and hazardous conditions. Should environmental constraints as identified above, it is the Developer's responsibility to incorporate mitigation measures to comply with environmental requirements in accordance with applicable and current rules and regulations.
4. Public lift stations are required to conform to all District and OSHA health and safety requirements. District operation staff safety shall also be considered during the design and construction of the lift station including, but not limited to:
 - a. Readily accessible equipment placement for maintenance activities
 - b. Classified areas in accordance with the National Fire Protection Association (NFPA) 820 Regulations
 - c. Lifting assistance for heavy equipment
 - d. Nonslip floor finishes
 - e. Handrails
 - f. First-aid and safety equipment
 - g. Fall protection
 - h. Limitation of confined spaces – it is desired by the District to limit confined space entries where possible

B. LIFT STATION

1. WET WELL
 - a. Wet well shall have sufficient capacity to contain the inflow for two (2) hours during peak flow conditions. Wet well shall be designed such that to limit pump starts to no more ten (10) per hour. Wet well shall be no smaller than a six (6) foot inside diameter precast concrete structure.
 - b. Wet well shall be designed for fully saturated earth load and shall be sealed from groundwater infiltration by installing a double mastic seal between precast sections.
 - c. All sealant between joints shall be flush with the exterior and interior surfaces. Any pockets, indentations or large cracks in the concrete shall be first troweled flush with patching mortar so that all surfaces are smooth.
 - d. Bottom section of the wet well shall be perfectly level in all directions, as being out of level will not allow the sides to remain plum as they are stacked upwards. Maximum out of plum allowable at the top shall not exceed one (1) inch from top to bottom.
 - e. Piping within the wet well shall be DIP with flange fittings. Individual pipes shall be installed to each pump. A-Lok, Link Seal or other approved watertight gaskets shall be used where the pipes penetrate the walls of the wet well.
 - f. Discharge piping in the wet well and valve vault shall be made up of flanged sections. Pipe shall be DIP and shall have exterior bituminous coating and double cement mortar lining.

- g. Hatch shall be installed in the top slab to allow for pump removal and personal access. The hatch shall be lockable and no smaller than the minimum size required by the pump manufacturer in order to adequately service and remove pumps.
- h. Manhole steps shall be provided to access the wet well. Refer to Detail Drawing S-13 Manhole Steps.

2. PUMPS

- a. Each lift station shall have a minimum of two (2) pumps installed and one (1) pump required as a shelf spare. The pumps shall be identical.
- b. The pumps shall be designed such that the lift station will remain fully operational and able to handle the design flow if one (1) pump fails or is removed from service.
- c. Pumps shall be submersible, explosion proof, Flygt sewage pumps. Deviations shall be approved by the District on a case-by-case basis.
- d. Pumps shall be capable of passing solids of at least three (3) inch in diameter.
- e. One (1) flow meter and one (1) spare pump shall be supplied with each lift station. Said pump shall be delivered and stored at location determined by the District.
- f. Pumps shall have moisture and motor temperature relays as required by the manufacturer for inclusion in the motor controls.
- g. Pumps shall have discharge pressure monitoring and alarming devices.

3. EMERGENCY STORAGE

- a. The lift station shall be designed for at least 60 minutes of emergency storage at peak hour flow conditions or as required by CDPHE. Emergency storage can utilize volume within the wet well above the high-level alarm and upstream collection system piping provided that it is demonstrated that back-up will not occur into any existing or potential future service connections or taps. No future taps shall be construction within the section of influent sewer or sewers to the lift station designated to provide emergency storage. If a piping connection is required to accommodate emergency storage provisions, the invert of the pipe connecting the wet well to emergency storage shall be above the high-level alarm. Additional emergency storage may be required at the discretion of the District based on site location, emergency response time, and potential environmental concerns.
- b. Emergency storage can be accomplished using an additional pre-cast concrete manhole or storage vault like structure. The emergency storage structures shall provide adequate access and floor slope for cleaning and shall be designed with pre-cast concrete, cast-in-place concrete or fiberglass reinforced plastic. If constructed of concrete, adequate protection (i.e. protective coatings) shall be provided to mitigate corrosion caused by hydrogen sulfide. If used, the emergency storage vault shall be designed to provide flow to and from the wet well to the vault and with adequate access for pumping via vacuum truck or other appropriate method.

- c. If emergency storage can be accomplished through gravity flow from the lift station to another existing collection system, the District may consider that as an option to meet emergency storage requirements. It shall be demonstrated that the gravity overflow, existing collection system, and downstream facilities be adequately sized to accept increased flow. Additionally, should the collection system be operated by another entity, a legal agreement stating the entity can and shall receive emergency flows shall be coordinated and presented to the District during the design review process.

C. VALVE VAULT

1. Valve vault shall be below ground, attached but separate from the wet well. It shall be a precast concrete structure.
2. Floor drain returning to the wet well shall be installed in the valve vault. The floor drain shall have a four (4) inch flapped type check valve to prevent the escape of gases from the wet well to the valve vault.
3. Valve vault shall have no direct buried valves.
4. Piping within the valve vault shall be DIP with flange fittings. The discharge line from each pump shall have a check valve, plug valve, pressure gauge, and flow meter with isolation valve and dismantling joints. Check valve shall be the first valve in line after the pump, followed by plug valve. The pressure gauge and flow meter shall be connected to the force main(s).
5. Lockable hatch shall be installed in the top slab to allow for personal access.
6. Manhole steps shall be provided to access the valve vault. Refer to Detail Drawing S-13 Manhole Steps.
7. Refer to Drawing – Lift Station Flow Schematic.

D. SITE AND BUILDING REQUIREMENTS

1. GENERAL
 - a. Sewage lift stations shall be in accordance with Town of Mt. Crested Butte and Gunnison County building codes and regulations.
2. LOCATION
 - a. The actual site of the lift station shall be on a separate lot. The lot shall be of sufficient size to accommodate all facilities and minimum required clearances around facilities. There shall be a minimum twenty (20) foot clearance between all facilities, equipment and the nearest lot line. The lot shall be deeded to the District.
 - b. No portion of the site shall be within the floodway zone. All parts of the lift station and the access road shall be located a minimum one (1)

foot above the hundred (100) year floodplain elevation as shown on FEMA FIRM maps.

- c. Developer shall perform a geotechnical evaluation of the site to determine soil conditions and hydrology as well as recommendations for lift station construction.
- d. All lift station site locations are subject to review and approval by the District and CDPHE Regulation 22.

3. ACCESS

- a. The site shall be accessible via public right-of-way. Entrance driveway shall be at least twenty (20) feet wide.
- b. All lift stations shall be sited to allow access by all-weather surface roads capable of accommodating maintenance trucks from public right of way to the lift station site. The access shall at a minimum support HS-20 loading with a minimum width of twenty (20) feet. The access points and site shall be designed to allow WB-50 trucks to maneuver within the site and exit the site without backing into public right of way. The site layout shall allow for access to the wet well and vacuum/jetter truck to clean out accumulated material in the wet well. All paved surfaces shall be designed for the expected vehicle and equipment loads.

4. BUILDING

- a. All lift station enclosures or buildings shall be in accordance with Town of Mt. Crested Butte and Gunnison County building codes and regulations. All lift station enclosures or buildings must be approved by the District and applicable associations.
- b. Adequate ventilation shall be designed in buildings and vaults as required and adhere to all applicable State, NFPA, and OSHA requirements.

5. POTABLE WATER

- a. The site shall have access to potable water. Potable water connection, service size, backflow device and meter shall be coordinated with the District. At a minimum, there shall be frost proof yard hydrant located in the vicinity of the wet well.

6. SECURITY

- a. The site shall have a security system which will monitor unauthorized access to the wet well and the valve vault. The security system shall consist of a limit switch on the access hatch to the wet well and valve vault. When a door or hatch is opened, an alarm signal shall be sent to the telemetry system. The security system shall include a lock and key operated manual override system. The manual override lock shall be mounted inside the valve vault on the wall. All locks shall be keyed per District's requirements at Developer's cost. The security system shall include a time delay to allow maintenance personnel time to operate the manual override before an alarm signal is sent to the telemetry system. The delay shall be field adjustable with a minimum time range of zero (0) seconds to five (5) minutes.

- b. The fence shall be six (6) feet in height with drive-through gate. No barbed wire, electrically charged wire, cyclone, chain link or similar type fencing shall be erected or maintained.

7. LIGHTING

- a. Lift station shall have a utility pole(s) with high intensity light source, such as mercury vapor lights, controlled by a photoelectric cell. Light pole(s) shall be installed no further than fifteen (15) feet away from the wet well and no further than fifteen (15) feet away from the generator. The light fixture shall be at least twenty (20) feet but not higher than twenty-five (25) feet above the ground. Light must also be able to be controlled with a hand switch that overrides photoelectric cell.
- b. Lift station building shall have adequate lighting controlled by a motion sensor. Light must also be able to be controlled with a hand switch that overrides motion sensor.
- c. Drawings showing location, height and picture example of the light fixture shall be submitted to the Town of Mt. Crested Butte for review and approval.

E. PIPING

- 1. All buried pipes shall be PVC or HDPE.
- 2. Buried pipe material shall be AWWA C900-16 with minimum wall thickness of at least DR-25. DR-18 or DR-14 shall be required if pressure or surface loading at any location in the system exceeds the DR-25 pressure rating.
- 3. PVC PIPING
 - a. Manufacturers:
 - i) JM Eagle
 - ii) Georg Fischer Piping Systems
 - iii) North American Pipe Corporation
 - iv) Diamond Plastics Corporation
 - v) Vinyltech Corporation
 - vi) Or accepted substitution
 - b. Pipe: AWWA C900, DR 18 except as otherwise specified
 - c. Marking: Identification markings on pipe shall conform to AWWA C900
 - d. Fittings: Ductile iron compact fittings: ANSI A 21.53/AWWA C153
 - i) Working pressure rating: 350 psi rating
 - ii) Joint: Mechanical joints with restraints
 - iii) Coating:
 - a) Exterior: AWWA C153, Asphalt coated
 - b) Interior: AWWA C104 and C153, lined with double thickness cement seal coated
 - c) Or interior and exterior: AWWA C116, fusion bonded epoxy coating
- 4. HDPE PIPING

- a. Manufacturers:
 - i) JM Eagle
 - ii) Performance Pipe
 - iii) WL Plastics
 - iv) ISCO Pipe
 - v) Or accepted substitution
- b. Material:
 - i) The pipe shall be manufactured from a PE 4710 resin compound listed with the Plastic Pipe Institute (PPI) as TR-4.
 - ii) The resin material shall be in accordance with ASTM D3350 with a minimum cell classification of 445574C/E.
 - iii) This resin material shall have a Long Term Hydrostatic Strength of 1600 PSI when tested in accordance to ASTM D2837.
 - iv) Pipe dimensions shall be in accordance with ASTM D3035 as a minimum.
 - v) The final compounded material shall contain a minimum of 2% carbon black
 - vi) The pipe shall contain no recycled material except that generated by the pipe manufacturer in their own plant from resin compound of the same specification and raw material supplier. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
 - vii) Pipe shall have a manufacturing standard of ASTM F714 and be manufactured by an ISO 9001 certified manufacturer.
 - viii) All pipes and fittings shall be suitable for use as pressure conduits, listed as NSF 14, and per AWWA C906 Pressure Class (PC) 100 have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe and/or fitting
- c. Fittings:
 - i) All fittings shall be PE 4710 HDPE, minimum Cell Classification of 445574C/E as determined by ASTM D3350, and approved for AWWA use.
 - ii) All fittings shall be of the same base resin as the pipe.
 - iii) All fittings shall have a working pressure rating equal to the pipe unless otherwise specified in the plans.
 - iv) All fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
 - v) Molded butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification.
 - vi) Compression Type Mechanical Coupling
 - a) Suitable for joining HDPE to HDPE, HDPE to PVC, or HDPE to DIP
 - b) Factory coat coupling internally and externally with a fusion bonded epoxy
 - c) Reinforce HDPE pipe with a split ring type stiffener in pipe bore. Size stiffeners for size of HDPE pipe being joined. Supply feature that prevents stiffener from sliding completely into pipe. Size stiffeners for length of mechanical coupling and not to extend outside of body of mechanical coupling. Mark

stiffener with pipe diameter. Factory coat stiffeners internally and externally with fusion bonded epoxy.

vii) Use seal and restraint type coupling. Requirements for type of couplings are specified herein.

viii) Approved Manufacturers:

- a) JCM Industries
- b) Agru America
- c) Romac Industries
- d) Or accepted substitution

5. All wet well and valve vault piping shall be ductile iron.

6. DUCTILE IRON PIPING

a. Manufacturers:

- i) U.S. Pipe
- ii) American Cast Iron Pipe Company
- iii) McWane Cast Iron Pipe Company
- iv) Pacific States Cast Iron Pipe Company
- v) Griffin Pipe Products Company
- vi) Or accepted substitution

b. Pipe:

- i) ANSI A21.51/AWWA C151, unless otherwise specified
- ii) Where fitted with push-on joints, mechanical joints or mechanical joints with joint restraint device, or restrained joints: minimum pressure class wall thickness that meets project pressure and structural requirements, unless otherwise specified.
- iii) Where fitted with flanged, grooved or restrained joints: Class 53
- iv) 4-Inch to 12-Inch: Class 350
- v) Thickness (minimum) for screw-on flanges shall be in accordance with AWWA C115
- vi) Pipe with grooved or shouldered joints for any restrained joint shall have wall thickness increased to provide the minimum wall thickness in accordance with AWWA C606

c. Fittings:

- i) Ductile iron full body fittings
 - a) ANSI A21.10/AWWA C110, ASTM A536
 - b) 24-inch and below: 350 psi rating, mechanical joint
- ii) Ductile iron compact fittings
 - a) ANSI A21.53/AWWA C153
 - b) 24-inch and below: 350 psi rating, mechanical joint
- iii) Fittings shall have a pressure rating no less than that of adjoining pipe
- iv) Fittings for pipe with mechanical or push-on joints shall have mechanical joints in accordance with ANSI A21.11/AWWA C111
- v) Comply with requirements for restrained fittings as indicated
- vi) Tapping Sleeve and Tapping Valve:
 - a) Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine
 - b) Tapping Sleeve: Cast-iron or ductile-iron 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may

have mechanical joint ends with rubber gaskets or sealing rings in sleeve body. Use sleeves that mate with size and type of pipe material being tapped. Outlet flange shall be of a size required for branch connection

- vii) Provide all specials, taps, flanges, plugs and wall fittings as required
- viii) Provide openings for air valve, drain, sampling, testing, sensing and all other connections with threaded bosses sized and located as indicated and specified
Threaded connections shall be in accordance with ANSI B2.1.NPT. Provide boss or tapping saddle at all tapped connections

F. VALVES

1. All valves shall be 316 stainless steel. Variances shall be approved by the District on a case-by-case basis.
2. Schedule 80 valves shall not be allowed. Variances shall be approved by the District on a case-by-case basis.
3. PLUG VALVES
 - a. Manufacturers:
 - i) DeZurik
 - ii) Henry Pratt Company
 - iii) Milliken
 - iv) Or accepted substitution
 - b. Design:
 - i) Valves shall conform to design specified herein
 - ii) Quarter-turn non-lubricated eccentric plug valves
 - iii) Resilient faced plug
 - iv) Tight shut-off up to scheduled rating with pressure in reverse direction where scheduled
 - v) Valves with vane type seat rings are not acceptable
 - vi) Valve port shall be at least 80% of full pipe area for valves through 20-inch in diameter
 - vii) Valve ends to match connecting piping
 - a) Buried: Mechanical joint, ANSI A21.11/AWWA C111
 - b) Flanged: 125 lb, ANSI B16.1
 - c) Screwed valve ends shall be to the NPT standard
 - d) Grooved ends shall conform to AWWA C606 rigid joint specifications
 - viii) Minimum Working Pressure Rating: 175 psig, 4 inch through 12 inch
 - ix) Opening motion eccentric, lifting plug away from body seat
 - x) Valve Alignment
 - a) In horizontal pipelines, valve shall be installed so that the plug is horizontal and rotates upward as the valve opens
 - b) In vertical pipelines, valve shall be installed with the end marked "seat" at the top of valve
 - c) Valve shall be installed with seat on low pressure side of valve

- xi) Provided with fully adjustable plug position stops
 - xii) Plugs shall be eccentric type with no backing ring or frame
 - xiii) Valve body cavity shall be smooth without protrusions or baffles
 - xiv) Electric actuators shall conform to AWWA C542
 - xv) Valve bonnet stuffing box sufficiently deep for 4 packing rings on 4" and larger valves
 - xvi) Valve body plainly marked to indicate seat end
 - xvii) Actual length within 1/16" ± of specified or theoretical length
 - xviii) Valve packing adjustment accessible without removing actuator from valve
- c. Materials
- i) Plug and body: Stainless steel
 - ii) Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with water and wastewater applications
 - iii) Seat rings shall be threaded, or welded of corrosion-resistant stainless steel (18-8), nickel, or Monel conforming to AWWA C517
 - iv) Sprayed or plated mating seat surfaces are not acceptable
 - v) Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion resistant stainless steel
 - vi) Shaft seals shall be multiple O ring, self-adjusting U-cup or chevron type packing conforming to AWWA C517
 - vii) Pull down packing is not acceptable
 - viii) Shaft seals shall be field adjustable or replaceable without valve disassembly
 - ix) Plug seat: Chloroprene (Neoprene)
 - x) Packing: Acrylonitrile Butadiene V-Type Cup, Dual U-cup
 - xi) Upper thrust bearing: TFE
 - xii) Body seat: Welded-in overlay seat of no less than 90% nickel
 - xiii) Upper and lower trunnion bearings: Sleeve type, 18-8 stainless steel
 - xiv) Valves complete with epoxy coating on the interior and exterior
- d. Mounting
- i) Each valve shall be mounted with plug in horizontal position (bearing shall not be mounted on bottom of valve), with valve closed in seating position with forcemain pressure downstream seating plug against valve.
- e. Testing
- i) Each valve shall be in accordance with AWWA C517 subjected to cycle life and pressure leak test (1,034 kPa)(150 psi) and a valve body hydrostatic test (2,068 kPa)(300 psi) by the manufacturer at their facilities prior to shipping
 - ii) Valves shall be capable of drip-tight shut-off up to the full leak test rating. Test and certify pressure capacity in the reverse direction
- f. Motor Actuators:
- i) Each motor actuator to consist of motor, actuator unit gearing, handwheel, limit and torque switches, mechanical position indicator, lubricants, heating element, wiring, terminals and

- integral reversing controller on capacitance starter as indicated, constructed as a self-contained unit
- ii) Housing: Cast, weatherproof, NEMA 4 unless indicated otherwise
 - a) Operating time from fully open to fully closed or the reverse:
 - b) For open/close valves: 30 seconds
 - c) For modulating valves: adjustable from 15 seconds to two minutes
 - iii) Motors
 - a) Mounted horizontally adjacent to or vertically above gearing
 - b) Do not mount with motor vertical below gearing
 - c) Totally enclosed, high torque, designed expressly for valve operator service
 - d) Service rating:
 - 1) Open/close service motors shall be rated for 15-minute continuous duty
 - 2) Modulating service motors shall be rated for a minimum of 600 starts/hour
 - 3) Designed in accordance with NEMA Standards
 - 4) Insulation: Class F or better
 - 5) Bearings: Permanently lubricated
 - 6) Voltage tolerance: +/- 10 percent
 - 7) Voltage rating: 480 Volt, 60 Hz, 3 phase
 - 8) Conform to AWWA C540
 - iv) Gearing
 - a) All grease lubricated
 - b) Service factor: 2.0
 - c) Effectively sealed against entrance of foreign material
 - d) AGMA nameplate not required
 - e) Supported by anti-friction bearings
 - v) Designed so motor comes up to speed before stem load is encountered in opening and closing direction
 - vi) Self-locking worm gear drive with alloy bronze worm gear and hardened steel worm
 - vii) Handwheel/Chainwheel mechanism
 - a) Designed so handwheel/chainwheel does not operate during motor operation
 - b) Designed so motor does not rotate when handwheel/chainwheel is rotated after declutching
 - c) Provide declutching extensions to allow declutching of all electric actuators from floor level
 - d) Actuator responsive to electrical power and control at all times, instantly disengaging handwheel/chainwheel
 - e) Shall meet all requirements for manual actuator
 - viii) Torque switches
 - a) Provide opening and closing torque and thrust limit switches
 - b) Micrometer adjustment on each switch
 - c) Reference setting indicator
 - d) Variability 40 percent
 - e) Contact rating: 6 amp inductive at 120 V ac
 - ix) Geared limit switches
 - a) Space for 4 geared limit switch assemblies

- b) Each assembly with 2 sets of NO contacts and 2 sets of NC contacts
 - c) Each assembly geared to driving mechanism and independently adjustable to transfer at any point between fully open and fully closed valve position
 - d) Contact rating: 6 amp inductive at 120 Vac
 - e) Provide three limit switch assemblies
 - x) Heating element
 - a) Provide in actuator housing
 - b) Rated 120 V ac
 - c) Continuously energized
 - xi) Terminal facilities: Provide for connection to motor leads, switches, heating elements, control and power supply
 - xii) Controller
 - a) Integrally mounted solid state reversing controller for modulating operators, integrally mounted electromechanical controller for open-close operators
 - b) Motor overload protective device
 - c) Electrically interlocked
 - d) Provided with the necessary direct operated auxiliary contacts for required interlocking and control
 - e) Pilot devices, Modulating Service
 - f) In a weatherproof enclosure close-coupled to actuator housing
 - g) Open-stop-close maintained contact push buttons
 - h) Hand-Auto maintained selector switch
 - i) Red "Open" and green "Closed" indicating lights
 - j) Auto position of selector allows 4-20 ma input proportional to required valve position
 - xiii) Pilot Devices, Open/Close Service
 - a) In a weatherproof enclosure close-coupled to actuator housing
 - b) Local Open/Close maintained pushbuttons
 - c) Local Hand-Auto maintained selector switch
 - d) Local red "Open" and green "Closed" indicating light
 - e) Auto position of selector allows open or close operation from remote un-powered contact from maximum distance of 300 feet
 - xiv) NEMA Size 1 minimum
 - xv) Action on loss of command signal shall be selectable to include open, close, or last position
 - xvi) Controller for modulating service shall include provisions for zero, span gain, opening and closing speed potentiometer and deadband adjustment.
4. Check valves shall be either swing check or ball check.
5. SWING CHECK VALVES
- a. Manufacturers:
 - i) DeZurik
 - ii) Or accepted substitution
 - b. Design

- i) 175 psi working pressure (general). 250 psi working pressure (special case).
- ii) Conform to AWWA C508
- iii) Unobstructed waterway, quick-closing, spring-loaded, horizontal swing
- iv) Stainless steel shaft with both ends extending through bronze bushed bearings and outside stuffing boxes
- v) Body and Cover: Shall be stainless steel, full opening
- vi) Flanges: Shall be ANSI B16.5 Class 125
- vii) Furnish with extended stainless steel hinge with outside lever and weight
- viii) For vertical installations, adjust lever angle accordingly

6. BALL CHECK VALVES

a. Manufacturers:

- i) Flomatic Valves, Type 408²S6
- ii) Flygt Corporation
- iii) AVK
- iv) Or accepted substitution

b. Design:

- i) Ball check valves shall be designed to be non-clog, fully automatic, maintenance free, and specifically suited for operation in wastewater where solids, fibers, grit or highly viscous materials are encountered
- ii) Ball check valves are designed to be maintenance-free and suited for installation in the horizontal or vertical position
- iii) Ball check valves will have one moving part, the ball, which automatically rolls out of the path of flow, thus providing an unobstructed and "full flow" equal to nominal size. Upon discontinuation of flow, the ball shall automatically roll back to the closed position providing a positive seal against back pressure or backflow
- iv) Ball shall have an exterior coating of vulcanized nitrile rubber resistant to grease, petroleum products, animal and vegetable fats, dilute concentrations of acids and alkalines, tearing and abrasion
- v) Valve shall be constructed so that by unbolting and lifting off the cover, the ball may be removed and replaced without removing the valve from the line
- vi) Ball check valves will be available with either a floating or sinking ball.
- vii) Suitable for 150 psi working pressure (all sizes)
- viii) Body and Cover: Flanged stainless steel body
- ix) Flanges: Shall be ANSI B16.5 Class 125

G. EMERGENCY OPERATION

- 1. A tee plug valve and blind flange assembly is required on the force main on the downstream side of the discharge valves. This is required so a truck mounted pump can bypass the lift station pumps and piping in case of equipment failure.

H. APPURTUNANCES

1. All hardware bolts, nuts, anchors, brackets, chains, etc. within wet well shall be made of non-corrosive materials.
2. Each lift station shall be supplied with at least one (1) of each size of motor starter and capacitor installed.

I. INSTRUMENTATION

1. MAGNETIC FLOW METERS

- a. The Magnetic Flow Meter shall be a completely obstructionless, in-line flow meter with no constrictions in the flow of fluid through the meter. The meter shall consist of a metallic tube with flanged ends and with grounding rings. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5, Class 150. Meters shall be suitable for the maximum range of working pressures of the adjacent piping. Electrode materials shall be fully compatible with the process fluid and shall comply with the requirements specified in the instrument device schedules. Each meter shall be factory calibrated, and a copy of the calibration report shall be submitted as part of the operation and maintenance manual submittal.
- b. The meter shall be capable of standing empty for extended periods of time without damage to any components. The meter housing shall be of a splash-proof and drip-proof design.
- c. The meter shall be located within the valve vault at least 3 diameters downstream and 5 diameters upstream for more accurate flow measurement.
- d. Power supply to the meter shall be 120 VAC, 60 Hz, single phase.
- e. Meters shall be Rosemount Type 8750W or approved equal.
- f. The flow meter shall be approved by the District.

2. MAGNETIC FLOW METER SIGNAL CONVERTERS

- a. Magnetic Flow Meter Signal Converters shall be separately mounted, microprocessor-based signal converters. They shall be provided for the magnetic flow meters. The signal converters shall include output dampening, self-testing, integral digital indicator, built-in calibration capability, and an "empty pipe zero" contact input. The overall accuracy of the magnetic flow meter transmitter and signal converter shall be +/-1.0 percent of actual flow rate for full-scale settings of 0.3 to 30 fps. The signal cable between the converter and the magnetic flow meter shall be furnished by the meter manufacturer. The signal converter shall be housed in NEMA Type 12 housing and shall be suitable for operation over an ambient temperature range of -30° to +140°F, and relative humidity of 10 to 100 percent. The converter shall have an analog output of 4-20 mA DC.
- b. The signal converter shall have a seven-digit, non-reset totalizer on the face of the enclosure. Local electronic indicators shall be provided. Indicators shall be mounted on or near the flow meter signal converters in weatherproof NEMA Type 4 housings. Indicators shall be four-digit LCD type and shall read in engineering units.

3. HYDROSTATIC LEVEL TRANSDUCER
 - a. Each transducer shall be a hydrostatic pressure sensor for level measurement of wastewater applications. The sensor shall be a permanently sealed submersible probe and cable combination. The transducer shall be a of the two-wire type which requires no direct power connection to the transducer. Transducer output shall be 4-20mA DC. The transducer shall be capable of the ranges and pressures for which the application will require. The sensor shall be mounted as required for application. The transducer shall be a Dwyer "PBLT2", Endress-Hauser "WaterpilotFMX21", GE Sensing (Druck) "PDCR/PTX- 1730", or approved equal. The level transducer shall be approved by the District.
 - b. The level transducer shall not be an ultrasonic level transducer.
4. WEIGHTED FLOAT SWITCHES
 - a. In addition to the primary level control system, the lift station shall be equipped with a secondary level control system for back-up. The secondary level control shall consist of electro-mechanical float switches for low water cut-off, pump on / off, and high-water alarm. Each level switch shall consist of a single-pole, double-throw switch, rated not less than 3 amperes AC, sealed and housed in a chemical-resistant polypropylene casing. The switch assembly shall be weighted and suspended on its own cable. The flexible support cable shall be waterproof, three-conductor, synthetic covered cable with 18AWG conductors, and shall be of sufficient length so that no splice or junction box is required in the wet well. Switches shall be suitable for operation up to 150 volts within an ambient temperature range of 0° to 60° C. Switches shall be suitable for use in a sanitary or wastewater wet well environment. Installation hardware shall be provided as necessary for application. Switches shall be Flygt "Type EMN-10", Siemens Water Technologies "Model 9G-EF", or approved equal.
 - b. Accepted manufacturers for float switches shall be Siemens Water Technologies Model 9G-EF or approved equal.
5. TEMPERATURE TRANSMITTER
 - a. The temperature sensors shall provide a 4-20mA signal and have a large LCD display. The sensor shall have an operating range of -40-185°C. Temperature transmitter shall be a Rosemount model "3144P" or approved equal.
6. TEMPERATURE SWITCH
 - a. Temperature switches shall be constructed with an all-metal case. Switches shall have contacts rated 10A at 120VAC. Switches shall be Dayton Model 2E206 or approved equal.
7. HUMIDITY TRANSDUCER
 - a. The humidity transducer shall provide an analog signal to alarm on high humidity levels (operator adjustable). The transducer shall have an operating range of -40-185°C. Accepted manufacturers for

humidity transducers shall be Emerson, Rosemount, or approved equal.

- b. Operating temperature: -5°C to 55°C
- c. Supply voltage: 18-35 VDC or 24VAC

8. LIMIT SWITCH

- a. The limit switch shall be of the lever operated limit switch type and shall be enclosed in a NEMA 4 housing. The switch shall be furnished with one NO and one NC contacts and screw type wiring terminal. The switch shall be heavy duty, oil tight type. Limit switches shall be Square D model "9007C54B2" with adjustable type roller lever arm "9007HA1" or approved equal.

9. MAGNETIC DOOR SWITCH

- a. The magnetic door switch shall be a two piece switch rated 100V ac/dc. Switch shall be Edwards 60 Series or approved equal.

J. SITE LIGHTING

- 1. Lighting shall be provided at the lift station site to allow for necessary activities during night and times of low visibility. The lighting system shall be designed to provide illumination best suited for the station layout with may include suspended, wall, or ceiling mounted fixtures and shall be suitable for routine maintenance activities and inspections. Site lighting equipped with photocells shall not be allowed.

K. BACKUP POWER

- 1. Back-up power shall be supplied at the lift station to power the pumps and ancillary equipment in the event of a power outage. The back-up power system shall be diesel powered. The Cummins standby generator system is preferred and the Developer shall determine if that system is suitable for the application. Other back-up power systems will be considered if application is not suitable for the Cummins system. If not provided by Cummins, the alternate back-up power system will be evaluated and approved by the District on a case-by-case basis.

L. ALARM/DISCONNECT PANEL

- 1. Each lift station shall include NEMA 4X listed suitable for wall or pole mounting. The enclosure shall be manufactured of stainless steel to assure corrosion resistance. The enclosure shall have a hinged, pad lockable cover, secured dead front and component knockouts.

M. TELEMETRY MONITORING SYSTEM

- 1. The following conditions shall be monitored and telemetered over a dedicated radio wave to District's RTU. Monitoring system shall be approved by the District.
 - a. Power monitor
 - b. Lead pump run

- c. Lead pump fail
- d. Lag pump run
- e. Lag pump fail
- f. Low battery — RTU
- g. Overflow
- h. High-water level
- i. Low-water level
- j. High temperature
- k. High humidity
- l. Valve vault intrusion alarm
- m. Wet well intrusion alarm
- n. Pump Check Valve Position (fail to close)
- o. Pump Check Valve Position (fail to close)
- p. Discrete spare
- q. Discrete spare
- r. Discrete spare

N. CONTROL PANEL

1. The pump station shall be provided with everything to provide a fully operational system in full conformity with the recommendations of the equipment manufacturer and communicate with the District's existing SCADA system. Unless indicated otherwise, all equipment and material shall be new, undamaged and meet the requirements of UL. Where UL requirements are not applicable, equipment and material shall be identified as such by the supplier and approved by the Engineer before purchase and installation.
2. Developer shall confirm specific requirements of programmable logic controller (PLC) including, but not limited to, Input/Output Modules, Programming Software, and Operator Interface Terminal and Software.

O. INTRUDER DETECTION SYSTEM

1. If the lift station includes a building, it shall also include an intruder detection system. Any deviation from other sites shall be approved by the District prior to procurement and install.

P. CORROSION PROTECTION

1. Lift Station shall have corrosion protection on the interior surfaces to prevent damage to the wet well caused by concentrated levels of H₂S and other corrosive properties of raw wastewater. Economic and life cycle analysis shall be performed on various corrosion protection methods including polymer concrete, waterproofing/microbicide admixtures, and epoxy coatings. Determination of the most suitable corrosion protection method is subject to District approval based on the economic and life cycle analysis.
2. A cathodic protection system shall be designed for any buried carbon steel or ductile iron piping and structures in the system.

3. All wet well penetrations shall be link sealed and grouted to inhibit any leakage from the wet well or groundwater infiltration.

Q. COATINGS AND PAINTINGS

1. All exposed carbon steel and ductile iron surfaces, piping and equipment shall have field-applied protective painting or coating except where material (i.e. PVC, HDPE, stainless steel) or factory coating warrants exception.
2. All flooring shall be aggregate-filled heavy duty epoxy flooring
 - a. Flooring shall be a nominal 1/4-inch-thick system comprised of a penetrating, moisture tolerant, two-component epoxy primer; a high performance, three-component mortar consisting of epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments; and a two-component, 100% solids, chemical resistant, epoxy coating.
 - b. Approved Manufacturers:
 - i) Tnemec StrataShield Series 237 Power-Tread top coated with Series 280 Tneme-Glaze
 - ii) Stonhard Stonclad GS top coated with Stonkote HT4
 - iii) Florock FloroBuild top coated with Floropoxy 4805
 - iv) Or accepted substitution.
3. All paint and coatings systems shall be approved by the District and shall adhere to District standards.

9.4 ODOR CONTROL

A. ODOR CONTROL EVALUATION

1. The lift station shall be evaluated for the odor mitigation system and final determination of implementing odor control measures will be reviewed and determined by the District. Supporting data, calculations, or assumptions for hydrogen sulfide generation based on estimated wastewater characteristics and industry standards shall be included in the evaluation. In the absence of supporting data and / or calculations, the Developer shall utilize the latest edition of "Metcalf and Eddy Wastewater Engineering Treatment and Resource Recovery" for medium strength sulfide concentrations in wastewater. Other factors to consider in the evaluation include but are not limited to:
 - a. Proximity to and use of neighboring properties
 - b. Composition of the wastewater (BOD5, COD, TSS, Sulfides, TKN, Ammonia-N)
 - c. Wind direction and downwind properties
 - d. Operation and maintenance requirements of odor control system

B. ODOR CONTROL SYSTEM

1. If odor control is determined necessary, the type of system shall be selected based on the site-specific needs of the lift station. All ancillary equipment and necessary provisions shall be incorporated into the design of the lift station to provide a functional system. Odor control systems may include but are not limited to the following mitigation technologies:
 - a. Carbon absorption systems
 - b. Biological scrubber or filter
 - c. Chemical scrubber
 - d. Calcium nitrate addition
2. If odor control is not required, provisions for future addition of odor control facilities (i.e. installation of ventilation ducts and penetration into the wet well for future connections) shall be provided.

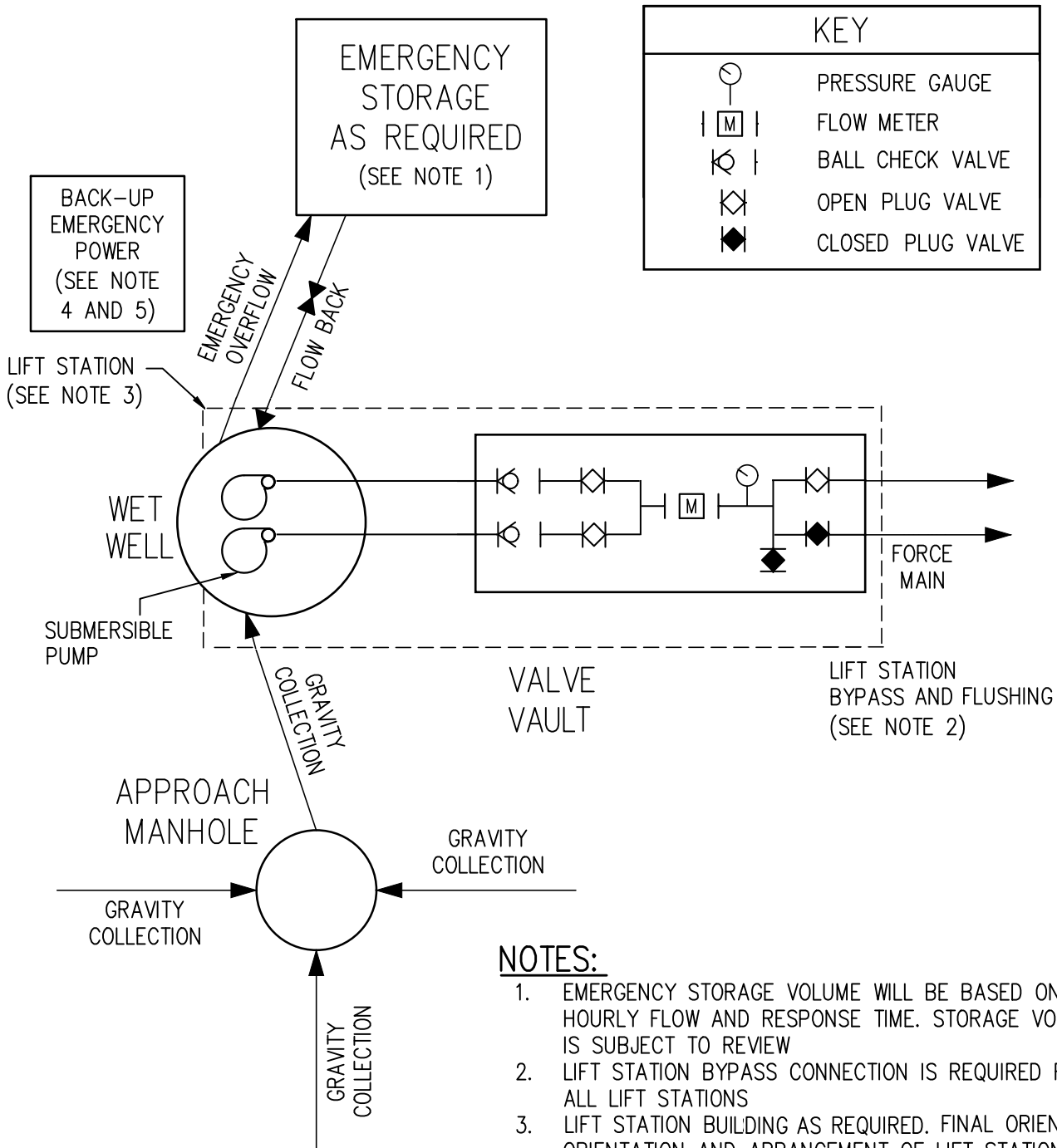
9.5 ACCEPTANCE

A. TESTING AND START-UP

1. The Owner shall develop a plan to test and demonstrate the successful and flawless operation of the lift station in manual and automatic mode prior to District's initial acceptance. The start-up operation shall demonstrate that the lift station and all components are completely functional in manual and automatic mode, including all pumps, valves, controls, telemetering, and alarms. The start-up and testing plan shall be submitted to the District and Engineer for review and approval prior to commencing the start up. A factory representative for the pumps and controls shall be on site for the start-up operation.
2. LEAKAGE TESTING
 - a. Structures shall be subjected to leakage tests after concrete has obtained specified design strength, and before backfilling or other Work which will cover faces of walls is begun
 - b. Tanks laterally restrained or supported by cross-walls, beams or slabs shall not be tested until such restraining or supporting construction is placed and has obtained its specified design strength
 - c. Fill structure with water to elevation given in the table below. After structure has been full for 24 hours, it will be assumed for purposes of test that absorption of moisture by concrete in structure is complete. Measure change in water level after 24 hours have elapsed.
 - d. Fill container with water and place next to or in structure being tested. Locate container so it experiences environmental conditions as close as possible to those experienced by structure. Container shall be used as an indicator to measure loss of water due to evaporation. Level of water in container shall be measured and recorded over same period as structure.
 - e. If drop in water level, adjusted for evaporation in 24-hr period, exceeds 1/32 of an inch leakage shall be considered excessive

- f. During test period, examine structure and mark visible leaks or damp spots
 - g. Damp spots on the exterior wall faces or footings shall be qualified as leaks. All leaks shall be repaired.
 - h. Drain structure to 2-ft minimum below leaks and damp spots and repair. Method of repair shall be Contractor's option, subject to requirements of these Contract Documents and review by Engineer.
 - i. If leakage was determined to be excessive, refill structure to specified level and retest
 - j. Continue this process until drop in water level in 24-hour period is less than 1/32 of an inch.
 - k. Repairs and additional tests shall be made by Contractor, in acceptable manner, at no additional cost to Owner.
3. The Owner shall supply the District with the Operation and Maintenance (O & M) Manual. The Manual shall contain complete operating information for all equipment, a complete set of approved shop drawings, pump curves, and a copy of the as-build drawings for lift station. The as-build drawings shall be updated to include all plan revisions and field changes made during construction. One (1) complete hard (paper) copy of the O & M with a reproducible set of drawings and one (1) complete electronic copy of the O & M and as-build drawings shall be submitted to the District prior to final acceptance.
4. Other deliverables shall include location of part warehouses in the State of Colorado, anticipated delivery methods and time for parts replacement.
5. Acceptance period: Refer to MCBWSD Rules and Regulation, Section 5.7.

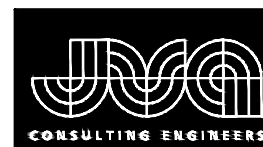
END OF SECTION



NOTES:

1. EMERGENCY STORAGE VOLUME WILL BE BASED ON PEAK HOURLY FLOW AND RESPONSE TIME. STORAGE VOLUME IS SUBJECT TO REVIEW
2. LIFT STATION BYPASS CONNECTION IS REQUIRED FOR ALL LIFT STATIONS
3. LIFT STATION BUILDING AS REQUIRED. FINAL ORIENTATION ORIENTATION AND ARRANGEMENT OF LIFT STATION AND FORCEMAIN COMPONENTS SUBJECT TO FINAL APPROVAL
4. BACK-UP EMERGENCY POWER SYSTEM INCLUDED W/ PUMP MANUFACTURER.
5. SKID-MOUNTED DIESEL FUEL DRIVEN ENGINES INTEGRAL WITH SKID-MOUNTED LIFT STATION PUMP SYSTEM PREFERRED FOR BACK-UP EMERGENCY POWER SYSTEMS.

**LIFT STATION FLOW SCHEMATIC
MT. CRESTED BUTTE
WATER & SANITATION DISTRICT**



JVA, Inc.
1319 Spruce Street
Boulder, CO 80302
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SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers excavation and trenching; including subsurface drainage, dewatering, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines, service lines and appurtenances.
- B. Excavation, trenching and backfilling within the Town of Mt. Crested Butte shall be in accordance with this section or the Town of Mt. Crested Butte Code Section 17-39 which ever is the more stringent. Section 17-39 of the Town of Mt. Crested Butte Code is attached as Appendix B.
- C. Reference Water Detail No. 1.
- D. Reference Sewer Detail No. 1.

1.2 QUALITY ASSURANCE

- A. Soil compaction tests shall be performed in accordance with the following specifications or the latest revision thereof:
 - 1. ASTM D698 - Standard Method of Test for Moisture Density Relations of Soils.
 - 2. ASTM D2049 - Standard Method of Test for Relative Density of Cohesionless Soils.
- B. Construction Staking.
 - 1. Construction staking shall be performed with qualified, competent personnel.
 - 2. All survey notes and construction staking notes shall be entered into bound, hard cover field books.
 - 3. Staking of the work shall be at 50 foot stations (maximum) and adequate to provide acceptable horizontal and vertical control.
 - 4. Offsets shall be staked so that vertical and horizontal alignment may be checked.
 - 5. All survey data, which is developed in performing surveys which are required by the work, shall be available to the District for examination throughout the construction period.

1.3 JOB CONDITIONS

- A. Drainage and groundwater.
 - 1. Contractor shall obtain all necessary permits prior to starting dewatering operations.
 - a. If ground water will be discharged into an irrigation ditch, pond, stream or other waterway, or will eventually drain to an irrigation ditch, pond, stream or waterway, a dewatering permit will be required.
 - b. Permit applications are available from:

Colorado Department of Health
WQCD-PE-B2
4300 Cherry Creek Drive South
Denver, CO 80222-1530

2. All excavations and trenches shall be kept free from excess groundwater during construction.
3. Any water which is encountered in the trench shall be removed 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.
4. Surface runoff shall be diverted as necessary to keep excavations and trenches free from water during construction.
5. The excavation or trench shall be kept 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.
6. Sumps shall be provided to prevent upward flow of water into the excavation when water is creating unstable trench bottom conditions. The bottom of sumps shall be a minimum of 2-feet below the bottom of the trench.
7. Water shall be prevented from entering into previously constructed pipe.
8. The pipe under construction shall not be used for dewatering.
9. Contractor shall be responsible for any damage to, and the restoration of curbs and gutters and drainage systems resulting from ground and surface waters.

B. Sequencing.

1. Pipeline installation shall be performed within 300 linear feet of trench excavation.
 - a. If construction is occurring in an open field, this distance may be amended, at the District's discretion.
2. Initial trench backfill shall be performed within 50 linear feet of pipeline installation.
 - a. If construction is occurring in an open field, this distance may be amended, at the District's discretion.
3. 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.
 - a. The contractor shall coordinate the amount and duration of road closure with the applicable jurisdiction.

C. Underground obstructions.

1. Contractor shall field verify all Drawing of Record information obtained from the District.
2. Contractor shall notify each utility owner and request utilities to be field located by surface reference at least 48 hours prior to trenching or excavation.
3. Where conflicts may exist, 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.
 - a. In the case of a conflict, the Contractor shall notify the District, Design Engineer, and the affected utility company.

- b. In the case of a conflict, the proposed work may be modified, at the District's discretion.
 - 4. Existing improvements, adjacent property, utilities, trees, and plants that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.
 - 5. If the Contractor removes any underground obstructions, the following shall apply:
 - a. Drainage culverts may be salvaged, stored and reused in the original location, if approval is obtained from the Town of Mt. Crested Butte.
 - 1) All other underground obstructions shall be replaced with new materials.
 - b. The area in which the underground obstruction was located shall be restored to original condition, or better.
 - 6. Contractor shall obtain permission from the Town of Mt. Crested Butte prior to removing any trees within the Town of Mt. Crested Butte.
- D. Bridging of Excavations and Trenches
- 1. In street locations where the Town of Mt. Crested Butte deems necessary, trenches and excavations shall be bridged to permit an unobstructed flow of traffic. Bridging shall be approved by the Town of Mt. Crested Butte and meet the following requirements:
 - a. Bridging shall be secured against displacement by using adjustable cleats, angles, bolts or other devices.
 - b. Bridging shall be installed to operate with minimum noise.
 - c. The trench shall be adequately shored to support the bridging and traffic.
 - d. Steel plates used for bridging shall extend one foot beyond the edges of the trench and meet the minimum thickness requirements listed in Table 3-1. Temporary paving materials shall be used to feather the edges of the plates to minimize wheel impact.

Table 3-1

MINIMUM STEEL PLATE THICKNESS FOR BRIDGING

Width of Trench	Minimum thickness of Steel Plates
1.0 ft	1/2 inch
1.5 ft	3/4 inch
2.0 ft	7/8 inch
3.0 ft	1 inch
4.0 ft	1-1/4 inch

1.4 MAINTENANCE AND CORRECTION

- A. Contractor shall maintain and repair all trench settlement and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of backfill settlement.
 - 1. Contractor shall warrant work for a period of five (5) years after final completion and acceptance of the work.

- B. Contractor may perform such maintenance and repairs by subcontract.
 - 1. If the contractor chooses to subcontract the warranty work, he shall submit to the District, a copy of the subcontract, or the work authorization, as evidence of the contractor's faithful intention to perform any repairs which may become necessary during the five-year warranty period.

PART 2 - MATERIALS

2.1 STABILIZATION MATERIAL

- A. If the existing soil in the trench bottom is judged to be unsuitable by the District, the top 6-inches of the pipe subgrade shall 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"	95-100
1"	35- 70
1/2"	10- 30
#4	0- 5

- 2. Or an approved substitute.

- B. Geotextile fabric may be used in conjunction with stabilization material, with the prior written approval of the Town of Mt. Crested Butte.

- 1. Acceptable types of geotextile fabric and their manufacturers are:
 - a. Mirafi 140 and 500 x, by "Celanese".
 - b. Bidim C-28 and C-34.
 - c. True Tex M G-100, by "True Temper".
 - d. Fibretex Grade 150, by "Crown Zellerbach".
 - e. TS700 or TS420, by "ADS".
 - f. Or an approved equal.

2.2 BEDDING MATERIALS

- A. Pipe shall be bedded in a uniformly graded material, conforming to CDOT #67.

SIZE	PERCENT PASSING
1"	100
3/4"	90-100
3/8"	20- 55
#4	0- 10
#8	0- 5

- B. Select soil.

- 1. Excavated material which is free from rocks, clods, and stones greater than 1 1/2 inch in any dimension, and which meets other requirements of trench backfill material.
 - 2. Granular material.
 - a. Reference paragraph 2.2.A.

- C. Hydrant gravel.

1. Reference Section 02644.

2.3 GROUND WATER BARRIERS

- A. Clay shall be used for ground water barriers and meet the following soil classification.
 1. GC - clayey gravels, gravel-sand-clay mixtures.
 2. SC - clayey sands, sand-clay mixtures.
 3. CL - inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, clean clays.
 4. Material may be finely divided, suitable, job excavated material free from stones, organic matter and debris.

2.4 TRENCH BACKFILL MATERIAL

- A. Trench backfill material shall be placed from a point 12-inches above the pipe to 8-inches below the ground surface for gravelled streets or to the bottom of the pavement for paved streets.
- B. Trench backfill material shall be either soil excavated from the trench, or imported soil.
 1. Any soil used for trench backfill, shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, and any rocks or stones which are larger than 6-inches, in any dimension.
 - a. Rocks or stones which are larger than 3-inches, in any dimension, shall not be placed within one foot of pipe, pavement subgrade, or finished surface of unpaved areas.
 2. If imported soil is used for trench backfill within the town of Mt. Crested Butte, it shall meet CDOT specifications for Class #6 material, and shall conform to the Town of Mt. Crested Butte Section 17-39 Code.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Topsoil shall be stripped and stockpiled from areas which are to be disturbed by construction.
 1. Topsoil shall be segregated from non-organic trench excavation material, and debris.

3.2 TRENCHING

- A. Trenches shall be excavated by open cut methods, except where boring or tunneling is approved by the District.
- B. Trench width shall be not less than pipe O.D. plus 20 inches for 12" and smaller pipe.
- C. Care shall be used when operating mechanical equipment in locations where it may cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground.
- D. Mechanical equipment shall be designed and operated in such a manner that the bottom elevation of the trench can be controlled with uniform trench widths and vertical sidewalls which extend from the bottom of the trench to an elevation one foot above the top of the installed pipe.

1. Contractor shall follow the most current regulations concerning excavations set forth by OSHA; 29 CFR Part 1926. The shoring shall not place any stress on the completed work until completed work construction has proceeded far enough to provide ample strength.
- E. Trench alignment shall be sufficiently accurate to permit pipe to be aligned properly with an 8 inch minimum clearance between the pipe and the sidewalls of the trench or trench box.
1. The trench sidewall shall not be undercut in order to obtain clearance.
- F. Preparation of trench bottom.
1. Trench bottoms shall be graded uniformly to provide clearance for each section of pipe.
 2. Loose material, water, and foreign objects shall be removed from the trench.
 3. The contractor shall provide a firm subgrade, which is suitable for application of bedding material.
 4. Wherever unstable material is encountered in the bottom of the trench, said material shall be over-excavated to a depth suitable for construction of a stable subgrade.
 - a. The depth suitable for construction of a stable subgrade shall be determined by the District's Engineer.
 - b. The over-excavation shall be backfilled with stabilization material and compacted as required by the District.
 - 1) Reference paragraph 2.1.
- G. Stockpiling excavated materials.
1. Suitable material for backfilling shall be stockpiled in an orderly manner, and a minimum of 2 feet from the edge of the trench.
 2. Excess excavated materials not suitable or not required for backfilling shall be removed and disposed properly.
 3. Excavated material shall not be stockpiled against existing structures or appurtenances.

3.3 PIPE BEDDING

- A. Placement and compaction.
1. Reference Detail Drawing No. S-1.
 2. Bedding material shall be distributed and graded to provide uniform and continuous support beneath the pipe at all points between bell holes, or pipe joints.
 - a. Pipe shall not be supported by the bells.
 - b. A minimum of 4-inches of bedding shall be placed prior to the installation of pipe.
 - c. Bedding material shall not be dropped on pipe which is supported only at each end.
 3. To prevent lateral displacement, granular bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe.
 4. Granular bedding material shall be to the spring line for water lines.
 5. Granular bedding material shall be compacted in accordance with these Specifications.

3.4 GROUND WATER BARRIERS

- A. Ground water barriers shall be constructed in such a manner as to impede passage of water through bedding material for the full depth of the granular bedding material, and the full width of the trench.
 - 1. Ground water barriers shall be approximately four (4) feet long and spaced not more than 400 feet apart.
 - 2. Trench excavated clay material will be suitable for barriers.

3.5 BACKFILLING AND COMPACTION

- A. Trenches shall be backfilled promptly after the pipe has been installed and inspected.
 - 1. All trench backfill shall be compacted as stipulated in this section.
 - 2. Backfill around manholes, valves boxes, and appurtenances shall be compacted with hand-operated equipment capable of producing the required compaction.
 - 3. Reference paragraph 1.3.B.2.
 - 4. Excavations in streets shall be paved with a hot mix asphalt within 24 hours of backfilling unless street was unpaved prior to excavation.
- B. Sheeting removal (if the contractor elects to use sheeting.)
 - 1. Do not remove sheeting prior to backfilling.
 - 2. Use effective methods to protect the construction, other structures, utilities and properties during sheeting removal.
 - 3. Voids left by sheeting removal shall be filled with dry sand.
 - 4. Sheeting which is left in place shall be cut off at an elevation 1-1/2 feet below the finish grade of unpaved areas, or the subgrade of paved areas.
- C. Backfill material shall be deposited in uniform horizontal layers which may not exceed six (6) inches (compacted depth), in all areas.
 - 1. Other thickness may be used with the prior written approval of the Town of Mt. Crested Butte.
- D. Methods and equipment which are appropriate for the backfill of material shall be employed.
 - 1. Backfill equipment or backfilling methods which transmit damaging shocks to the pipe, are not to be used.
- E. Compaction shall not be performed by jetting or water settling.
- F. If compaction can not be obtained with job excavated material, trench backfill material shall be imported.
- G. Topsoil shall be replaced to the depth of stripping.
- H. Excess excavated materials and materials not suitable for backfill shall be disposed properly.

3.6 FIELD QUALITY CONTROL

- A. Field compaction control.

1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with ASTM D2922 (Tests for Density of Soil and Soil-Aggregate In Place by Nuclear Methods).
 2. Moisture/density tests will be performed by a private Geotechnical Consultant retained by Owner.
 - a. Test results shall be submitted to the District by the Geotechnical Consultant the day of the tests.
 - b. Copies of the field work sheets are acceptable.
 - c. Summarized test results shall be submitted to the District prior to the initial acceptance of the trenched areas.
 3. Compaction tests shall be performed at a depth of 1.5 feet above the top of the pipe and in 1 foot vertical increments up to the finish grade.
 - a. Compaction tests shall be performed at least once every 100 linear feet, as measured along the length of the pipe.
 - b. If the Town of Mt. Crested Butte determines that reliable and uniform results are produced by the Contractor's construction techniques, the frequency of testing may be changed to once every 300 feet.
 4. Moisture/density tests in the vicinity of manholes, valve boxes and appurtenances shall be performed at a maximum of one (1) foot away from the structure.
 - a. A test shall be made in all four directions from the structure.
 - b. A minimum of one test shall be performed for every two (2) feet of backfill material.
 - c. The Contractor may be required to dig up portions of the trench for compaction tests below the top surface of the backfill material.
 5. All failed test areas shall be recompacted and retested.
- B. Compaction shall be to the following minimum densities: (Reference ASTM D698 or AASHTO T99 unless otherwise indicated).
1. Barrier material: 95% of maximum density.
 2. Pipe bedding.
 - a. Compacted granular material: 80% of maximum relative density (ASTM D2049).
 - b. Carefully compacted select soil: 95% of maximum density.
 3. Trench backfill.
 - a. All Locations: 95% of maximum density.
- C. Moisture content.
1. All compacted backfill shall be within 2% (+/-) of the optimum moisture content of the soil as determined by 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.

END OF SECTION

SECTION 02224

PIPE BORING AND JACKING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the furnishing and installation of casing pipe by boring or jacking.
- B. Reference Detail Drawing No.5:Pipe Casing Detail

1.2 QUALITY ASSURANCE

- A. Design Criteria
 - 1. Specified thicknesses for pipe and casing are based upon the superimposed loads and not upon the loads which may be placed on the pipe as a result of jacking operations.
 - 2. Provide increased pipe strength necessary to withstand jacking loads.
- B. Requirements of Regulatory Agencies
 - 1. Obtain the necessary permits from the appropriate jurisdiction.
 - 2. Obtain bonds or indemnity required by the permits for protection against damage and interference with traffic and service by construction activities.

1.3 SUBMITTALS

- A. Certification: Submit manufacturer's certification that materials meet referenced standards.
- B. Shop Drawings: Submit manufacturer's drawings and specifications on the materials.

1.4 ALTERNATIVES

- A. Bid shall be based upon new pipe. However, request for substitution of "reject" or used pipe in lieu of new pipe may be made after award of the Contract. Used pipe shall be clean, free from heavy corrosion, patches, cuts and holes, and shall be straight and true in centerline alignment and circular in cross section. Pipe shall in all other respects meet the requirements specified for new pipe. Acceptance of all pipe shall be at the discretion of the District Engineer.

PART 2 - PRODUCTS

2.1 CASING PIPE

- A. Smooth Steel Pipe
 - 1. Minimum Yield Point: 35,000 psi.
 - 2. Wall Thickness: Minimum allowable.

<u>Diameter, inches</u>	<u>Thickness, inches</u>
24 inch or smaller	0.250
30	0.250
36	0.312

3. Ends: Beveled for field welding.
4. Exterior Coating: Coal tar enamel, AWWA C203, Section 2.

2.2 ACCESSORIES

- A. Casing Seals
 1. Materials: High density rubber with stainless steel strap.
 2. Manufacturer: Pipeline Seal and Insulator Co., Model W, or equal.
- B. Casing Chocks
 1. Materials: Stainless steel casing chock
 2. Manufacturer: Pipeline Seal and Insulator Company, Model 4810, or equal.
- C. Bands: Stainless steel straps.

PART 3 - EXECUTION

3.1 CASING INSTALLATION

- A. General
 1. Install the casing by jacking or tunneling through the earth.
 2. Open trench excavation shall not be permitted where boring or jacking is specified.
 3. Remove earth displaced by the casing through the interior by hand, by auger, or other acceptable means.
 4. Where indicated on the drawings install the casing by open-cut methods in accordance with Section 02221.
- B. Smooth Steel Pipe
 1. Provide adequate equipment to insure a smooth, continuous and uniform casing with no exterior voids.
 2. Weld each section of pipe with a full penetration butt weld around the entire circumference of the joint to form a continuous conduit capable of resisting all stresses, including jacking stresses.

3.2 CARRIER PIPE INSTALLATION

- A. Install pipe in accordance with the applicable pipe specification sections.
- B. Attach 3 pipe chocks to each pipe length with a maximum spacing of 6 feet and insert carrier pipe.
- C. Seal the ends of the casing with casing seals.

END OF SECTION

SECTION 02615

DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers ductile iron pipe. Furnish pipe complete with all fittings, flanges, specials and other accessories.

1.2 SUBMITTALS

- A. Certification: Submit manufacturer's certification that products meet the referenced standards.
- B. Shop Drawings: Submit manufacturer's specifications and details for all ductile iron and cast iron piping and accessories. Submit complete layout drawings and details of connections for all piping installed within the limits of structures.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handling
 - 1. Use slings, pipe tongs or skids.
 - 2. Do not drop pipe or fittings including dropping on old automobile tire or other cushions.
 - 3. Do not skid or roll pipe into pipe already on the ground.
 - 4. Do not damage coating or lining.
 - 5. Do not use hooks.
- B. Storage
 - 1. Maintain lubricant in a sanitary condition during storage.
 - 2. Store rubber gaskets in a cool, dark location away from grease, oil and ozone producing electric motors.
 - 3. Do not exceed maximum stacking heights listed in AWWA C600, Table 1.

PART 2 - PRODUCTS

2.1 PIPE

- A. Ductile Iron Pipe
 - 1. Standard: ANSI(AWWA C151)21.51-93.
 - 2. Class 52 standard thickness for mechanical and push-on joint piping.
 - 3. Class 53 for flanged piping.
- B. Flanged Ductile Iron Pipe
 - 1. Standard: ANSI(AWWA C115)A21.15-88, flat faced.

2.2 FITTINGS

- A. Flanged, Mechanical Joint, Push-on.
 - 1. Standard: ANSI(AWWA C110)A21.10-93.

2. Dimensions: Shorter laying lengths will be acceptable except where longer lengths are indicated on the Drawings.

B. Threaded

1. Standard: ANSI B16.4, ANSI B16.14.

2.3 JOINTS

A. Mechanical and Push-On

1. Standard: ANSI(AWWA C111)A21.11-90.
2. Gaskets: Synthetic Rubber.
3. Lubricant: Furnished by pipe manufacturer.

B. Flanged

1. Standard: ANSI(AWWA C115)A21.15-88.
2. Flanges: ANSI B16.1
3. Drilling: 125 lb., unless otherwise indicated.

2.4 COUPLINGS

A. Mechanical Couplings

1. Type Mechanical compression sleeve.
2. Omit pipe stop unless indicated otherwise on the Drawings.
3. Gaskets: Synthetic Rubber.
4. Dresser Style 38, Smith-Blair Type 41 Baker Series 400, or equal.

B. Flanged Coupling Adapters

1. Three (3) inch through 12 inch: Dresser Style 127; Smith-Blair Type 912; or equal with locking pins unless indicated otherwise on the Drawings.
2. Gaskets: Synthetic Rubber.

C. Transition Couplings

1. Dresser Style 162, or equal.

D. Wall Castings

1. Mechanical joint with waterstop and tapped holes.
2. Plug all holes with plastic plugs.

2.5 PIPE LINING

A. Cement Mortar

1. Standard: ANSI(AWWA C104)A21.4-90.
2. Thickness: Not less than 1/16 inch.

2.6 PIPE COATINGS

A. Underground or Submerged Locations: ANSI/AWWA 151/A21.51-91

1. Type: Bituminous.
2. Thickness: Approximately 1 mil.

B. Polyethylene Encasement

1. Polyethylene encasement shall be used whenever the resistivity of the native soil is less than 2,500 ohm-centimeters, or as required by the District.

2. Standard: ANSI(AWWA C105)A21.5-93
3. Thickness: 8 mil.
4. Method: A.

2.7 ACCESSORIES

- A. Tie Rods
 1. Rods: ASTM A307.
 2. Steel Rods: ASTM A120, standard weight.
 3. Washers: ANSI B18.22.1, plain steel.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine pipe and fittings and do not use individual section's containing:
 1. Cracks.
 2. Flaws.
 3. Broken or loose lining.
 4. Other defects.
- B. Mark defective pipe and remove from the site.

3.2 INSTALLATION

- A. Install pipe in accordance with Section 02623 or Section 02722.
- B. Cutting the pipe.
 1. Cut pipe smooth, straight and at right angles to the pipe axis.
 2. Do not damage the pipe or cement lining.
 3. Use a saw, abrasive wheel, or oxyacetylene torch for ductile iron pipe.
 4. Do not use an oxyacetylene torch for cutting holes for saddles.
 5. Grind out ends and rough edges smooth.
 6. Bevel the cut end for push-on joints.
- C. Field Joints
 1. Use push-on mechanical joints in underground locations unless indicated otherwise on the Drawings.
 2. Use flanged joints at other locations unless indicated otherwise on the Drawings.
 3. All joints shall be watertight and free from leaks.
 4. Repair each leak discovered within one year after final acceptance.
 5. Do not deflect joints beyond the maximum values specified in AWWA C600, Tables 5 and 6.
- D. Polyethylene Encasement
 1. Install polyethylene encasement on ductile iron pipe as noted.

3.3 JOINT INSTALLATION

- A. Push-On Joints
 1. Clean the inside of the bell and the outside of the spigot to remove dirt, oil, excess coating and other foreign matter.
 2. Insert the gasket.

3. Apply a thin film of lubricant to either the inside surface of the gasket, the spigot end of the pipe or both.
 4. Do not permit the joint surface to come in contact with the ground.
 5. Assure that pipe is marked with a depth mark before assembly to assure the spigot end is inserted the full depth of the joint.
 6. Complete the joint making certain the spigot is inserted to the depth mark.
- B. Mechanical Joints
1. Remove all dirt, oil, grit, excess coating and other foreign matter from the inside of the bell and the outside of the spigot.
 2. Apply a thin film of lubricant to the inside of the bell, the outside of the spigot and the gasket.
 3. Tighten nuts alternately on opposite sides of the pipe to produce equal pressure on all parts of the gland.
 4. Use a torque limiting wrench and do not exceed the maximum torque values listed in AWWA C600 Table 4.
 5. Holes in mechanical joint bells shall straddle the top (or side for vertical piping) centerline.
- C. Flanged Joints
1. Extend pipe completely through screwed-on flanges.
 2. Machine finish the pipe end and flange face in a single operation.
 3. Eliminate any restraints on the pipe which would prevent uniform gasket compression or cause unnecessary stress in the flanges.
 4. Do not assemble mechanical connections until all flanged joints affected thereby have been tightened.
 5. Alternately tighten bolts spaced on opposite sides of the pipe to assure uniform gasket compression.
 6. Holes in flanges shall straddle the top (or side for vertical piping) centerline.
- D. Mechanical Couplings
1. Clean and smooth pipe ends.
 2. The gap between pipe ends being coupled shall be less than one inch and greater than $\frac{1}{4}$ inch.

END OF SECTION

SECTION 02622

PLASTIC GRAVITY SEWER PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers plastic gravity sewer pipe and fittings to be furnished complete with all jointing materials.

1.2 QUALITY MATERIALS

- A. Manufacturers:
 - 1. Certain-teed Corporation.
 - 2. No substitutes, without prior approval from District.

1.3 SUBMITTALS

- A. Certification: Submit manufacturer's certification that products meet requirements of referenced specifications.
- B. Shop Drawings: Submit drawings and data showing details of joints, gasket material and pipe length.

1.4 PRODUCT DELIVERY

- A. Do not damage the pipe by impact, bending, compression or abrasion during handling and storage.
- B. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging.
- C. Do not stack pipe higher than five (5) feet.
- D. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months.
- E. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.
- F. Use only nylon protect slings or hands to handle pipe. Do not use hooks or bare cables.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

- A. Pipe and Fittings: ASTM D3034, Type PSM, SDR 35.
- B. Joints: ASTM D3212, Push-On.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine pipe and fittings and do not use individual sections containing:
 - 1. Cracks.
 - 2. Dents.
 - 3. Abrasions.
 - 4. Other defects.
- B. Mark rejected pipe and remove from the site.

3.2 INSTALLATION

- A. Install pipe in accordance with Section 02722, Wastewater Collection System.
- B. Cutting the Pipe:
 - 1. Cut pipe square with saw or pipe cutter designed specifically for the material.
 - 2. Bevel the end in accordance with the manufacturer's recommendations.
 - 3. Remove burrs and wipe off all dust and dirt from the jointing surfaces.
- C. Jointing the Pipe:
 - 1. Remove all dirt and foreign material from the pipe ends, gasket and gasket groove.
 - 2. Apply lubricant furnished by the pipe manufacturer to the spigot end of the pipe.
 - 3. Insert the spigot to the reference mark.
 - 4. Do not disturb previously installed joints during jointing operations.

3.3 FIELD QUALITY CONTROL

- A. Pipe Deflection Tests:
 - 1. Reference Section 02722, Wastewater Collection System.
- B. Leakage Tests:
 - 1. Reference Section 01666, Testing Piping Systems.

END OF SECTION

SECTION 02623

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1- GENERAL

1.1 DESCRIPTION

- A. This section covers plastic pressure pipe and fittings to be furnished complete with all joining materials.

1.2 SUBMITTALS

- A. Shop Drawings: Submit complete drawings and data showing details of joints, joint restraints, gasket material and pipe length specifications covering the pipe and their appurtenances.
- B. Certification: Submit manufacturer's certification that products meet requirements of referenced specifications.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Do not damage the pipe by impact, bending, compression or abrasion during handling and storage.
- B. Take precautions to keep joints and internal parts clean.
- C. Store PVC sewer pipe on a flat surface, which provides even support for the barrel with bell ends overhanging.
- D. Do not stack pipe higher than 5 feet.
- E. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months. Use only nylon protected slings or hands to handle pipe. Do not use hooks or bare cable.

PART 2 - PRODUCTS

1.1 SPECIFICATIONS

- A. The pipe shall be designed, manufactured, tested, inspected and marked in accordance with the provisions of this Specification and AWWA Standard C-900, "Polyvinyl Chloride (PVC) Pressure Pipe 4 inch through 12 inch for Water Distribution," pressure class 150 psi, DR18. The pipe shall have the same outside diameter as ductile iron pipe.
- B. Joints: Bell ends with elastomeric gaskets.

2.1 JOINT TYPE

- A. Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint. Where restrained joints are specified, the joint shall conform to EBBA Iron's "Megalug", "Uni-Flange" Series 900, 1300, 1350 or approved equal.

PART 3 - EXECUTION

3.1 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE INSTALLATION

- A. General: All PVC pipe shall be installed in accordance with this specification. All pipe shall be handled and installed in accordance with AWWA C-600.
- B. Handling
 - 1. All pipe and fittings shall be handled at all times by lifting with padded cradles of canvas, leather or other suitable material to avoid shock or damage. Pipe shall be handled so that the exterior surface will not be damaged. If, however, any part of the exterior surface coating or lining is damaged, the repair or rejection of pipe shall be made by the contractor at his expense in a manner satisfactory to the District.
 - 2. Stockpiled pipe shall be supported on wood blocks and/or sand bags placed under the ends of the pipe. Bags shall be of sufficient size to prevent contact with the ground or any obstruction. Rolling the pipe shall not be permitted. Adequate strutting shall be provided if necessary to prevent pipe damage.
 - 3. PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care shall be used in handling PVC pipe during cold weather.

4. Stockpiled PVC pipe stored outside, which may be exposed to sunlight for more than thirty (30) days, shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover pipe. Air circulation shall be provided under the covering.

- C. Subgrade: No blocking of pipe will be permitted. Before the pipe is laid, the subgrade shall be prepared by backfilling with clean uniformly graded sand to provide a uniform and continuous bearing and support for the pipe at every point between bell holes.
- D. Joining Push-On Joints
 - 1. Immediately before joining two (2) lengths of pipe, the inside of the bell, and the outside of the spigot end and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The rubber gasket shall be flexed inward and properly inserted in the gasket recess of the bell socket. Caution shall be exercised to ensure the correct type of gasket is used.
 - 2. A thin film of gasket lubricant shall be applied to either the inside face of the gasket or the spigot end of the pipe or both.
 - 3. The spigot end of the pipe shall be placed in the socket with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to assure Insertion to the full depth of the joint. The spigot end of field cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured.
- E. Joining Mechanical Joint Pipe
 - 1. Before joining mechanical joint ductile iron fittings to the pipe, the outside of the spigot, the inside of the bell and the rubber gasket shall be thoroughly cleaned to

remove oil, grit, excess coating, and other foreign matter.

2. Normal practice is to lubricate the joint with a soap solution; however, in cold weather the joint may be assembled dry if approved by the engineer. Extreme care shall be exercised in making the dry joint.
3. The ductile iron gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland.
4. The pipe shall be pushed forward until the spigot end fully penetrates the bell. The gasket shall then be pressed into place in the bell evenly around the entire joint. The gland shall be moved along the pipe into position for bolting, the bolts inserted, and the nuts screwed finger tight, then tightened with a torque limiting wrench. The torque for the various sizes of bolts shall be as follows:

Pipe Size (inches)	Bolt Size (inches)	Range of Torque (ft.-lbs.)
3	5/8	60
4-24	3/4	90

5. Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

F. Flexible Coupled Joint

1. When installing flexible steel couplings, care shall be taken that the connecting pipe ends, couplings and gaskets are clean and free of all dirt and foreign matter with special attention being given to the contact surfaces of the pipe, gaskets and couplings. These couplings shall be assembled and installed in conformity with the recommendations and instructions of the coupling manufacturer.
2. Wrenches used in bolting couplings shall be of a type and size recommended by the coupling manufacturer. Coupling bolts shall be tightened to secure a uniform annular space between the follower rings and the body of the pipe and all bolts tightened approximately the same amount.
3. Diametrically opposite nuts shall be tightened progressively and evenly. Final tightening shall be done with a torque limiting wrench set for the torque recommended by the coupling manufacturer.

G. Cutting and Fitting

1. The Contractor shall make all pipe cuts required to conform to location, line and grade. All cuts on pipe shall be made by the use of pipe cutters or pipe saws. All cuts shall be straight and true.

3.2 PIPE INSTALLATION – GENERAL

A. Temporary Bulkhead.

Whenever the pipe is left unattended, temporary plugs shall be installed at all openings. Temporary plugs shall be watertight and of such design as to prevent children, animals, or debris from entering the pipe. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

3.3 THRUST RESTRAINT

- A. Blockage.
 - 1. Provide concrete thrust blocks for preventing pipe movement at tees and bends installed in piping and called for on the drawings.
 - 2. Extend concrete to solid undisturbed earth. Construct so joints are clear and accessible.
 - 3. Concrete to be separated from fittings by 8 mil polyethylene film. No concrete shall be poured directly on or over fittings to be blocked.
 - 4. Excavate thrust block bearing into undisturbed soil; clean out loose soil and carefully shape to provide uniform bearing surfaces of the proper area.
 - 5. Install thrust blocks so bottom is flat and sides are vertical.
 - 6. Form to provide access to fittings.

- B. Joint Restraints
 - 1. Provide joint restraints and restrained joint pipe if noted on the drawings.
 - 2. Joint restraints shall be in addition to thrust blocks.

3.4 PROTECTION OF METAL SURFACES

- A. Polyethylene Encasement
 - 1. Wrap loose polyethylene encasement around all exposed metal surfaces, including fittings and couplings.
 - 2. Repair rips, punctures or other damage with adhesive tape or with a short length of polyethylene encasement wrapped around pipe and secured in place.

- B. Protect metal surfaces by one of the following two methods:
 - 1. Apply two 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, and are not encased in concrete.
 - a. Apply first coat of coal tar paint to a dry, clean surface.
 - b. Allow first coat of coal tar paint to dry before the second coat is applied.
 - 2. Protect ferrous metal rods, rebar, clamps, bolts, nuts and other accessories which are subject to submergence or contact with earth or fill material, and not encased in concrete with coal tar paint and double wrap of Protecto Wrap.

3.5 FIELD QUALITY CONTROL

- A. Testing
 - 1. Reference Section 01666 Testing Piping Systems of Standards and Specifications for Water System Construction.

END OF SECTION

SECTION 02722

WASTEWATER COLLECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the installation and testing of sanitary sewer pipelines plus the furnishing and installation of manhole materials and other appurtenances.
- B. Definitions:
 - 1. Manhole Depth: Distance measured at centerline from invert of lowest pipe to top of ring and cover.

1.2 QUALITY ASSURANCE

- A. Lay pipe true to line and grade shown on Drawings. Under no circumstances shall pipe be laid which results in a level or reverse sloping invert.
- B. Manhole and pipe inverts shall not deviate from elevations shown on Drawings by more than (\pm) 0.03.

1.3 SUBMITTALS

- A. Certification: Submit manufacturer's certification that products meet requirements of referenced specifications.
- B. Shop Drawings: Submit shop drawing on all materials specified.

1.4 JOB CONDITIONS

- A. Use effective measures to prevent foreign material from entering the pipe.
- B. Do not place debris, tools, clothing or other materials in the pipe.
- C. Whenever pipe laying is stopped, close the open end of the pipe with a plug or end dam to prevent the entry of foreign material into the pipe.
- D. Use effective measures to prevent the uplift or floating of the line prior to completion of the backfilling operation.

1.5 ALTERNATIVES

- A. Use either PVC or Ductile Iron pipe. Use only DIP at the locations indicated on the Drawings and at locations specified.
- B. Manholes:
 - 1. Where District anticipates wet conditions, use only precast manhole bases.
 - 2. Other locations Contractor's option of precast or cast-in-place bases.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

- A. Type
 - 1. DIP: Reference Section 02615.
 - 2. PVC: Reference Section 02622.

2.2 FLEXIBLE COUPLINGS

- A. When jointing two pipes of dissimilar material or two pipes with different outside diameters, use the following:
 - 1. Pipe sizes 12 inches or smaller.
 - a. Can-Tex, COT Adapters.
 - b. Fernco, Flexible couplings or reducing couplings.
 - c. Jointers, Inc., Carder Coupling.
 - d. Mission, Bushing Adapters.
 - e. Nashua Pre-Cast Corp., Flex-O-Joint.
 - f. Or equal.
- B. Encase flexible couplings in concrete, 24 inches long, minimum, centered on joint.

2.3 MANHOLE MATERIALS

- A. Precast Bases
 - 1. Precast base and first barrel section monolithic, conformance ASTM C478, Type II Cement.
 - 2. Pipe penetration gaskets.
 - a. Kor-N-Seal, Dukor Company.
 - b. PS-10, Press Seal Gasket Corp.
 - c. A-Lok, A-Lok Corp.
 - d. Lock Joint Flexible Manhole Sleeve, Interpace Corp.
 - e. Or approved equal.
 - 3. Invert
 - a. Material: Reference Section 03300, Cast-In-Place Concrete, Cement Type II.
 - b. Compressive strength: 3000 psi at 28 days.
- B. Cast-In-Place Bases
 - 1. Material: Cast-in-place concrete in accordance with Section 03300.
 - 2. Compressive Strength: 3000 psi at 28 days.
 - 3. Cement: Type II.
- C. Barrels, Cones and Flat Slab Tops
 - 1. Material: Precast Concrete, ASTM C478.
 - 2. Cement: Type II.
- D. Mortar
 - 1. One part Portland Cement, ASTM C150, Type II.
 - 2. Two parts sand, ASTM C144.
 - 3. ½ part hydrated lime, ASTM C207, Type S.
- E. Grout (Non-Shrink)

1. Pre-Mixed: Master Builders "Embeco Mortar", Sonneborn "Ferrolith G-D.S. Redi-Mixed" or equal.
2. Job Mixed:
 - a. One part Portland Cement, ASTM C150, Type II.
 - b. One part sand, ASTM C144.
 - c. One part shrinkage correcting aggregate, Master Builders "Embeco Aggregate", Sonneborn "Ferrolith G-D.S." or equal.

F. Ring and Cover

1. Gray Iron: ASTM A48, with asphalt varnish coat applied at foundry.
2. Pattern: The word "sewer" shall be cast in cover.
3. Bearing Surfaces: Machined, required for pavement and pedestrian locations.
4. Weight: Heavy duty traffic lid, 400 pounds combined weight, 24 inch minimum clear opening.
5. Watertight Covers: Non-pressure Neenah "Self Sealing" or equal if required.

G. Steps

1. Material: Aluminum, Fed. Spec. QQ-A0200/A.
2. Provide plastic coating or bituminous coating to protect from corrosion with concrete or mortar.
3. Manufacturer's Comco 12653B; Neenah R-1982-W or equal.

H. Pre-Formed Plastic Gaskets

1. Conformance: Fed. Spec. SS-S-00210 (GSA-FSS), Type I, Rope Form.
2. Diameter:
 - 1 ½ inch for 48 inch manhole.
 - 1 ¾ inch for 60 inch manhole.
 - 2 inch for 72 inch manhole.
3. Acceptable Manufacturers
 - a. "Ram-Nek", K.T. Snyder Co.
 - b. "Rub'r-Nek", K.T. Snyder Co.
 - c. "Kent Seal", Hamilton-Kent Manufacturing Co.
 - d. Or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform excavation in accordance with Section 02221, Trenching, Backfilling and Compacting.
- B. Where connections are to be made to existing pipes or appurtenances, the exact location of which cannot be determined without exposing the existing appurtenance, excavate and expose the existing improvement before installing any pipe. District Engineer will examine the existing pipe or appurtenance and specify any necessary adjustments in line or grade of the proposed pipe to accomplish the connection.

3.2 PIPE INSTALLATION

- A. Pipe Laying
 1. Begin pipe laying at the lowest point, unless otherwise approved by District Engineer, and install the pipe with the spigot ends pointing in the direction of the flow.
 2. Lay pipe true to line and grade.

3. As each length of pipe is placed in the trench, complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade. Make adjustments by scraping away or filling pipe bedding under the body of the pipe and not by wedging or blocking up the bells.
4. Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints. 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. Do not walk on small diameter pipe or otherwise disturb pipe after the jointing has been completed.

B. Waterline Crossings

1. Where sewer lines cross watermains, and the sewer is above the watermain or less than 18 inches clear distance vertically below the watermain, construct the crossing using one length of pipe, PVC or DIP, at least 18 feet long centered over or under the watermain. Use Flexible Couplings when jointing two pipes of dissimilar materials or two pipes with different outside diameters and encase in concrete.
2. In lieu of the above, Contractor may, at his option, encase the sewer pipe with reinforced concrete at least six (6) inches thick at all locations within 10 feet either side of the waterline. Minimum reinforcement shall consist of a No. 5 bar placed at each corner of the section tied with No. 3 bars at three (3) foot centers.
3. Provide suitable backfill or other structural protection to preclude settling or failure of the higher pipe.
4. Reference Detail Drawings S-3. & S-4.

C. Pre-Taps (Service Connections)

Pre-Taps, or Service Connections, are not a requirement of this District but may be required by the entities served by the District.

1. Install "Y" branches for service connections at locations designated. Verify that service connection locations have been marked prior to commencing construction of any segment of sewer line.
2. Where an existing sewer is being replaced, locate and connect all existing services to the new sewer.
3. Install service connections on existing sewers using saddles securely fastened on the main. Cut a neat hole in the main by means of a tapping machine designed for such use. The finished connection shall be watertight and there shall be no projections inside the sewer main.
4. Incline the centerline of the branch upward at an angle of forty-five degrees (45°).
5. All service lines shall be extended at a constant grade to property line.
 - a. 4 inch service lines shall have a minimum grade of 1/4 inch per foot (2%).
 - b. 6 inch service lines shall have minimum grade of 1/8 inch per foot (1%).
6. Install air tight plugs at the end of all unconnected service lines.
7. Install thrust blocks at the end of all unconnected service lines.
8. Mark the location of each unconnected service line with a FRC utility marker extending from the branch vertically to three (3) feet above the ground surface. Maintain in a vertical position during embedment to the depth indicated on the marker. Marker shall be supplied in the standard APWA color for sewer.
9. Reference Detail Drawing S-6: Sewer Service Pre-tap Detail.

- D. Install airtight plugs in each unconnected lateral stub-out.
 - 1. Place a 4" x 4" timber across plug extending a minimum of 2 inches beyond each side of the pipe.
 - 2. Pour a concrete thrust block on each side of 4"x 4" to extend from timber to solid undisturbed earth. Minimum bearing area, 1.0 sq. foot for each thrust block. Keep thrust block out of alignment for lateral extension.

3.3 MANHOLE CONSTRUCTION

- A. Construct manholes at locations indicated on the Drawings or otherwise designated by District Engineer to accommodate field conditions. Record locations of buried manholes referenced to minimum of two permanent surface references prior to backfill.
- B. Use 48 inch diameter manholes on pipe lines 8 inch through 12 inch in diameter. Use manholes with eccentric cones where manhole depth is 60 inches or greater. Use flat top manholes when manhole depth is less than 60 inches.
- C. Provide a joint in 8 inch to 12 inch pipe 18 inches from all manhole walls and other solid structures
- D. If inverts are not constructed by precast and wherever grade and alignment permit, lay the main sewer continuously through the manhole and split the pipe after construction of the inverts. Where this is not possible, terminate pipe flush with interior manhole wall and construct transition smooth and of proper radius for uninterrupted flow. In no case shall the invert flow section through the manhole be greater than that of the outgoing pipe. Finish invert prior to adding any riser sections to the base. Construct top of bench to match pipe crowns.
- E. For cast-in-place bases, set stubs and mains before concrete is placed and recheck for alignment and grade before concrete has set. Wherever grade and alignment permit, lay the main sewer continuously through the manhole and split the pipe after construction of the base. Where this is not possible, terminate pipe flush with interior manhole wall and construct transitions smooth and of proper radius for uninterrupted flow. In no case shall the invert section through the manhole be greater than that of the outgoing pipe. Construct top of bench to match pipe crown. Allow base to set a minimum of 24 hours before continuing construction. Wherever plastic sewer pipe is used, make connections to manholes using rubber connector conforming to A.S.T.M. C-443 & C-923 or approved equal, cast or grout into the manhole.
- F. Set each manhole riser section plumb. The sections of various heights to bring ring and cover to grade. Cut openings to receive entering pipes of sufficient size to provide 3/4 inch annular space around pipe. After pipe is in position, fill space with non-shrink mortar. Fill all lifting holes and other imperfections with mortar.
- G. Join manhole sections using pre-formed flexible plastic gaskets. All joint surfaces shall be clean, dry and warm during installation. Prime entire surface of both joints prior to placement of gasket material.
- H. Fill all lifting holes and other imperfections with mortar. Neatly point inside and outside of joints no matter what joint material is used.

- I. Apply Bituminous paint to all exterior surfaces
- J. Installation of Rings & Covers
 - 1. In paved, or to be paved areas, install ring and covers a minimum of two (2) and a maximum of six (6) two inch pre-cast adjusting rings above the top or cone of the manhole. Set rings on butyl mastic gasket material and encase in mortar around the entire perimeter. Unless otherwise indicated, set the top of the rings-six (6) inches below finish grade in gravel roadways and such that no part of the ring or cover will project above a point ¼ inch below the finish surface of pavement in paved areas subject to cleaning by snowplows.
 - 2. In Right Of Ways and easements where the slope is greater than 2(H): 1(V), finished grade will be two (2) inches below top of ring. At flat surface with four (4) foot radius, measured from center of cover, will be created. Manhole ring will consist of a type S frame and cover. A retaining wall will be constructed on the upslope side. Retaining wall height and length will be site determined.

Reference Detail Drawing S-14: Manhole Retaining Wall.

- K. Connections to Existing Manholes
 - 1. Construct in such a manner that the finished work conforms as nearly as practicable to the requirements specified for new manholes.
 - 2. Where no provision has been made for additional connection, coredrill concrete wall as necessary to insert the new pipe.
 - 3. Chip the existing manhole base to the cross-section of the new pipe and finish with mortar to form a smooth continuous watertight invert.
 - 4. Seal the space between the new pipe and the manhole wall using a rubber connector conforming to A.S.T.M. C-443 & C-923 or approved equal grouted into the manhole.
- L. Reference Detail Drawings S- 8 through S-13 for Manhole Construction.

3.4 CONSTRUCTION OF APPURTENANCES

- A. Install cleanouts and stubs at locations indicated on the Drawings. Insert removable airtight plugs in unused stubs and record location of cleanout referenced to a maximum of two permanent surface references.

3.5 FIELD QUALITY CONTROL

- A. Alignment Tests
 - 1. District Engineer may lamp each section of sewer between manholes to determine whether any displacement of the pipe has occurred. Provide suitable assistants to help.
- B. District Engineer will determine if infiltration tests will be allowed, the normal test for the District is air testing.
- C. Air Test
 - 1. General:
 - a. Plug pipe ends with test plugs. Brace plugs securely to prevent blowouts during air test.
 - b. Pressurizing equipment shall include regulator set to avoid over-pressurizing and damaging line.
 - c. Safety pressure test in accordance with OSHA requirements.

2. Test Procedure

- a. Clean and flush section of pipe to be tested prior to conducting low pressure air test.
- b. Isolate section to be tested by means of inflatable stoppers or other suitable test plugs. Plugs to have provisions for connecting hose from portable air source.
- c. Where test section is below ground water level, determine height of groundwater above spring line of pipe at each end of test section and compute average. Increase gage test pressure by 0.43 lbs per sq in. for each ft of groundwater above pipe spring line.
- d. Add air slowly to test section until pressure inside pipe is raised to 4.0 psig greater than average back pressure of groundwater above pipe spring line.
- e. After a pressure of 4.0 psig above back pressure is obtained, regulate air supply to maintain pressure between 3.5 and 4.0 psig (above back pressure) for period of 2 min. Check plugs with soap solution to detect leaks during this period.
- f. After 2-min. air stabilization period, disconnect air supply and decrease test pressure to 3.5 psig. Record time for pressure to drop to 2.5 psig with stop watch. Time shall be equal to or greater than test time based on following:

$$T = 0.0237D^2L$$

Where:

T = Time of Test (sec.)

D = Dia (in.)

L = Length of Test Section (ft.)

D. Infiltration Tests

1. Conduct infiltration tests where infiltration appears to exceed specified limits.
2. Conduct tests by placing a calibrated v-notch weir in the line as it leaves the manhole and plugging the line as it leaves the higher manhole.
3. Allow sufficient time for the water level behind the weir to stabilize before reading. Remove any foreign matter hanging on the weir being read. Take successive readings until consistent results are obtained.
4. Maximum allowable infiltration shall be 250 gallons per day per inch of pipe diameter per mile of pipe length.
5. Repair defects and retest the sewer until the infiltration limits are met prior to proceeding with further construction.

E. Cleaning

1. Prior to substantial completion, remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the sewer system. Use mechanical rodding or bucketing equipment as required.
2. Upon final inspection, if any foreign matter is present in the system, flush and clean the sections of the line as required.

F. Deflection Test

1. Test plugs shall be either solid sleeve type or cage type.

- a. Device shall be identified as to size and type of pipe for intended use and outside dia of device.
 - b. Identification shall be stamped on device or on metal plate permanently attached thereto.
 - c. Worn, damaged or deformed test plugs will not be allowed.
2. Provide cable at either end of test plug/mandrel to allow withdrawal if plug/mandrel becomes stuck.
 3. Test in accordance with requirements of following table for SDR-35 PVC Pipe.

Nominal Size in.	Base ID (in.)	Mandrel Diameter (in.)	
		5% Defl.	7.5% Defl.
6	5.742	5.45	5.31
8	7.665	7.28	7.09
10	9.563	9.08	8.84
12	11.361	10.79	10.51

NOTE: Use 5% for testing within 30 days of backfilling and 7.5% thereafter.

- a. Deflection test PVC sewer line piping immediately upon completion of construction.
 - 1) Test to determine CONTRACTOR's means, methods, materials, and workmanship to produce pipeline within specified deflection tolerance.
 - 2) Sections which do not pass test shall be repaired and retested.

G. Vacuum Test

1. Manholes shall be vacuum tested after assembly and prior to backfilling.
2. Care shall be taken to secure a seal between the vacuum base and the manhole rim. Pipe plugs shall be secured to prevent movement while the vacuum is drawn.
3. A vacuum of 10 inches of mercury shall be drawn. The time for the vacuum to drop to nine (9) inches of mercury shall be recorded.
4. Acceptance shall be defined as when the time to drop to nine (9) inches meets or exceeds the following:

Diameter	Time to Drop 1" Hg
4 ft.	60 seconds
5 ft.	75 seconds

5. If the manhole fails the test, make necessary repairs. Repairs and repair procedures must be acceptable to the District.

6. If preformed plastic gaskets are pulled out during the vacuum test, the manhole shall be disassembled and the gaskets shall be replaced.
- H. Closed Circuit Television Inspection
1. Prior to closed circuit television inspection, all pipe sections shall be flushed clean and all water drained by gravity for potential low spot detection.
 2. All lines inspected as above will be re-inspected by closed circuit television prior to ending the line acceptance period.
 3. All publicly dedicated sewer line shall be televised. A DVD recording of the line shall be made and submitted to the District. The recording shall be made using a color self-propelled or other camera, having sufficient light to show detail of problem areas and joints. Camera speed shall not exceed 3 feet per second. If problems or concerns are seen by the operator then the camera shall be backed up and an extended look at the area shall be recorded. All recordings will have time, date, and footage displayed. Manhole I.D. will be recorded on the DVD and shall match the I.D. as designated on the Construction Plans. All DVD recording speeds shall be SP. Recording to include two downstream sections of sewer from new construction. Total distance to be recorded downstream for existing line to be four hundred (400) feet minimum.
- I. Manholes and pipe lines shall not have any visible leaks or damp spots.

END OF SECTION

SECTION 02732

SANITARY SEWER GRAVITY SERVICE LINES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section covers materials and installation of sanitary sewer gravity service lines, the furnishing and installation of clean-outs, and other appurtenances.

1.2 QUALITY ASSURANCE

- A. Under no circumstances shall pipe be laid which results in a level invert, reverse sloping invert, or a grade flatter than one (1) percent (1/8" per foot).

1.3 JOB CONDITIONS

- A. Use effective measures to prevent foreign material from entering the pipe.
- B. Do not place debris, tools, clothing, or other materials in the pipe.
- C. Close the open end of any pipe with a plug or cap to prevent the entry of foreign material or water into the pipe.
- D. Use effective measures to prevent the uplift of floating of the line prior to completion of the backfilling operation.

PART 2 – PRODUCTS

2.1 PIPE MATERIALS

- A. PVC: Reference Section 02622.

2.2 FLEXIBLE COUPLINGS

- A. When joining pipes where conditions will not allow joining by use of a bell section use the following:
 1. Can-Tex, C-T Adapters.
 2. Fernco, Flexible couplings or reducing couplings.
 3. Jointers Inc., Calder Coupling.
 4. Mission, Bushing Adapters.
 5. Nashua Pre-Cast Corp., Flex-O-Joint.
 6. Or approved equal.

PART 3 – EXECUTION

3.1 PIPE INSTALLATION

- A. Pipe Laying.

1. Prior to installation of pipe, pothole existing stub-out and existing sewer service at proposed points of connection. Place new service line at a uniform grade between these points.
2. Begin pipe laying at the lowest point, unless otherwise approved by District, and install the pipe with the spigot ends pointing in the direction of flow.
3. Lay pipe true to the line and grade.
4. As each length of pipe is placed in the trench, complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade. Make adjustments by scraping away or filling pipe bedding under the body of the pipe, and not by wedging or blocking up the bells.
5. Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints. Do not use mechanical compacting equipment in the zone above the centerline of the pipe and below a plane one (1) foot above the top of the pipe. Do not walk on small diameter pipe or otherwise disturb pipe after the jointing has been completed.
6. Clean-outs.
 - a. Place top of clean-out flush with finished grade.
 - b. Place horizontal section of clean-out in line with downstream alignment of service line.
 - c. Maximum spacing of clean-outs shall be one hundred (100) feet.
 - d. Clean-outs in traffic areas shall be designed to the approval of the District.
7. Reference Drawing S-7:

END OF SECTION

SECTION 02740

GREASE INTERCEPTOR / GREASE TRAP

1. GENERAL

1.1 DESCRIPTION

- A. This section covers design, installation and maintenance of grease interceptors and grease traps.
- B. Reference Details Drawings S-15, S-16.

1.2 DEFINITIONS

- A. "Food Service Facility" shall mean any facility on which premises food is served, prepared, packaged or processed for sale or consumption with the exception of private residences. Food Service Facility shall include, but is not limited to food courts, food manufacturers, food processors, food packagers, restaurants, grocery stores, delicatessens, bakeries, lounges, hospitals, nursing homes, and schools. Food Service Facility shall not include a facility that only prepares beverages and a facility that only sells prepackaged foods.
- B. "Garbage Disposal" shall mean a device that shreds or grinds food waste materials into smaller portions for discharge into the wastewater collection system.
- C. "Gray Water" shall mean all of the liquid contained in a grease interceptor that lies below the floating grease layer and above the solids layer.
- D. "Grease" shall mean a liquid or solid material containing substances, which may solidify or become viscous at temperatures between 32 degrees and 150 degrees Fahrenheit, composed primarily of fats, oils or grease from animal or vegetable sources. The phrase "fats, oils and grease (FOG)" shall be included in this definition.
- E. "Grease Interceptor" shall mean a unit designed to retain grease from one or more fixtures, which shall be located outside the building being served. This is the preferred unit of choice by the District.
- F. "Grease Trap" shall mean a unit designed to retain grease from one to a maximum of four fixtures, which shall be located inside the building being served.
- G. "Fixture Unit Equivalent (FUE)" shall mean a value, which permits the comparison of different sized fixtures based on the drainage load produced. One (1) FUE is equivalent to discharge flow rate of 7.5 gpm.

2. GREASE INTERCEPTOR REQUIREMENTS

- A. The District will determine in its sole discretion whether a Grease Interceptor or Grease Trap shall be installed.
- B. Each Food Service Facility is required to install and maintain a Grease Interceptor or Grease Trap through which all wastes shall be discharged prior to entry into any wastewater collection system.
- C. All drains from the kitchen, food preparation, and dishwashing areas shall be connected to a Grease Interceptor or Grease Trap. Interior fixtures to be connected include, but are not limited to, scullery sinks, pot and pan sinks, mop sinks, dishwashing machines, soup kettles, and floor drains located in food preparation and storage areas and any other fixture determined to be a potential source of grease.

- D. Toilets, urinals and similar fixtures shall not waste through a Grease Interceptor or Grease Trap. Such fixtures shall be plumbed directly into the building sewer and wastewater collection system.

3. DESIGN AND SIZING CRITERIA

- A. The design and sizing of Grease Interceptors and Grease Traps shall be in accordance with the current edition of the Uniform Plumbing Code and International Plumbing Code as utilized by the local building permitting authority and these Standards. Grease Interceptors and Grease Traps shall be designed, sized, installed, maintained and operated to accomplish their intended purpose of intercepting the grease and solids from the wastewater generated by a Food Service Facility and preventing the discharge of such grease and solids to the District's wastewater collection system.
- B. The size, type and location of each Grease Interceptor and Grease Trap shall be approved by the District, in accordance with these Standards. Except where otherwise specifically permitted, no wastes other than those requiring separation shall be discharged into any Grease Interceptor or Grease Trap.
- C. One set of plans including complete plumbing section, showing location of all fixtures connected to a Grease Interceptor or Grease Trap, shall be submitted to the District for approval prior to construction. Such plans shall include location, type, calculation of the size of each Grease Interceptor or Grease Trap, and point of connection to the sanitary sewer main line for each Grease Interceptor. Such approval shall not exempt the Food Service Facility from compliance with any applicable codes, ordinances, rules, regulations or orders of any governmental authority.
- D. A Food Service Facility may request a variance from the requirements set forth in these Standards. The District shall review a written request based on documentation supplied by the Food Service Facility that an alternative method of grease management is at least as effective in managing grease as the measures required by these Standards. The following information shall be submitted along with the above request.
 - 1. Location of sewer main and easements in relation to available exterior space outside building.
 - 2. Plans showing existing plumbing at the facility, including plans showing any common plumbing for all wastewater services at the building.
 - 3. A description of a design plan for any alternative pretreatment technology proposed to be installed to trap, separate and prevent FOG from being discharged into the wastewater collection system.
 - 4. A plan for regular maintenance of the alternative pretreatment unit.

3. DESIGN AND SIZING CRITERIA

- A. The design and sizing of Grease Interceptors and Grease Traps shall be in accordance with the current edition of the Uniform Plumbing Code and International Plumbing Code as utilized by the local building permitting authority and these Standards. Grease Interceptors and Grease Traps shall be designed, sized, installed, maintained and operated to accomplish their intended purpose of intercepting the grease and solids from the wastewater generated by a Food Service Facility and preventing the discharge of such grease and solids to the District's wastewater collection system.

- B. The size, type and location of each Grease Interceptor and Grease Trap shall be approved by the District, in accordance with these Standards. Except where otherwise specifically permitted, no wastes other than those requiring separation shall be discharged into any Grease Interceptor or Grease Trap.
- C. One set of plans including complete plumbing section, showing location of all fixtures connected to a Grease Interceptor or Grease Trap, shall be submitted to the District for approval prior to construction. Such plans shall include location, type, calculation of the size of each Grease Interceptor or Grease Trap, and point of connection to the sanitary sewer main line for each Grease Interceptor. Such approval shall not exempt the Food Service Facility from compliance with any applicable codes, ordinances, rules, regulations or orders of any governmental authority.
- D. A Food Service Facility may request a variance from the requirements set forth in these Standards. The District shall review a written request based on documentation supplied by the Food Service Facility that an alternative method of grease management is at least as effective in managing grease as the measures required by these Standards. The following information shall be submitted along with the above request.
 - 1. Location of sewer main and easements in relation to available exterior space outside building.
 - 2. Plans showing existing plumbing at the facility, including plans showing any common plumbing for all wastewater services at the building.
 - 3. A description of a design plan for any alternative pretreatment technology proposed to be installed to trap, separate and prevent FOG from being discharged into the wastewater collection system.
 - 4. A plan for regular maintenance of the alternative pretreatment unit.

3.1 DESIGN CRITERIA

- A. All waste shall enter the Grease Interceptor or Grease Trap through the inlet pipe only. There shall be one (1) inlet and one (1) outlet pipe.
- B. Grease Interceptors and Grease Traps shall be so designed and located as to be readily accessible for maintenance and inspection, and shall have a water seal of not less than six (6) inches for Grease Interceptors and two (2) inches or the diameter of the outlet, whichever is greater, for Grease Traps.
- C. Grease Interceptor shall be located within fifty (50) feet of the last appliance connected to the grease line within the building.
- D. Grease Interceptors shall have a minimum of two (2) compartments with fittings designed for grease retention.
- E. There shall be a minimum of one (1) manhole over each compartment to provide access for maintenance and inspection of all fixtures of the interceptor. A minimum of one (1) access per ten (10) feet of interceptor length shall be provided. Additional access shall be required for each additional ten (10) feet of length. All areas of the second compartment shall be accessible for cleaning.
- F. Manhole covers shall be gas-tight in construction having a minimum opening dimension of twenty four (24) inches. In areas where traffic may exist, the interceptor shall be designed to have adequate reinforcement and cover, meeting HS-20 traffic loading specifications. Grease Interceptor in traffic areas requires a concrete driving surface over the piping with structural backfill around piping.

- G. Grease Interceptor shall not become air bound if a closed cover is used. The tank and the discharge line shall each be vented, and the vents shall not be tied together less than forty-two (42) inches above the tank lead elevation. Whenever practical, the two vents shall be run underground to building and up through the roof. Vent shall extend six (6) inches minimum above the roof or ten (10) feet minimum above the finished grade.
- H. Double cleanouts with long sweep wye shall be installed on the inlet and outlet line.
- I. A sampling port shall be installed on the outlet line of each Grease Interceptor before the downstream clean out and vent. The sampling port shall be a tee connection, located within two (2) feet of the interceptor wall. The tee shall be extended to the surface with a four (4) inch pipe and a clean out adapter to cap the pipe. In traffic areas, a valve box shall be used to protect the pipe.
- J. A flow control device shall not be required preceding a Grease Interceptor.
- K. Grease Traps shall be equipped with a flow control or restricting device installed in a readily accessible and visible location preceding the Grease Trap. Flow control devices shall be designed and rated such that the flow through such a device shall at no time be greater than the rated capacity of the Grease Trap. Flow control device shall have an air intake connected to common waste bent line. No flow control devices having adjustable or removable parts will be permitted.
- L. Upon change of ownership of any existing facility, which would be required to have a Grease Trap or Grease Interceptor under these Standards, the applicant for sanitary sewer service shall demonstrate that a properly sized and functioning Grease Trap or Grease Interceptor is installed.

3.2 SIZING CRITERIA

3.2.1 GREASE INTERCEPTORS

- A. The District has the sole discretion to determine which sizing method is appropriate under the circumstances.
- B. The minimum acceptable volume shall be not less than seven hundred fifty (750) gallons. The recommended maximum volume shall not exceed 3000 gallons based on maintenance requirements. Larger interceptors may require more frequent maintenance. Where design capacity cannot be achieved with a single unit, installation of grease interceptors in series is required.
- C. The following procedure shall be used to determine the size of the Grease Interceptor.

1. Maximum drainage flow from fixtures.

Number of fixtures x fixture flow rate

Flow drain/sink, wok oven	10 gpm
Restaurant kitchen sink	15 gpm
Single compartment sink	20 gpm
Double compartment sink	25 gpm
2, single compartment sinks	25 gpm
2, double compartment sinks	35 gpm
Triple sink, 1.5 in. drain	35 gpm
Triple sink, 2 in. drain	35 gpm
Garbage disposal	40 gpm

30 gal. Dishwasher	15 gpm
50 gal. Dishwasher	25 gpm
50-100 gal. Dishwasher	40 gpm

2. Average flow rate, gpm
Total maximum flow from all fixtures / Number of fixtures
3. Loading factor.
Fast food (no dishes) = .50
Dine-in (0-100 seats) = .50
Dine-in (>100 seats) = .60
Cafeteria-Buffer = .75
Food Production = .85
4. Average one-hour flow, gph
Average flow rate x Loading factor x 60 min
5. Volume of Grease Interceptor, gal.
Average one-hour flow x 2 hours retention time

- D. An alternate method of determining the size of the Grease Interceptor is based on the maximum number of meals serviced at the maximum periods of the day (either breakfast lunch or dinner). Volume, in gallons, of the interceptor shall be 2.5 gallons times the maximum meals served during the busiest period of the day.
- E. The size of the Grease Interceptor may also be determined by multiplying seating capacity by a turnover constant of 1.6 times 2.5 gallons. Seating capacity shall be approximated, using ten (10) square feet of dining area per person.
Volume of Grease Interceptor = Seating Capacity x 1.6 x 2.5 gallons.

3.2.2 GREASE TRAPS

- A. The District has the sole discretion to determine which sizing method is appropriate under the circumstances.
- B. The smallest Grease Trap permitted shall have minimum grease retention capacity of 100 pounds and shall provide a hydraulic retention time of at least 15 minutes at the design flow rate.
- C. No Grease Trap shall be installed which has a rated capacity of less than 30 gpm.
- D. The use of larger capacity Grease Traps is encouraged whenever possible in that larger traps work more efficiently. In resolving any question of capacity of the Grease Trap, any uncertainties shall be resolved in favor of the larger capacity Grease Trap.
- E. Fixture Unit Method.
Under this method, the fixture compartment outlet shall be utilized to determine the fixture compartment drainage load in gpm, assuming one (1) FUE produces a flow rate of 7.5 gpm. The sum of the drainage loads for each fixture compartment to be connected to a single Grease Trap or the rated capacity of the flow control device will be the total Grease Trap drainage load in gpm. Multiply this total drainage load in gpm by the minimum retention time (15 minutes) to determine the required liquid capacity of the Grease Trap to be installed.

The following fixture unit values shall be utilized when sizing Grease Traps under the Fixture Unit Method.

Fixture Drain or Trap Size	Drainage FUE Value
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1-1/4"	1
1-1/2"	2
2"	3
2-1/2"	4
3"	5
4"	6

F. Fixture Capacity Method.

Under this method, the physical size of each fixture compartment to be connected to the Grease Trap shall be measured and the capacity determined. The drainage load in gallons shall then be computed assuming the drainage load to be equal to 0.75 times the total physical capacity. The sum of the drainage loads for each fixture compartment to be connected to a single Grease Trap will be the total Grease Trap drainage load. The total Grease Trap drainage load is then divided by the drainage period for the fixture compartments connected to the Grease Trap to determine the flow rate to the Grease Trap in gpm. Multiply the Grease Trap flow rate thus determined, or the rated capacity of the flow control device, by the minimum retention time (15 minutes) to determine the required liquid capacity of Grease Trap to be installed.

- G. Selection of the appropriate size for a Grease Trap is dependent on the drainage period of the fixtures connected to the trap. By adjusting the fixture drainage period through use of a flow control device, a smaller Grease Trap could be utilized for a given fixture size or capacity, or multiple fixtures could be connected to the same Grease Trap.
- H. Where the required Grease Trap size would exceed that which is commercially available, either multiple Grease Traps shall be installed in parallel or a Grease Interceptor shall be utilized.

4. INSTALLATION

- A. Installation of Grease Interceptors and Grease Traps shall be in accordance with the current edition of the Uniform Plumbing Code and International Plumbing Code as utilized by the local building permitting authority and these Standards and shall be accomplished in a workmanlike manner in compliance with these design and sizing criteria.
- B. The installation of Grease Interceptors and Grease Traps shall be accomplished by a licensed plumber with documented experience in the installation of such devices.
- C. Each Grease Interceptor / Grease Trap shall be readily accessible for inspection by the District and for servicing and maintaining in proper working condition. Grease Trap shall be fully recessed in floor and has a non-skid cover.
- D. Use of ladders of removal of bulky equipment such as dumpsters in order to inspect or service Grease Interceptor shall constitute a violation of accessibility.
- E. No landscaping shall be permitted within fifteen (15) foot radius from the center of manhole access location. Sixteen (16) foot wide access drive to manholes shall be provided in landscaped areas.
- F. The District representatives shall be allowed access to any Food Service Facility at all reasonable times for the purpose of inspecting or sampling any Grease Trap or Grease Interceptor for compliance with these Standards.

- G. Location of all interceptors and traps shall be approved by the District, and shall be shown on the construction drawings.
- H. No dishwasher shall be connected to or discharge into any Grease Interceptor of less than 1000 gallons capacity, which is utilized by other fixtures.
- I. No dishwasher, food grinder or disposal unit shall be connected to or discharge into any Grease Trap. Such units shall be plumbed through a properly sized Grease Interceptor.
- J. All fixtures not equipped with a garbage disposal (garbage grinder), which are connected to a Grease Interceptor shall be equipped with a fixed or removable mesh or screen, which shall catch garbage and food debris and prevent it from entering the Grease Interceptor.
- K. Wastes in excess of 140 degrees Fahrenheit shall not be discharged into Grease Interceptor or Grease Trap. Liquid discharge from a Grease Interceptor or Grease Trap shall not exceed 70 degrees Fahrenheit.

5. MAINTENANCE

- A. Any Food Service Facility shall be severally responsible for cleaning and maintaining Grease Interceptors and Grease Traps in efficient operating condition at all times, and for otherwise complying with these Standards. Grease Interceptors and Grease Traps shall be maintained by regularly scheduled removal of the accumulated grease and solids so that they will properly operate as intended to intercept the grease and solids from the wastewater generated by the Food Service Facility and prevent the discharge of grease and solids to the District's wastewater collection system. This maintenance shall be performed in a workmanlike manner before the retention capacity of the interceptor or trap is reached.
- B. Maintenance of Grease Interceptors / Grease Traps shall be done only by a business/professional normally engaged in the servicing of such plumbing fixtures. Pumping shall include the removal of all contents from the interceptor, including grease, floating materials, gray water, bottom sludge and solids. Cleaning shall include removal of solids from the walls, floors, baffles and pipes in the interceptor. A Food Service Facility will not be permitted to accomplish maintenance specified by these Standards. It shall be the responsibility of each Food Service Facility to verify that the interceptor is properly cleaned out and that all fittings and fixtures inside the interceptor are in good working condition.
- C. The District shall provide a customer with a form for recording Grease Interceptor / Grease Trap maintenance. The customer shall provide one copy of the completed form to the District immediately following accomplishment of maintenance of any Grease Interceptor or Grease Trap within the District.
- D. Each food service facility shall maintain a grease interceptor / trap binder on site in an easily accessible location and shall make it available for review upon request by the District. The binder shall contain a chronological record of all maintenance and repairs performed on the grease interceptor(s) / trap(s) during the most recent three (3) year period. The binder shall include copies of the District's maintenance forms, a brief description of the nature of the maintenance or repair, and any other pertinent information.

- E. As a minimum, any Grease Interceptor in service in the District shall be serviced at a maximum interval of one hundred twenty (120) days.
 - 1. A variance from this requirement may be obtained when the owner can confirm that there is no normal use during any given one hundred twenty (120) calendar day period. With written authorization from the District, the maximum time variance between services is three hundred sixty five (365) calendar days.
 - 2. The District may inspect the interceptor and outlet and if it is deemed necessary by the District, more frequent servicing and maintenance will be required.
- F. As a minimum, any Grease Trap in service in the District shall be serviced at a maximum interval of thirty (30) days.
 - 1. A variance from this requirement may be obtained when the owner can confirm that there is no normal use during any given of thirty (30) calendar day period.
 - 2. The District may inspect the trap and outlet and if it is deemed necessary by the District, more frequent servicing and maintenance will be required.
- G. Biological treatment shall not be a substitute for the servicing of Grease Interceptors and Grease Traps at the frequency determined by the District. Emulsification of oil and grease with enzyme treatments only delays physical separation. Grease may then separate down stream and cause clogging problems in the wastewater collection system.

6. INSPECTION

- A. The District may inspect Grease Interceptors and Grease Traps monthly to determine the load on the fixture and the effectiveness of maintenance activities. The District will inventory all Grease Interceptors and Grease Traps in their service area and document the inspections of these interceptors and traps. These inspections may determine that more frequent maintenance than previously specified is required, in which case the District shall require and the property owner shall undertake more frequent maintenance.
- B. Existing sources not connected to a Grease Interceptor or Grease Trap and contribute grease to the District's wastewater collection system will be identified through the District's inspection program. Once these sources are identified, they will be required to install a Grease Interceptor or Grease Trap and maintain it according to these Standards. In the time before a Grease Interceptor or Grease Trap can be installed the District will require these businesses to implement Best Management Practices (BMP) to keep grease out of the sanitary sewer system. BMP shall include but not be limited to the following.
 - 1. Scrape food from plates into garbage cans.
 - 2. Pre-wash plates by spraying them off with cold water over a small mesh catch basin positioned over a drain. This catch basin should be cleaned into a garbage can as needed.
 - 3. Pour all liquid oil and grease from pots into waste grease bucket stored at the pot washing sink. Heavy solid build-up of oil and grease on pots and pans should be scraped off into a waste grease bucket.
 - 4. Other kitchen practices identified by the District and/or Food Service Facility, which will decrease the point source discharge of grease.

**MT CRESTED BUTTE WATER & SANITATION DISTRICT
GREASE INTERCEPTOR / GREASE TRAP MAINTENANCE FORM**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Pipe lining
 - 1. Slip Lining Pipe.
 - 2. Cured-in-Place Pipe Lining.
 - 3. Formed-in-Place Pipe Lining.
 - 4. Spot Repairs by Pipe Replacement.

1.2 SUBMITTALS

- A. Certification: Submit manufacturer's certification that products meet the referenced standards.
- B. Shop Drawings: Submit manufacturer's specifications and details for all products.
- C. Manufacturer's instructions for installation of pipe liner and appurtenances.
- D. Submit plan for construction sequence and schedule prior to commencing construction.
- E. Catalog data, samples, manufacturer's data and listing of applicable standards for special, unique or proposed substitute materials.
- F. Project record documents.

1.3 SUBSTITUTIONS

- A. Use only materials conforming to these specifications unless otherwise approved in writing by the District.
- B. Provide, as a minimum, the following information for evaluation.
 - 1. Product Information.
 - a. Product name.
 - b. Year product first available in United States.
 - c. Total footage or number of line segments installed in United States.
 - d. Results of all available product testing, including but not limited to leakage, physical properties, pipe stiffness, chemical resistance, strain corrosion, external loading, flow characteristics, infiltration/inflow reductions, structural capacity, and external hydrostatic loading capacity.
 - e. Design methods.
 - f. Typical liner thickness for pipe sizes included in the project.
 - 2. Manufacturer Information.
 - a. Manufacturer name.
 - b. Years experience manufacturing the product.
 - c. Quality control procedures for product manufacture, including inspection requirements, testing procedures and allowable tolerance limits.
 - d. Related ASTM standards, or other nationally recognized standards for product manufacturing.

1.4 CONTRACTOR INFORMATION

- A. Provide, as a minimum, the following information about Contractor who will perform the Work

1. Contractor name.
2. Completed project list for last five years including for each project and year completed, client name/address/contact person/phone number, footages installed by pipe diameter and number of lateral reinstatements.
3. Detailed installation procedures, including estimated times for each task, lateral reinstatement methods, number of required excavations and any other items unique to each product.
4. Video of installation process, if available.
5. Evidence of properly trained personnel.
6. Related ASTM standards or any nationally recognized standards for product installation.
7. Available equipment list.
8. Detailed procedures for repairing the product in the event of future damage failure and for tapping future service connections, including and required specialized equipment or training.
9. Videos of two rehabilitated sewer sections showing before and after conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver only materials that fully conform to these specifications or otherwise approved by the District.
- B. Store materials and handle to avoid damage.

1.6 INTERRUPTION OF SEWER SERVICE

- A. The Contractor shall notify the District forty-eight (48) hours in advance when conducting sewer rehabilitation project, which will result in the interruption of sewer service to an existing customer.
- B. All affected customers shall be notified twenty-four (24) hours in advance in writing. The notices, specifying the work to be done and length of time their sewer service will be blocked, shall be delivered to each customer by the Contractor. An attempt shall be made to deliver the notice personally to the customer; otherwise the notice shall be left at the customer's door.
- C. Personal contact shall be made with any customer, whose service cannot be reconnected within the time stated in the written notice.
- D. If so required by any customer, portable toilets for use by the occupants shall be furnished and serviced by the Contractor.
- E. If full normal sewer service is not re-established within the times stated, provide temporary facilities or hotel accommodations for affected residents and businesses.
- F. In commercial areas any disruption of service shall be undertaken only after said disruption has been coordinated with the District and the private property owner.
- G. If there exists a business or building for which sewer service cannot be interrupted, the Contractor shall be required to provide an appropriate means of providing sewer service to the affected customer during the sewer rehabilitation process.

1.7 INSTALLATION

- A. The District will provide available VHS format video tapes to contractor for use during pipe rehabilitation, as appropriate.
- B. The District will provide water for installation of cured-in-place pipe at a nearby hydrant. Contractor shall use a separate valve mounted on hydrant.

PART 2 -PRODUCTS

2.1 POLYETHYLENE AND POLYOLEFIN MANUFACTURED PIPE FOR SLIP LINING

- A. Pipe: Polyethylene (PE) or Polyolefin (PO):
 - 1. Conform to ASTM D 1248, Type III, Class C, Category 5, Grade P 34 or equivalent ASTM D 3350 Cell Classification PE 335434C.
 - 2. Maximum outside diameter and SDR as indicated on plans.
- B. Joints.
 - 1. Joined into continuous length on job site.
 - 2. Butt joints fused in accordance with pipe manufacturer's recommendations with approved equipment and in accordance with ASTM D 2657.

2.2 POLYVINYL CHLORIDE (PVC) PIPE FOR SLIP LINING

- A. Pipe.
 - 1. Conform to ASTM F 949, minimum pipe stiffness, 46 psi.
 - 2. PVC plastic in accordance with ASTM D 1784, cell classification 12454.
- B. Joints.
 - 1. Gasketed joints as per ASTM F 477 and ASTM D 3212.

2.3 RESIN-IMPREGNATED TUBE FOR CURED-IN-PLACE PIPE (CIPP)

- A. Pipe.
 - 1. Comply with ASTM F 1216.
 - 2. One or more layers of flexible needled felt or equivalent non-woven material.
 - 3. Stretch material to fit irregular pipe and negotiate bends.
 - 4. Outside layer plastic coated with a translucent flexible material. No delamination of plastic coating is allowed.
 - 5. Fabricated to a size when installed will tightly fit length without joints.
- B. Resin and Catalyst.
 - 1. Unsaturated, styrene-based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible.
 - 2. Cure in the presence of water with temperature in excess of 150°F.
- C. Cured Pipe Dimensions.
 - 1. Nominal internal diameter and length such that CIPP will form to internal circumference and length of original pipe.
 - 2. Field verify diameter and length.
 - 3. One continuous length without joints.

- 2.4 DEFORMED HIGH DENSITY POLYETHYLENE FOR FORMED-IN-PLACE PIPE (HDPE-FIPP)
- A. Pipe.
1. Manufactured in deformed shape from high-density polyethylene pipe compound conforming to ASTM D 1248, Class C, Category 5 and Grade P 34.
 2. Conform to long-term hydrostatic strength rating of 1600 psi or more in accordance with ASTM D 2837.
- B. FIPP Dimensions:
1. Nominal internal diameter and length of existing pipe as indicated on plans.
 2. Field verify diameter and length.
 3. Outside diameter fabricated to fit tightly.
 4. One continuous length without joints between manholes.
 5. Minimum wall thickness required to meet Standard Dimension Ratio (SDR) as indicated on plans.
- 2.5 DEFORMED POLYVINYL CHLORIDE FOR FORMED-IN-PLACE PIPE (PVC-FIPP)
- A. Pipe.
1. Manufacture in deformed shape in accordance with ASTM D 1784, Cell Classification 12454 B. Compounds with different cell classifications superior to those specified are acceptable.
 2. Performance requirements in accordance with ASTM D 3034.
- B. FIPP Dimensions.
1. Nominal internal diameter and length of existing pipe as indicated on plans.
 2. Field verify diameter and length prior to manufacturing.
 3. One continuous length without joints between manholes.
 4. Outside diameter fabricated to fit tightly.
 5. Minimum wall thickness required to meet specified Standard Dimension Ratio (SDR) as indicated on plans in accordance to ASTM F 1216.
- 2.6 PIPE REPAIR COUPLINGS FOR SPOT REPAIRS BY PIPE REPLACEMENT
- A. Style: Full circle, fully lined, bolted.
- B. Length: 12 inches, minimum.
- C. Materials and Manufacturer:
1. Shells, armors, side bars, lugs, Turner lifting bars, bolts and nuts; stainless steel, Type 304, per ASTM A 240.
 2. MIG welds, fully passivated.
 3. Rubber gasket.
 - a. Full coverage.
 - b. Grid pattern.
 - c. Per ASTM D 2000.
 4. Bolts: 1/2" or 5/8", Teflon coated threads.
 5. Stainless steel armor bonded to gasket to bridge lug area.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Furnish jurisdiction with a standard VHS video tape of sewers before lining process and after lining process and service reconnections have been completed.
- B. Provide on-tape numerical display of camera location, indexed from starting manhole, in feet.

3.2 BYPASSING SEWAGE

- A. If bypassing is required, submit bypass plan to the District for review.
- B. Plug line at a point upstream of pipe to be rehabilitated.
- C. Pump flow to downstream point or adjacent system as directed by the District.
 - 1. Provide pump and bypass lines of adequate capacity to handle all flows.
 - 2. Provide adequate reserve pumps on site for emergency.

3.3 SLIP LINING

- A. Installation.
 - 1. Pull or push liner into the host pipe in accordance with manufacturer's recommendations for liner pipe and ASTM F 585, unless noted otherwise.
- B. Excavation.
 - 1. For slip lining insertions, excavate at or near one structure and work from existing manhole at other end of section to be pulled.
 - 2. Pit.
 - a. If one section of pipe to be pushed or pulled at a time, dig evenly down to sewer similar to a jacking pit.
 - b. If liner pipe is to be joined together above ground and pulled into sewer, dig pit length 12 times inside pipe diameter and slope pit end back to ground surface at 2.5 to 1.
- C. Head Test.
 - 1. Pull pulling head with one short section of liner pipe through sewer before inserting liner to test for taps or obstructions protruding too far into the sewer.
 - 2. Attach cables to both ends of test head to allow for removal if an obstruction is encountered.
- D. Grouting.
 - 1. Before trimming ends of pipe and sealing, allow pipes to recover its original length. Time to be at least equal to time to pull liner into place.
 - 2. Fill space between liner and host pipe with Controlled Low Strength Material or other material approved by the District. Pump filler from lower end of liner.

3.4 RESIN IMPREGNATED CURED-IN-PLACE PIPE (CIPP)

- A. Installation.
 - 1. Install in accordance with manufacturer's recommendations for this lining process and ASTM F 1216 unless noted otherwise.
 - 2. Tube to be resin impregnated, hydraulically inverted in place with an approved lubricant and cured in place as per ASTM F 1216, Section 7.

3. CIPP to be continuous between manholes and may span several manhole reaches as allowed by the equipment, properties of CIPP and size and condition of sewer.
4. Material to be free of uncured spots, spots cured away from the pipe, and delaminations.
5. Any defects shall be repaired at Contractor's expense.

3.5 DEFORMED HDPE OR PVC FORMED-IN-PLACE PIPE (FIPP)

- A. Installation.
 1. Install in accordance with manufacturer's recommendations for particular lining material and process, unless noted otherwise.
- B. Liner Installation.
 1. Designate location where insertion will begin, subject to District's approval.
 2. Transport FIPP to site in continuous length on spools compatible with manufacturer's designated process.
 3. Heat FIPP material at job site as necessary for insertion. Pull FIPP into sewer with appropriate pulling heads, cables, and heat distribution equipment.
 4. FIPP to be continuous between manholes as allowed by tensile properties of FIPP and size and condition of sewer.
 5. Connect fully inserted FIPP to heat source distribution equipment.
 6. Round and expand by uniformly distributed heat, steam and pressure and by mechanical devices.
 7. After FIPP has been expanded to a tight fit, cool gradually under pressure until process is complete.
 8. FIPP to be continuous without joints over entire length.
 9. FIPP to be free of all material defects including but not limited to pits, pinholes, cracks, crazing, folds or unrounded sections.
 10. Any defects shall be repaired at Contractor's expense.

3.6 SPOT REPAIRS BY PIPE REPLACEMENT

- A. Installation.
 1. Strip and stockpile topsoil and excavate at each location. Remove any pavement materials from site. Use care to avoid damage to existing pipe.
 2. Remove existing pipe to the extent required and disconnect affected sewer services.
 3. Install replacement pipe of the same nominal size as existing using stainless steel band clamps.
 4. Temporarily support pipe at proper line and grade.
 5. Reconnect sewer services.
 6. Wrap all couplings with Polyethylene Wrap.
 7. Install controlled density fill bedding.
 8. Backfill trench per Section 02221.
 9. Replace topsoil in grassed areas.
 10. Replace pavement as directed.

3.7 SERVICE RECONNECTION

- A. Allow liner material to fully cure.
- B. No sanitary sewer service shall be left unconnected for more than twenty-four (24) hours.
- C. Complete reconnections involving excavation of service lines in accordance with the District's Standards.

3.8 CLEANUP AND CLOSEOUT

- A. Verify that services are reconnected and fully operable.
- B. Submit initial and final video tapes to the District.

3.9 MANHOLE REHABILITATION

- A. Liner Material.
 - 1. Strong-Seal Liner System: Strong-Seal High Performance Mix. Fiber-reinforced, spray-applied, cementitious mortar.
 - 2. LaFarge Calcium Aluminate Sewpercoat
- B. Patching Material.
 - 1. Rapid-setting, fiber-reinforced, high-early-strength, corrosion-resistant, hand-mixed and hand-applied, calcium aluminate based cementitious material.
 - 2. Acceptable Manufacturers: Strong-Seal Systems Corporation, Strong-Seal QSR.
- C. Infiltration Control Material.
 - 1. Rapid-setting, high-early-strength, hand-applied, cementitious material.
 - 2. Acceptable Manufacturers: Strong-Seal Systems Corporation, Strong-Seal Strong-Plug.
- D. Cementitious Grout
 - 1. Cementitious grout, volume stable.
 - 2. Minimum Compressive Strength, ASTM C 109: 250 psi at 28 days.
- E. Water.
 - 1. Clean and potable.
 - 2. Test nonpotable water in accordance with ASTM C 94.
- F. Surface Preparation.
 - 1. Per manufacturer's recommendations.
- G. Invert Repair.
 - 1. Using patching material per manufacturer's recommendations.
- H. Manhole Liner Installation.
 - 1. Apply liner material in accordance with manufacturer's instructions.

- I. Curing.
 - 1. Cure materials in accordance with manufacturer's instructions.

- J. Field Quality Control.
 - 1. Visually verify absence of leaks.
 - 2. Perform exfiltration test.
 - a. Manholes Maximum of 6 Feet Deep: Manhole rehabilitation is acceptable if water loss is maximum of 1 inch in five minutes.

 - b. Manholes Over 6 Feet Deep: Manhole rehabilitation is acceptable if water loss is maximum of 1 inch plus 1/8 inch for each additional foot of depth in five minutes.
 - c. Perform vacuum test. Vacuum test shall not be performed earlier than 7 days after application.

- K. Protection.
 - 1. Do not allow traffic for a minimum of 24 hours after final application of liner material.

END OF SECTION

SECTION 03300

03300-1

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers all cast-in-place concrete, including forms, reinforcing steel, finishing, curing and other appurtenant Work.

1.2 QUALITY ASSURANCE

- A. Reference Standards
 - 1. Except as modified or supplemented in these Specifications, all structural concrete shall meet the requirements of the following standards. Refer to the standards for detailed requirements.
 - a. ACI 301 Specification for Structural Concrete for Buildings.
 - b. ACI 347 Recommended practice for Concrete Formwork (Chapters 1 through 5).

1.3 SUBMITTALS

- A. Submit for approval the proposed mix proportions to meet 2.2A before any concrete is ordered for concrete structures.
- B. Submit delivery tickets for each load at the time of delivery indicating the following:
 - 1. Quantity delivered.
 - 2. Quantity of each material in the batch.
 - 3. Outdoor temperature in the shade.
 - 4. Time at which the water was added.
- C. Shop Drawings
 - 1. Show sizes, quantity and dimensions for fabrication and placing of reinforcing bars and bar supports.
 - 2. Indicate bar schedules, stirrup and tie spacing, and diagrams of bent bars.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Cement:
 - 1. Store in weather-tight enclosures and protect against dampness, contamination and warehouse set. Do not use cement that has become caked or lumpy.
- B. Aggregates:
 - 1. Stock pile to prevent excessive segregation or contamination with other materials or other sizes of aggregates.
 - 2. Use only one supply source for each aggregate stock pile.
 - 3. Do not use the bottom six (6) inches of aggregate piles in contact with the ground.
- C. Admixtures:
 - 1. Store to prevent contamination, evaporation or damage.
 - 2. Protect liquid admixtures from freezing or harmful temperature ranges.
 - 3. Agitate emulsions prior to use.
- D. Mixing and Transporting Ready-mixed Concrete:

1. The maximum elapsed time from the time water is added to the mix until the concrete is in place shall not exceed 1½ hours when concrete is transported in revolving-drum truck bodies.

E. Reinforcing Steel:

1. Deliver to site in bundles marked with metal tags indicating bar size and length.
2. Carefully handle and store on supports which will keep the steel from coming in contact with the ground.
3. Remove all mud, oil, loose rust or mill scale and other foreign materials prior to placing concrete.
4. Rust or mill scale which is "tight" will be permissible without cleaning or brushing, provided weight dimensions, cross sectional area and tensile properties meet the requirements of ASTM A615.

1.5 JOB CONDITIONS

A. Environmental Requirements

1. Do not place concrete during rain, sleet or snow unless adequate protection is provided.
2. Do not allow rain-water to increase the mixing water or damage the surface finish.

B. Cold Weather Concreting

1. Conformance: ACI 306, "Recommended Practice for Cold Weather Concreting."
2. Temperature of concrete when placed shall not be less than the following:

Air Temp. °F	Minimum Concrete Temp. °F Sections with least dimension Under 12"
30 to 45	60
0 to 30	65
Below 0	70

3. When placed, heated concrete shall not be warmer than 80°F.
4. Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed and the temperature of the surfaces to be in contact with the new concrete shall be raised above 35°F.
5. Protect concrete during specified curing period.
6. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections.
7. Do not permit heating units to locally heat or dry the concrete.
8. Do not use combustion heaters during the first 24 hours unless the concrete is protected from exposure to exhaust gases which contain carbon dioxide.

C. Hot Weather Concreting

1. Conformance: ACI 305 "Recommended Practice for Hot Weather Concreting."
2. Take precautions when the ambient air temperature is 90°F or above.
3. Temperature of concrete, when placed, shall not exceed 85°F.
4. Cool forms and reinforcing to a maximum of 90°F by spraying with water prior to placing concrete.
5. Do not use cement that has reached a temperature of 170°F or more.
6. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.

7. Do not place concrete when the evaporation rate (actual or anticipated) equals or exceeds 0.20 pounds per square foot per hour, as determined by Figure 2.1.4 of ACI 305.
8. Approved set-retarding and water reducing admixtures may be used when ambient air temperature is 90°F or above to offset the accelerating effects of high temperature.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150
 1. Sidewalks and other surface pavement: Type IA.
 2. Sewer inverts and collars: Type IIA.
 3. Below grade water structures and thrust blocks: Type IIA
- B. Aggregates:
 1. Fine aggregate AASHTO M-6 Sieve size, range 3/8" to #100.
 2. Coarse aggregate AASHTO M-80 sieve designation #67, range 1" to #4.
- C. Water: Clean and fresh.
- D. Air-entraining Agent: ASTM C260.
- E. Ready-mixed Concrete: Mixed and delivered, ASTM C94.
- F. Batching and Mixing Equipment: ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."

2.2 CONCRETE MIX DESIGN

- A. Concrete Mix: Measure and combine cement, aggregates, water, and admixtures in accordance with ASTM C94.
 1. Class A:
 - a. Minimum Cement Content: 6.0 bags/cu. yd.
 - b. Minimum 28-day Strength: 4,000 psi.
 - c. Air Content: 6%, ± 1%.
 - d. Maximum Slump: 4 in.
 2. Class B:
 - a. Minimum Cement Content: 5.0 bags/cu. yd.
 - b. Minimum 28-day Strength: 3,000 psi.
 - c. Air Content: 6%, ± 1%.
 - d. Maximum Slump: 4 in.
- B. Concrete Usage:
 1. Class A: Valve vaults and location not specified for class B.
 2. Class B: Manhole bases, buried thrust blocks, and where specifically stated.

2.3 FORM MATERIALS

- A. Forms
 1. Plywood - PSI, waterproof, resin-bonded, exterior type, Douglas Fir.

2. Lumber - straight, uniform width and thickness, free from knots, off-sets, holes, dents and other surface defects.
 3. Designed to produce hardened concrete having the shape, lines and dimensions shown on the Drawings.
- B. Form Oil
1. Light colored paraffin oil, or other non-staining material. For exposed surfaces not in contact with earth backfill, acceptable chemical release agents are Protex Industries, "Pro-Cote", Symons Corp., "Magic-Kote", L & M, "Debond", or equal.
- C. Form Ties
1. Commercially manufactured permanently embedded type with removable ends for all exposed surfaces.
 2. Permanently embedded portion shall terminate not less than one inch from the face of the concrete.

2.4 REINFORCING MATERIALS

- A. Bars: ASTM A615, Grade 40 or 60 unless specified otherwise.
- B. Welded Wire Fabric: ASTM A185 or A497.
- C. Fabrication ACI 315 and 318 unless shown otherwise on Drawings.

2.5 NON-SHRINK GROUT

- A. Ferrolith G.D.S. grout by Sonneborn Building Products, Inc., Embecco Grout by Master Builders Co., Vibrofoil by W.R. Grace Co., Construction Materials Division, or equal.

2.6 CURING AND SEALING COMPOUNDS

- A. ASTM C309, Type 1, Class B.
- B. Use Protec "Triple Seal", Symons Corp., "Cure and Seal", or equal.

PART 3 - EXECUTION

3.1 ERECTION OF FORMS

- A. Brace or tie to maintain desired position, shape and alignment before, during and after concrete placement.
- B. Construct forms of beams and slabs supported by concrete columns so the column forms can be removed without disturbing the beam or slab supports.
- C. Provide temporary openings at the bottom of columns and wall forms and at other locations where necessary to facilitate cleaning and inspection.
- D. Where concrete is placed against rock, remove loose pieces of rock and clean the exposed surface with a high pressure air hose.

- E. Place chamfer strips in forms to bevel salient edges and concrete corners of exposed surfaces except the top edges of walls and slabs which are to be tooled. Unless otherwise noted on the Drawings, bevels shall be 3/4 inches wide.
- F. Remove mortar or grout from previous concrete and other foreign material from the surfaces. Coat form surfaces with approved coating material before either the reinforcing steel or concrete is placed.
- G. Do not allow form coating to:
 - 1. Stand in puddles in the forms.
 - 2. Come in contact with the reinforcing steel.
 - 3. Come in contact with adjacent hardened concrete against which fresh concrete is to be placed.

3.2 REMOVAL OF FORMS

- A. Do not remove or disturb forms until the concrete has attained sufficient strength to safely support all dead and live loads.
- B. Remove forms with care to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

3.3 REINFORCING

- A. Installation
 - 1. Accurately place reinforcing bars and maintain in proper position while concrete is being placed and compacted.
- B. Bar Supports
 - 1. Provide minimum number of supports as required by ACI 315.
 - 2. Do not use pebbles, pieces of broken stone, common or face brick, metal pipe or wood blocks to support reinforcement.
 - 3. On ground, where necessary, supporting solid concrete bricks may be used.
 - 4. Use concrete, metal, plastic or other approved bar chairs, bolsters and spacers over flat form surfaces.
 - 5. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories within 1/2 inch of the concrete surface shall be non-corrosive or protected against corrosion.

3.4 CONCRETE PLACEMENT

- A. Conveying
 - 1. Convey to the point of final deposit by methods which will prevent the separation or loss of ingredients.
 - 2. During and immediately after placement, concrete shall be thoroughly compacted, worked around reinforcements and embedments and worked into all corners of the forms.
 - 3. Compact using immersion-type vibrators, vibrating screeds, or other acceptable mechanical compaction equipment.

3.5 FINISHING FORMED SURFACES

- A. Rough Form Finish

1. Rough form finish is acceptable for surfaces not exposed to view such as surfaces in contact with earth backfill.
2. Patch tie holes with mortar.
3. Repair defects.
4. Smooth form finish is acceptable alternative.

3.6 FINISHING UNFORMED SURFACES

- A. Slabs, Pavements, Sidewalks, Driveways, Curb and Gutters and Similar.
1. Screed and give an initial float finish as soon as concrete has stiffened sufficiently for proper working.
 2. Remove coarse aggregates disturbed by the initial floating or which cause a surface irregularity and replace with mortar.
 3. Initial floating shall produce a surface of uniform texture and appearance.
 4. Follow with a second floating at the time of initial set. This floating shall produce a finish of uniform texture and appearance.
 5. In areas where concrete is to remain exposed, follow the second floating with a broomed treatment to the surface to provide a uniform abrasive texture of constant color, except where steel trowel surface is indicated.
- B. Sewer Inverts
1. Invert channel: Smooth steel trowel finish.
 2. Benches: Broom treatment to provide a uniform abrasive texture.

3.7 DEFECTIVE CONCRETE

- A. Repair in accordance with ACI 301, Chapter 9.

3.8 CURING

- A. Keep concrete continuously moist for at least 7 days after placement by use of:
1. Ponding or continuous sprinkling.
 2. Wet burlap, wet absorptive mats or wet sand.
 3. Waterproof sheets.
 4. Polyethylene film.
 5. Membrane curing compound.
 - a. Do not use membrane curing compounds when the surface is to be painted or other material is to be bonded to the surface.
- B. Maintain concrete within 50° to 70° range during curing.
- C. Apply coating and sealing compounds in accordance with manufacturers's instructions.

3.9 FIELD QUALITY CONTROL

- A. Test Cylinders
1. Make a set of test cylinders (three 6"x 12") each 50 cubic yards place or portion thereof.
 2. Deliver test cylinders to testing laboratory.
 3. Comply with ASTM C192.

END OF SECTION

