CENTRAL IRON COUNTY WATER CONSERVANCY DISTRICT

CULINARY WATER SYSTEM CONSTRUCTION SPECIFICATIONS

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SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 GENERAL CONDITIONS

A. The work to be performed under this project shall consist of furnishing all labor, materials, and equipment necessary or required to complete the work in all respects as shown on the plans and as herein specified. All work, materials, and services not expressly shown or called for in the Contract Documents which may be necessary to complete the construction of the work in good faith shall be performed, furnished, and installed by CONTRACTOR as though originally so specified or shown, at no increase in cost to OWNER.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The purpose of this project is to construct a new culinary water distribution system incorporating the existing individual system in different subdivisions, if applicable. The work shall include the development of a well, installation of new culinary water pipelines with connections as shown on the Plans. Additionally, the work shall include the construction of a storage tank, a well house, new appurtenances, fire hydrant, valve vault with electrically-actuated valve, and miscellaneous other appurtenances.

1.03 CONTRACT METHOD

A. The work hereunder will be constructed under a lump sum contract.

B. CONTRACTOR shall include the General Conditions and Supplementary Conditions of the Contract as a part of all of its subcontract agreements.

1.04 WORK SEQUENCE

A. The contract time for substantial and final completion is as indicated in the Agreement (Document 00500), and is on a calendar day basis commencing from the date of the Notice to Proceed.

1.05 CONTRACTOR USE OF PROJECT SITE

A. CONTRACTOR's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.

1.06 PROJECT SECURITY

A. CONTRACTOR shall make all necessary provisions to protect the project and CONTRACTOR's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.

1.07 CHANGES IN THE WORK

A. It is mutually understood that it is inherent in the nature of municipal construction that some changes in the plans and specifications may be necessary during the course of construction to adjust them to field conditions, and that it is of the essence of the Contract to recognize a normal and expected margin of change. The ENGINEER shall have the right to make such changes, from time to time, in the plans, in the character of the work, and in the scope of the project as may be necessary or desirable to ensure the completion of the work in the most satisfactory manner without invalidating the Contract.

- END OF SECTION -

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 GENERAL

A. All work completed under this contract shall be in accordance with the Plans and Specifications and will be measured by the ENGINEER.

B. The term "Lump Sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure, portion of work, or unit is specified "Lump Sum" as the unit of measurement, the unit will include fittings, accessories, and all work necessary to complete the work as shown on the plans and as specified.

C. Discounts and Sales Tax.

1. CONTRACTOR shall maintain full responsibility for all materials and is to include all costs of materials and taxes as part of their bid.

1.02 SLATE CANYON WATER SYSTEM IMPROVEMENTS – CULINARY WATER SYSTEM UPGRADE, NEW IRRIGATION WATER SYSTEM AND APPURTENANCES

A. Water system

1. **METHOD OF MEASUREMENT** This Bid Item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work.

2. **BASIS OF PAYMENT** Payment shall be made at the contract lump sum bid price. Payment shall be considered complete compensation for all labor, equipment, and materials, including but not limited to a complete pump house construction, including foundation, walls, roof, floor, doors and other structural appurtenances; valves, fittings and piping, ventilation, and testing. Payment shall also include the free draining gravel beneath the floor slab and the concrete floor slab.

B. The Lump Sum amount indicated shall be for a complete and operational culinary and irrigation water systems as shown on the Drawings.

- END OF SECTION -

SECTION 01040

COORDINATION

PART 1 GENERAL

1.01 GENERAL

A. The OWNER and/or utility owners may be working within the project area while this contract is in progress. If so, the CONTRACTOR shall schedule his work in conjunction with these other entities to minimize mutual interference.

B. CONTRACTOR shall notify ENGINEER of the schedule for materials testing required by CONTRACTOR in Section 01440 a minimum of 24 hours in advance in order to provide ENGINEER time for scheduling of desired Quality testing.

C. CONTRACTOR shall notify Owners of Private right-of-ways 72 hours prior to work being performed across Ownersô right-of-ways.

D. If required to work in Utah Department Of Transportation (UDOT) right-of-way, CONTRACTOR shall notify UDOT 72 hours prior to work being performed therein. Work within the UDOT right-of-way shall be in accordance with their required permit and their license agreement with OWNER.

E. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the waterline and informing them of the work to be conducted, and when the water service will be back online. The Contractor shall also provide the following:

1. **Water service may only be interrupted for a maximum period of 2 hours. Contractor shall provide a minimum notice of 48 hours to State Hospital personnel prior to a disruption in service.**

2. Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any problems which could arise.

F. The CONTRACTORôs working hours shall be within the hours of 7 AM to 6 PM.

- END OF SECTION -

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 GENERAL

A. CONTRACTOR shall provide all survey construction staking as necessary to complete the facilities and appurtenant work according to the contract documents, including:

1. Building corner offsets.
2. Benchmark network throughout the construction zone.
3. Cut and fill staking with offset for pond construction (question).
4. Two intermediate offset cut stakes for pipeline construction.
5. Removal and replacement of survey monuments if required. Any removal of survey monuments, without notification to the Engineer/Surveyor, is illegal and replacement costs will be charged to the CONTRACTOR.

B. CONTRACTOR shall be responsible for notifying utility owners to request location staking of all utilities in the areas of construction. All utility staking shall be protected during construction activities from removal and disturbance. CONTRACTOR shall be responsible for replacement of all stakes removed as a result of CONTRACTOR and Subcontractor activities. (not sure)

- END OF SECTION -

SECTION 01070

ABBREVIATIONS/DEFINITIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

1.02 ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AGC	American General Contractors
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American Nation Standards Institute, Inc.
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASCE	American Society of Civil Engineers
ASOC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DEQ	Department of Environmental Quality
DWQ	Department of Water Quality
DWR	Drinking Water Regulations
EIA	Electronic Industries Association
ETC	Electrical Test Laboratories

ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
ISA	Instrument Society of America
ISO	International Organization of Standardization
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SSPWC	Standard Specification for Public Works Construction
UDOT	Utah Department of Transportation
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
UPRR	Union Pacific Railroad
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcements Institute, Inc.
WWPA	Western Wood Products Association

1.03 DEFINTIONS

CONTRACTOR	The person or persons performing the construction work.
CICWCD	Central Iron County Water Conservancy District
CUSTOMER	Individual/institutions requiring utility services such as power, water or sewer.
DEVELOPER	The contractor, property owner or agent as applicable.
DISTRICT	
ENGINEER	CICWCD Engineer or an authorized representative.
OWNER	Subdivision owners, developers, or others responsible parties for constructing improvements or developments on property within CICWCD.
WATER LATERAL	Domestic service water pipe, including meter box or vault, meter setter, valving and lid.
WATER DISTRIBUTION MAIN	Domestic water line which is 6-inch to 12-inch diameter.
WATER TRANSMISSION MAIN	Domestic water line which is larger than 12-inches in diameter.

- END OF SECTION -

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 GENERAL

A. TITLES OF SECTIONS AND PARAGRAPHS. Captions accompanying Specifications sections and paragraphs are for convenience of reference only, and do not form a part of the Specification.

B. APPLICABLE PUBLICATIONS. Whenever in these specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards or requirements of the respective issuing agencies which have been published as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the drawings shall be waived because of any provision of, or omission from, said standards or requirements.

C. SPECIALISTS, ASSIGNMENTS. In certain instances, specifications test requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements and shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the work; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with CONTRACTOR.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the specifications, all work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.

B. Reference herein to "Building Code" or IBC shall mean the International Building Code of the International Conference of Building Officials (ICBO). The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor. CONTRACTOR shall bid the most stringent requirements.

D. APPLICABLE STANDARD SPECIFICATIONS. CONTRACTOR shall construct the work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein; except, that wherever references to "Standard Specifications" are made, the provisions therein for measurement and payment shall not apply.

E. References in the Contract Documents to "Standard Specifications" shall mean the Contract Documents including all current supplements, addenda, and revisions thereof.

F. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

G. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including changes and amendments thereto.

H. UTAH STATE DIVISION OF DRINKING WATER. New source development (such as well) and installations shall conform to the requirements of the Utah Administrative Code, Rule R309-515. "Facility Design and Operation: Source Development."

I. UTAH STATE DIVISION OF DRINKING WATER. New wellhouse installations and existing wellhouse modifications shall conform to the requirements of the Utah Administrative Code, Rule R309-520. "Facility Design and Operation: Disinfection."

J. UTAH STATE DIVISION OF DRINKING WATER. New Transmission Pipeline and Distribution Pipeline installations and modifications shall conform to the requirements of the Utah Administrative Code, Rule R309-550. "Facility Design and Operation: Transmission and Distribution Pipelines."

K. UTAH STATE DIVISION OF DRINKING WATER. New Drinking Water Storage Tank installations and modifications shall conform to the requirements of the Utah Administrative Code, Rule R309-545. "Facility Design and Operation: Drinking Water Storage Tanks."

L. UTAH STATE DIVISION OF DRINKING WATER. New wellhouse installations and existing wellhouse modifications and installation shall conform to the requirements of the Utah Administrative Code, R309-540, "Facility, Design & Operation: Pump Stations".

M. Reference herein to APWA shall mean the latest edition of the "Manual of Standard Specifications" and "Manual of Standard Plans" as prepared by the American Public Works Association and the Associated General Contractors of America.

- END OF SECTION -

SECTION 01210

PROJECT MEETINGS

PART 1 GENERAL

1.01 PRECONSTRUCTION CONFERENCE

A. Prior to the commencement of work at the site, a preconstruction conference will be held at a mutually agreed time and place which shall be attended by CONTRACTOR, its superintendent, and its subcontractors as appropriate. Other attendees will be:

1. ENGINEER and the Resident Project Representative (RPR).
2. Representatives of OWNER.
3. Governmental representatives as appropriate.
4. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

B. Unless previously submitted to ENGINEER, CONTRACTOR shall bring to the conference one copy of each of the following:

1. Progress schedule.
2. Procurement schedule of major equipment and materials and items requiring long lead time.
3. Shop Drawings/Sample/Substitute or "Or Equal" submittal schedule.

C. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to CONTRACTOR prior to the meeting date, which may include the following:

1. CONTRACTOR's tentative schedules.
2. Transmittal, review, and distribution of CONTRACTOR's submittals.
3. Processing applications for payment.
4. Maintaining record documents.
5. Critical work sequencing.
6. Field decisions and Change Orders.
7. Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
8. Major equipment deliveries and priorities.
9. CONTRACTOR's assignments for safety and first aid.

D. ENGINEER will preside at the preconstruction conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

1.02 PROGRESS MEETINGS

A. CONTRACTOR shall schedule and hold regular on-site progress meetings at least weekly and at other times as required by ENGINEER or as required by progress of the work. CONTRACTOR, ENGINEER, and all subcontractors active on the site shall be represented at

each meeting. CONTRACTOR may at its discretion request attendance by representatives of its suppliers, manufacturers, and other subcontractors.

B. ENGINEER shall preside at the meetings and provide for keeping and distribution of the minutes. The purpose of the meetings will be to review the progress of the work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

C. At each construction progress meeting a progress report shall be presented by the CONTRACTOR containing an updated Progress Schedule. Where the delayed completion data of a project phase is noted, the Contractor shall describe the anticipated delays or problems and outline the action plan being taken to counter their effect.

1.03 MEASUREMENT AND PAYMENT

A. Project Meetings shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

- END OF SECTION -

SECTION 01300

CONTRACTOR SUBMITTALS

PART 1 GENERAL

1.01 SHOP DRAWING SUBMITTAL

A. CONTRACTOR shall furnish to the ENGINEER for review, 4 copies of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, list, graphs, operating instructions, catalog sheets, data sheets, and similar items. Shop drawings and submittal requirements shall include interpretations of proposed or required configurations not shown on the drawings, so as a document record of such can be approved.

B. Drawings shall be submitted sufficiently in advance to allow the ENGINEER not less than ten regular working days for examining the drawings. These drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items and unit assemblies in relation to the contract drawings and/or specifications.

C. When the shop drawings are approved by the ENGINEER, two sets of prints will be returned to CONTRACTOR marked "Approved", "Approved, Except as Noted", or similar notification. If changes or corrections are necessary, one set will be returned to CONTRACTOR with such changes or corrections, indicated by a brief statement, and CONTRACTOR shall correct and resubmit the drawings, in triplicate, when requested by the ENGINEER.

D. Approval of shop drawing will not be required of reinforcing steel that is detailed by CONTRACTOR in accordance with the plans and specifications. Any change from the plans and specifications that is made by CONTRACTOR in reinforcing steel as well as any other change shall be approved by the ENGINEER in a written change order prior to any work being altered from that already approved for construction.

E. Fabrication of an item may be commenced only after the ENGINEER has reviewed the pertinent submittals and returned copies to CONTRACTOR marked either "Approved", or "Approved - Except as Noted". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

F. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of CONTRACTOR, prior to submission to the ENGINEER.

G. The ENGINEER's review of CONTRACTOR shop drawing submittals shall not relieve CONTRACTOR of the entire responsibility for the corrections of details and dimensions. CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. CONTRACTOR shall be responsible for dimensions and the design of adequate connections and details.

1.02 SAMPLES SUBMITTAL

A. Whenever requested of the ENGINEER, CONTRACTOR shall submit at least 1 sample of each item or material to the ENGINEER for acceptance at no additional cost to OWNER.

B. Samples, as required herein, shall be submitted for acceptance prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delay in the Work.

C. Unless otherwise specified, all colors and textures of specified items will be selected by the ENGINEER from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.03 OPERATIONS AND MAINTENANCE MANUAL SUBMITTAL

A. The Contractor shall furnish to the Engineer 4 (four) identical sets of Operations and Maintenance Manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl, hard-cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A Table of Contents shall be provided which indicates all equipment in the Operations and Maintenance Manuals.

B. The Contractor shall include in the Operations and Maintenance manuals full details for care and maintenance for all visible surfaces as well as the following for each item of mechanical, electrical, and instrumentation equipment (except for equipment furnished by the Owner):

1. Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.

2. Preventative maintenance procedures and schedules.

3. Complete parts lists, by generic title, identification number, and catalog number, complete with exploded views of each assembly.

4. Disassembly and reassembly instruction.

5. Name and location of nearest supplier and spare parts warehouse.

6. Name and location of manufacturer.

7. Recommended troubleshooting and start-up procedures.

8. Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.

C. All Operations and Maintenance manuals shall be submitted in final form to the Engineer not later than the 75 percent of construction completion date. All discrepancies found by the Engineer in the Operations and Maintenance manuals shall be corrected by the Contractor prior to final acceptance of the project.

1.04 PROGRESS SCHEDULE SUBMITTAL

A. The CONTRACTOR shall prepare a project progress schedule using the Critical Path Method, and meeting the following requirements:

1. Minimum Sheet Size: as required to show appropriate level of detail.

2. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

3. Provide separate schedule of submittal dates for shop drawings, product data, and samples.

4. Submit revised Progress Schedule with each Application for Payment.

1.05 MEASUREMENT AND PAYMENT

A. Contractor submittals shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

- END OF SECTION -

SECTION 01410

TESTING AGENCY SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. CONTRACTOR shall be responsible for providing Construction Quality Control Testing of all soils, concrete, etc. as required by the various sections of these specifications. This section includes the following:

1. Use of independent testing agency.
2. Control testing report submittal requirements.
3. Responsibilities of testing agency.

1.02 REFERENCES

A. ASTM D 3740: Standard Recommended Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ASTM D 4561: Standard Practice for Quality Control Systems for and Inspection and Testing Agency for Bituminous Paving Materials.

C. ASTM E 329: Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

D. Any other

1.03 DEFINITIONS

A. Independent Testing Agency: A testing agency NOT owned by CONTRACTOR, and an agency that does not have any preferential affiliation or association with CONTRACTOR, or any of CONTRACTORôs Subcontractors and Suppliers other than entering into a contract with CONTRACTOR to perform the duties defined in these specifications.

B. Professional Engineer: An engineer who complies with Utah licensing law and is acceptable to the authority having jurisdiction.

1.04 QUALITY ASSURANCE

A. CONTRACTOR shall employ and pay for services of an independent testing agency which complies with ASTM D 3740, ASTM D 4561, and ASTM E 329 to test materials for contract compliance.

B. Concrete Technician: Approved by ENGINEER or ACI certified.

1.05 TESTING AGENCY SUBMITTALS

A. Field Test Report: Submit report no later than the end of the current day.

B. Laboratory Test Report: Submit original report within 48 hours after test results are determined.

C. Final Summary Report: Submit prior to final payment.

D. On all reports include:

1. Project title, number and date of the report.
2. Date, time and location of test
3. Name and address of material Supplier.
4. Identification of product being tested and type of test performed.
5. Identify whether test is initial test or retest.
6. Results of testing and interpretation of results.
7. Name of technician who performed the testing.

1.06 RESPONSIBILITIES OF TESTING AGENCY

A. Calibrate testing equipment at least annually with devices of an accuracy traceable to either National Bureau of Standards or acceptable values of natural physical constraints.

B. Provide sufficient personnel at site and cooperate with CONTRACTOR, ENGINEER and OWNERôs Representative in performance of testing service.

C. Secure samples using procedures specified in the applicable testing code.

D. Perform testing of products in accordance with applicable sections of the Contract Documents.

E. Immediately report any compliance or noncompliance of materials and mixes to CONTRACTOR, ENGINEER and OWNERôs Representative.

F. When an out-of-tolerance condition exists, perform additional inspections and testing until the specified tolerance is attained, and identify retesting on test reports.

1.07 LIMITS ON TESTING AGENCY AUTHORITY

A. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Agency may not suspend Work.

C. Agency possesses the authority to accept Work for OWNER.

- END OF SECTION -

SECTION 01440

QUALITY CONTROL & MATERIALS TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Responsibilities for controlling quality of materials, products and workmanship.

B. Responsibilities for manufacturerôs instructions, certificates and field service.

1.02 MATERIALS

A. All materials incorporated in the project shall be new and shall fully comply with the specifications. Unless otherwise clearly provided in the specifications, all workmanship, equipment, materials, and articles incorporated in the work covered by the contract are to be of the best available grade of their respective kinds. Whenever, in the specifications, any material, article, device, product, fixture, form, type of construction, or process indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired and shall be deemed to be followed by the words "or approved equal" and CONTRACTOR may in such case, upon receiving the ENGINEER's approval, purchase and use any item, type, or process which shall be substantially equal in every respect to that indicated or specified.

B. Materials and equipment may be used in the Work based upon receipt of a Supplierôs certificate of compliance. Certificate must be in possession of CONTRACTOR and reviewed by ENGINEER prior to use.

C. Quality Assurance Testing by the OWNER and/or ENGINEER shall not relieve CONTRACTOR of responsibility to furnish materials and work in full compliance with Contract Documents.

1.03 MANUFACTURER'S INSTRUCTIONS

A. Should instructions conflict with Contract Documents, request clarification before proceeding.

B. When required in individual sections, submit manufacturerôs instructions in the quantity required for product data, delivery, handling, storage, assembly, installation, start-up, adjusting, balancing, and finishing, as appropriate.

1.04 MANUFACTURER'S CERTIFICATES

A. When required in individual sections, submit manufacturerôs certificate in duplicate executed by responsible officer certifying that product meets or exceeds specified requirements.

1.05 MANUFACTURER'S FIELD SERVICES

A. When required in individual sections, have manufacturer or Supplier provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable and to make written report of observations and recommendations to ENGINEER.

1.06 WORKMANSHIP

A. Maintain performance control and supervision over Subcontractors, Suppliers, manufacturerôs, products, services, workmanship, and site conditions, to produce work in accordance with Contract Documents.

B. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

C. Provide suitable qualified personnel to produce specified quality.

D. Ensure finishes match approved samples.

1.07 INSPECTION OF MATERIALS

A. At the option of the ENGINEER, materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the work. CONTRACTOR shall give the ENGINEER written notification well in advance of actual readiness of materials to be tested and/or inspected at point of origin. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude retesting or reinspection at the site of the work.

B. CONTRACTOR shall furnish such samples of materials as are requested by the ENGINEER, without charge. No material shall be used until it has been approved by the ENGINEER. See Section 01300, CONTRACTORôs Submittal.

1.08 UNSATISFACTORY CONDITIONS

A. Examine areas and conditions under which materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

1.09 QUALITY CONTROL TESTING

A. ENGINEERôs failure to detect any defective Work or materials does not prevent later rejection when such defect is discovered nor does it obligate ENGINEER for acceptance.

B. CONTRACTOR shall provide 24-hours minimum notice to ENGINEER for all testing required by these specifications.

1.10 TESTING ACCEPTANCE AND FREQUENCY

A. Minimum Quality Control Testing Frequency: As defined in Table 01440-1. The CONTRACTOR shall be responsible to ensure that testing is performed at the frequencies shown. CONTRACTOR shall uncover any work at no cost to OWNER to allow OWNER to perform required testing at the frequencies shown.

B. Acceptance of Defective Work: As defined in Article 9.6 of the General Conditions.

1.11 MEASUREMENT AND PAYMENT

A. Quality Control and Materials Testing required in Table 01440-1, is the responsibility of the CONTRACTOR.

TABLE 01440-1: QUALITY CONTROL TESTING FREQUENCY

SYSTEM or MATERIAL	TESTS	MINIMUM REQUIRED FREQUENCY
SUBGRADE AND BACKFILL MATERIALS		
Section 02221 Excavation and Backfill for Buried Pipelines	Field Density *	1 test per 300 linear feet per 1.5 feet of backfill thickness placed.
	Laboratory	1 test for each material type which includes proctor, classification and gradation.
Section 02222 Excavation and Backfill for Structures	Field Density *	1 test per 300 linear feet per 1.5 feet of backfill thickness placed.
	Laboratory	1 test for each material type which includes proctor, classification and gradation.
Section 02278 Road Base - Untreated Base Course	Field Density *	Base course subgrade: 1 tests per 8,000 square feet of area. Base course: 1 test per 8,000 square feet of area.
	Laboratory	Base course: 1 test for each material type which includes proctor, classification and gradation.
ASPHALT		
Section 02500 Removal and Replacement of Surface Improvements	Mix Design	Marshall Test Method: 1 test initially per each type of material and each change in target, and for each day of production thereafter. Specific Gravity: 1 per each Marshall Test Extraction: 1 test per each Marshall Test
	Field Density *	Bituminous surfaces: 1 test per 8,000 square feet placed or part thereof.
	Asphalt Thickness and Core Density	Bituminous surfaces: 1 test sample every 300 linear feet of completed roadway.

PORTLAND CEMENT CONCRETE		
Section 03300 Cast-in-Place Concrete	Slump	1 test every day of placement or 1 test for every 50 cubic yards and more frequently if batching appears inconsistent. Conduct with strength tests.
	Entrained air	1 test with slump test.
	Ambient and concrete tem-peratures	1 test with slump test.
	Water cement ratio.	to be verified and provided with batch tickets.
	Compressive strength	1 set of 4 cylinders every 50 c.y. or part thereof per day.

NOTES:

1 Additional tests shall be conducted when variations occur due to the contractor's operations, weather conditions, site conditions, etc.

2 Classification, moisture content, Atterberg limits and specific gravity tests shall be conducted for each compaction test if applicable.

3 Tests can substitute for same tests required under "Aggregates" (from bins or source), although gradations will be required when blending aggregates.

4 Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement calculations.

5. * All nuclear density meters used for in place field testing shall have been calibrated by ASTM methods within 1 year previous to current testing.

SECTION 01710

GENERAL IMPROVEMENT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section presents the general requirements for improvements of public utilities in Central Iron Water Conservancy District (CICWCD). The improvements primarily include water systems. The necessary improvements shall extend from the nearest acceptable point of existing improvements. The layout must allow possible future extension to adjacent properties and shall be compatible with appropriate District master plans. All water lines shall be installed to the boundary lines of the development. The recommendations from geotechnical investigation must be followed.

1.02 CONSTRUCTION DRAWINGS

A. A complete and detailed construction plans and drawings of improvements shall be submitted to the District Engineer. No construction shall be started until plans have been checked and approved by the District Engineer, and other appropriate District officials. The following instructions are provided for the purpose of standardizing the preparation of drawings and to obtain uniformity in appearance, clarity, size and style:

1. Two sets of construction plans shall be submitted to the District Engineer for checking and returned to the developer/contractor for correction. When all corrections have been made and the set approved, one copy of the approved set shall remain with the District Engineer.

2. The plans and designs shall meet the standards defined in the Specifications and Drawings hereinafter outlined.

3. All drawings and/or prints shall be clear and legible and conform to good engineering and professional drafting practice. Size of drawings shall be 24" X 36".

4. The developer/contractor shall provide all as-built drawings in AutoCad 2002 format on a CD-ROM with a .dxf or .dwg extension file format upon completion of the project.

B. GENERAL: The following shall be included on the drawings:
   a. North arrow (plan).
   b. Scale and elevations referenced to USGS datum.

c. Stationing and elevations for profiles.
d. Title block, located on the right side of the sheet to include:
    i. Project title;
    ii. Type of project and
    iii. Professional Engineer stamp (licensed in the State of Utah).

C. Culinary water drawings should show the following:

1. Size and location of all existing and proposed water mains, valves and hydrants, and service laterals.
2. Type of pipe (only pipe materials approved by CICWCD may be used).
3. Minimum cover (42-inches to top of pipe).
4. Typical trench section showing backfill, compaction and shoring requirements

D. DETAILED SHEETS: Each set of plans shall be accompanied by a separate sheet of details for structures which will be constructed. Detail sheets shall include the following information:

1. Drawing size: 24" X 36".
2. Scale of each detail.
3. Title block on the right side of the sheet (same format on all sheets).
4. Name of the development.
5. All details must be completely dimensioned and described.
6. All details shall conform to the standard details shown in the standard drawing section of these standards.

1.03 INSPECTION, TESTING AND QUALITY CONTROL

A. All construction work involving the installation of improvements in Central Iron County Water Conservancy District shall be subject to District inspection and testing standards as outlined in the quality control section of each specification.

1. REQUEST FOR INSPECTION: Requests for inspections shall be made to the District Engineer or Inspectors by the person responsible for the construction. Notice shall be given 24 hours in advance before the starting of work. Any site to be backfilled or covered shall not start prior to inspection.

2. CONSTRUCTION COMPLETION INSPECTION: A final inspection shall be made by the District Engineer, or a representative upon receipt of a request by the owner after all construction work is completed. Any faulty or defective work shall be corrected by the persons responsible for the work, within thirty (30) days from the date of the District Engineer's Inspection Report.

3. QUALITY CONTROL TESTING: Material testing shall be conducted by an

independent laboratory, approved by the District Engineer at the developer/contractorôs expense. All testing shall comply with current ASTM, AASHTO, AWWA or Public Drinking Water Regulation standards and shall meet the minimum testing requirements as outlined in the specifications. The cost of any testing and/or re-testing required to incorporate materials into the specification shall be borne by the developer/contractor. The time and locations of all tests shall be approved by the District Engineer's office. If determined necessary by the District Engineer or a representative, additional testing can be required.

4. TEST REPORTS: A written copy of test results will be required for review by the District Engineer after each portion of the work (i.e. pipeline construction, earthwork, curb, gutter and sidewalk, roadway construction).

5. FINAL REPORT: Upon completion of the project, a final report certified by a registered professional engineer in Utah must be submitted by the firm employed by developers for testing. This report will include: number of tests required and number of tests actually conducted, number of repeated tests for each type, all test results and other pertinent items required herein.

6. AS-BUILT DRAWINGS: Before final inspection, the developer/contractor shall provide a complete set of as-built drawings that includes all items specified in Section 1.02 for construction drawings. The as-built drawings shall show all improvements as they were constructed in the field. The as-built drawings shall be submitted on 24"X 36" bond paper and on CD in AutoCAD with .dxf or .dwg extension file format. No bond retainer shall be released until as-built drawings are received.

7. GUARANTEE OF WORK: The developer/contractor shall warrant and guarantee that the improvements provided for hereunder, and every part thereof, will remain in good condition for a period of one year after the date of the acceptance of the project by Central Iron County Water Conservancy District. The owner shall make all repairs to and maintain the improvements and every part thereof in good condition during the specified time at no cost to the District.

8. REPAIR AND MAINTENANCE: The determination for the necessity of repairs and maintenance of the work shall rest with the District Engineer. Such decision upon the matter shall be final and binding upon the developer/contractor. The guarantee hereby stipulated shall extend to and include, but shall not be limited to, the entire road base, all pipes, joints, valves, manholes, backfill and compaction as well as the working surface, curbs, gutters, sidewalks, and other accessories that shall be constructed by the developer/contractor. Whenever, in the judgment of the District Engineer, said work shall be in need of repairs, maintenance, or rebuilding, written notice shall be served upon the developer/contractor and thereupon the developer/contractor shall undertake and complete such repairs, maintenance or rebuilding. If the developer/contractor fails to do so within thirty days from the date of the service of such notice, the District Engineer shall have such repairs made, and the cost of such

repairs shall be paid by the developer/contractor together with 25 percent of the cost of the repairs in addition thereto, as stipulated damages for such failure on the part of the developer/contractor to make the repairs. Any omission on the part of the Engineer to condemn defective work or material at the time of construction shall not be deemed an acceptance. The contractor and/or developer will be required to correct defective work or material at any time before final acceptance and within one year thereafter.

9. BARRICADES AND WARNING SIGNS. The developer/contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs, and other traffic control devices. All necessary precautions shall be taken to protect the work and to safeguard the public. Streets closed to traffic shall be protected by effective barricades, and obstructions shall be illuminated during hours of darkness. Suitable warning signs shall be provided to control and direct traffic properly. All traffic control operations and signing shall be performed in accordance with the instructions outlined in the latest edition of "Manual on Uniform Traffic Control Devices". A traffic control plan will be required for submittal and approval on each project.

- END OF SECTION -

SECTION 01720

GENERAL CONSTRUCTION STANDARDS

PART 1 PIPELINE CONSTRUCTION

1.01 SUMMARY

This section covers the requirements for material trenching, placement, backfilling, cleaning and testing of underground pipelines and incorporates the requirements of the AWWA Standards and Manufacturers Recommended Installation Procedures, whichever is more stringent. Backfill shall include filling of all trenches to the original ground surface or final grading elevation as shown on the drawings, or otherwise directed by Central Iron County Water Conservancy District (CICWCD).

1.02 MATERIALS

This section specifies acceptable pipe and accessories for public water pipeline construction within Central Iron County Water Conservancy District. The materials used for pipe and fittings shall be new and shall conform to the requirements for class, brand, size and material as specified.

A. WATER PIPE AND FITTINGS. The materials used for pipe and fittings shall be all new and shall conform to the requirements for class, brand, size and material as specified.

1. A copy of the manufacturer's installation recommendation for each kind of pipe shall be provided to each foreman prior to construction. These recommendations shall be followed during construction unless instructed otherwise by the District Inspector or Engineer. All pipe materials shall conform to the following requirement:

Pipe diameter	Pipe material
1/2" - 4"	Polyethylene Pipe SIDR-7, ASTM D2239 Type K Copper ASTM B88
8" - 12"	Polyvinyl Chloride (PVC) Pressure Pipe AWWA C-900 Ductile Iron Pipe Class 250/350
Over 12"	Polyvinyl Chloride (PVC) Class C905 Ductile Iron Class 250/350 AWWA C151 HDPE SDR 7/11

B. CONNECTION WATER METERS: Only authorized employees of the CICWCD shall be allowed to connect or disconnect water meters. All boxes set in concrete shall be flanged to prevent settlement.

NOTE: Where the Standards refer to AWWA Standards, a copy of the standards should be available for review at the Central Iron County Water Conservancy District

C. POLYETHYLENE (PE) PRESSURE PIPE (½"-2"): All Polyethylene (PE) Pressure Pipe shall be Pressure Class 200, SIDR 7, unless otherwise specified.

D. POLYVINYL CHLORIDE (PVC) PRESSURE PIPE (24"): All Polyvinyl Chloride (PVC) Pressure Pipe shall be Pressure Class 200, DR-14, conforming to the latest edition of AWWA Specification C-900. Unless otherwise specified, all PVC pipe furnished under these specifications shall be constructed in accordance with ASTM D-1784.

1. All fittings used on rigid PVC pipe shall be ductile iron and conform with AWWA Specification C110.

2. Couplings used on rigid PVC pipe shall be solid sleeve or transition type with mechanical joints complying with AWWA Specification C110.

E. DUCTILE IRON PIPE: All ductile iron pipe, when required; shall be Class 350 conforming to the latest edition of AWWA Specifications C-151.

Unless otherwise specified, all Ductile Iron Pipe furnished under these Standards shall be designed in accordance with AWWA Specification C-150-76 "American National Standard for the Thickness Design of Ductile Iron Pipe."

1. PHYSICAL AND MECHANICAL PROPERTIES: The Ductile Iron Pipe shall conform with all requirements of the ANSI Specification A21.51. The physical properties shall not be less than 60-42-10.

2. MARKING: Each pipe shall be legibly marked "Ductile". The weight, a manufacturer's mark, and the year in which the pipe was produced shall be cast or marked on the pipe.

3. JOINTS: Ductile Iron Pipe shall be Mechanical Joints, Rubber Gasket Slip-on Joints, Flanged Joints, or a combination of the above as specified on the plans.

a. MECHANICAL JOINTS: Mechanical joints and the rubber gaskets and lubricant for Ductile Iron Pipe shall comply with the requirements and be dimensioned in accordance with the latest edition of AWWA specifications C-104, C-110 and C-111. Bolts and

rubber gaskets shall be furnished with mechanical joint pipe in sufficient quantity for the amount of fittings ordered.

b. RUBBER GASKETS SLIP-ON JOINT: Rubber gasket slip-on joints, and the rubber gaskets and lubricant for Ductile Iron Pipe shall comply with the general requirements of AWWA C-151 and C-111.

c. FLANGED JOINTS: Cast iron pipe flanges, and bolts and nuts therefore, shall be dimensioned in accordance with ANSI B-16.2 for Class 200. Threads for screw-on flange pipe shall comply with ANSI B-21. Flange bolts, nuts and gaskets shall be furnished with flange joint pipe in sufficient quantity to make each joint for the pipe ordered. Flanged fittings and spools shall conform to AWWA C-104, C-110 and C-115.

4. LINING AND COATING: The waterway surfaces of all Ductile Iron water pipe and fittings shall be coated in accordance with AWWA C-104.

Ductile Iron Pipe or Fittings lined in the field will not be accepted as conforming to AWWA C-104.

5. POLYETHYLENE WRAPPING: A polyethylene sleeve will be required on all ductile iron pipe unless otherwise specified by the District Engineer. The polyethylene sleeve tubing shall be cut to provide for a minimum of one foot of lap over both the adjoining pipes. The ends of the tubing shall be wrapped using three circumferential turns of plastic adhesive tape. The loose wrap on the barrel shall be pulled snugly around the barrel of the pipe and the excess folded over at the top. This fold shall be held in place by means of six-inch strips of plastic tape placed at intervals of three feet along the pipe barrel.

Bends, reducers, and offsets shall be sleeved in the same manner as the pipe. Valves shall be sleeved by bringing the tube sleeve on the adjacent pipe over the bells of the valve and sealing with adhesive tape. The valve bodies shall then be wrapped with flat sheets passed under the valve bottom and brought up around the body to the stem and fastened with the tape.

F. COPPER PIPE: Where service lines are two-inch or less in diameter, type K copper pipe shall be used. Pipe which has outside dimensions greater than two-inch in diameter shall not be copper. All copper pipes shall conform to the following specifications:

1. MATERIAL: Pipe shall be used which conforms to the requirements of ASTM B88. The pipe shall be of a Type K only and shall be dimensioned so as to allow the connection to AWWA standard water service taps and

fittings. The pipe shall have surfaces smooth and free from bumps and irregularities.

2. SERVICE CONNECTIONS: The installation of service connections shall use only connections, equipment and practices recommended by the manufacturer. The service connection shall conform to the detail drawing shown in the standard drawings.

G. FITTINGS: Fittings shall be Copper and of a pressure rating as may be required by the ASME B16.

H. TAPPING/REPAIR CLAMP MATERIAL SPECIFICATION:

1. SMALL TAPS/REPAIR CLAMPS: For small tappings and repair clamps (3/4" through 3") on cast iron, steel or ductile iron pipe, the following materials shall be required:

a. SADDLE CASTINGS: Small saddle tappings shall be similar to "Romac Stainless Steel Saddles" constructed of high tensile ductile (modular) iron, in accordance with ASTM specification 536-71, and shall be covered by a black nylon fused coat, approximately 10-12 mils thick, with an approximate dielectric strength of 1000 volts per mill.

b. STAINLESS STEEL STRAP: The stainless steel strap shall consist of a two-inch wide strap to spread out the clamping force on the pipe and shall come complete with sufficient bolts, nuts and washers (with five-eighths-inch N.C. Teflon coated roll threads) to properly clamp the strap to the pipe. M.I.G. welds shall be pasivated for resistance to corrosion.

c. GASKETS: Gaskets shall be made from virgin SBR compounded for water services.

I. VALVES AND BOXES: All valves, twelve inches and smaller shall be of a resilient-seat-gate-valve type, and all valves over twelve inches shall be butterfly valves unless otherwise specified by the District Water Department.

1. GATE VALVES: Valves shall conform to the latest revision of AWWA Resilient Seated gate valve Standard C-509 and be UL listed, FM approved. All internal parts shall be accessible without removing the body from the line. The wedge shall be of cast iron completely encapsulated with resilient material. The resilient sealing material shall be permanently bonded to the cast iron wedge with a rubber tearing bond to meet ASTM D 429. NRS stems shall be cast bronze with internal collars in compliance with AWWA.

OS&Y stems shall be bronze. The NRS stuffing box shall have two "O"-Ring seals above the thrust collar. These rings shall be field replaceable without removing the valve from service.

There shall be low friction thrust bearings above and below the stem collar. The stem nut shall be independent of the wedge and of solid bronze. The waterway in the seat area shall be smooth, unobstructed and free of cavities. Stuffing box shall be attached to the bonnet and the bonnet to the body with bolts and nuts. Blind bolts threaded directly into the body or bonnet will not be acceptable. The body and bonnet shall be coated interior and exterior with corrosion resistant coating. Each valve shall be hydrostatically tested at 400 PSI to the requirements of both AWWA and UL/FM.

Valves shall be installed vertically in a horizontal run of pipe, and shall be provided with a two-inch square operating nut for manually operating the valve with a "T" handle wrench. The direction of rotation to open shall be to the left (counter-clockwise).

2. BUTTERFLY VALVES: All butterfly valves shall be of the tight-closing, rubber-seat type with rubber seats that are securely fastened to the valve body. No metal-to-metal seating surfaces shall be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction, and shall be satisfactory for applications involving valve operation after a long period of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves twenty inches and smaller shall meet the full requirements of AWWA Standard C504 for Class 150B. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five years. All valves shall be similar to those as manufactured by the Henry Pratt Company or approved equal.

   Valve bodies shall be constructed of cast iron ASTM A-126 Class B (for flanged end valves) or ASTM A-48 Class 40 for safer type valves. Flange drilling shall be in accordance with ANSI B16.1 Standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be in strict accordance with AWWA Standard C504.

   Valve discs shall be constructed of alloy cast iron ASTM A436 Type I (Ni-Resist).

   Shafts of all valves shall be turned, ground and polished. Valve shafts shall be constructed of 18-8 Type 304 or Type 316 stainless steel. Shaft diameters shall meet minimum requirements established by AWWA Standard 75 lbs. pull under test procedure ASTM D-429, Method B.

Valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearing load shall not exceed one-fifth of the compressive strength of the bearing of shaft material. Packing shall be self-adjusting Chevron type. Valve operators shall conform to AWWA C504.

Manual operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical stop-limiting devices to prevent over-travel of the disc in the open and closed positions. Valves shall close with a (clockwise) rotation. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 lbs. on the handwheel or chain-wheel. Operator components shall withstand an input of 450 Ft. Lbs. at extreme operator position without damage.

3. VALVE BOXES: All valves shall be provided with a Cast Iron valve box of the extension sleeve type, and the correct adjustable height to bring the top of the valve box flush with the ground surface. The valve box shall not be less than five inches in diameter and shall have a minimum thickness of .375 inch. The box provided also shall be provided with a suitable base and cover. The word "WATER" shall be cast on the cover.

J. WATER SERVICE LATERALS: The material used for water service connections shall comply with the following:

1. SERVICE PIPE: Copper or polyethylene (PE) pipe shall be seamless and suitable for use as underground service connections and shall conform to Section 4.1 of these Standards.

2. CORPORATION STOPS: Corporation stops shall be similar to those manufactured by Ford; shall be fitted with the proper adapter to the service line and shall conform to the designation shown below for the various sizes:

	Water service connection size					
	1/2"	3/4"	1"	1 1/2"	2"	3"
FORD	600	600	600	600	600	600

All services shall have a flare or compression type joint for the service pipe and threaded on the inlet end with an AWWA thread.

3. METER SETTER YOKES: Meter setters or meter yokes shall be 18" high, Ford 70 series copper setter or equal, and shall have an AWWA approval, built-in back-flow device, inlet angle ball valve, and grip joint compression

couplings for copper tubing or PE pipe on both inlet and outlet. All internal parts shall be accessible without removing the valve from the line. Meters shall only be installed by District Water Department personnel.

4. METER BOX AND LID: The meter boxes shall be white, high density polyethylene ADS N-12 or equal, 18" X 30" (standard size). The meter lids shall be cast iron, auto read. D & L Supply L-2241 with 2" hole (O.A.E.).

5. BUILDING SERVICE CONNECTIONS: At all points designated by the District Engineer, the owner shall install services for building connections, and shall extend such services to the property line, unless otherwise indicated by the District Water Department. Individual water services shall be 1 inch from the water main to the meter setter for normal domestic service, but may be one-and-one-half or two-inches in diameter as directed by the District Water Department. Services shall have a minimum of three feet of cover and be laid as shown in the standard drawings.

K. FIRE HYDRANTS: Fire Hydrants shall be Mueller, Model A-423; Kennedy, Model K81A, or approved equal with 5 ½" diameter 3 nozzle, foot valve and 6" mechanical joint connection. It shall be the responsibility of the Owner to furnish hydrants with finish paint above the ground line identical to the existing hydrant paint (red).

L. FLOWABLE BACKFILL: Flowable backfill material shall conform to the following:

1. Portland Cement - Type I or II Subsection 718.01.

2. Fly Ash - ASTM C-618, Class F, except loss on ignition shall not exceed three percent maximum, and shall come from a source approved by the District Engineer.

3. The coarse and fine aggregate for flowable fill shall be natural and consisting of mineral aggregate particles meeting the following:

Sieve Size	Percent Passing
3/4	100
200	0-10

4. Mix Design - meet the following:

Minimum compressive strength (28 days)	50 PSI
Maximum compressive strength (28 days)	150 PSI
Minimum fly ash per cubic yard	300 lbs.
Maximum cement per cubic yard	50 lbs.
Maximum slump	10 in.

PART 2 PIPELINE CONSTRUCTION METHODS

2.01 SUMMARY

This section covers the requirements for trenching, placement, and back filling of all underground pipelines. The methods employed in performing the work shall be the responsibility of the developer. The developer shall make such changes in the methods employed as are necessary to install an acceptable finished product. These methods shall include but are not limited to the following:

A. CONTROL OF GROUNDWATER: All trenches shall be kept free from water during excavation, fine grading, pipe laying, jointing, and embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of ground water, and in cases where the static ground water elevation is above the bottom of any trench or bell hole excavation, such ground water shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. Surface water shall be prevented from entering the trenches.

B. EXCAVATION FOR PIPELINES: Trench excavation shall include all operations necessary for excavation of all materials of whatever nature falling within the designated lines of the trenches. Trenches shall be excavated to the lines shown on the drawings or otherwise established by the District Engineer, and to a depth so as to provide a minimum burial of three feet over the pipe unless otherwise specified. The bottom two feet of the trench walls shall be vertical. All finish grade excavation necessary for preparation of the trench bottom shall be made manually. No over-excavating shall be allowed without re-compaction of backfill in accordance with these Standards.

Excavation for trenches in ledge rock, cobble rock, or stones shall extend to a depth of at least four inches below the invert of the pipe. Bedding material as outlined in table 4.1 shall be placed and compacted to 95% of maximum dry density with pneumatic or vibratory tampers in six-inch lifts to provide a smooth, well compacted and stable foundation for the pipe or appurtenant works.

Trench bottoms shall be hand-shaped as specified and the maximum width of the trench, measured at the top of the pipe, shall be as narrow as possible, but not wider than 12 inches on each side of the pipe.

Where unstable earth, mud or muck is encountered in the excavation at the grade of the pipe, the unsuitable material shall be removed to a minimum of 12-inches below grade and the subsequent hole shall be backfilled with crushed rock or gravel (as called out in table 4.2 under "foundation material") to provide a stable subgrade. The gravel material shall be deposited over the entire trench width in a maximum of six-inch thick layers. Each layer shall be compacted by tamping, rolling, vibrating,

spading, slicing, rodding or by a combination of one or more of these methods. In addition, the material shall be graded to produce a uniform and continuous support for the entire length of the installed pipe. When dealing with clays it may be required to replace all of the material with suitable fill(road base/sand) to provide a stable subgrade.

Table 4.1 Backfill materials

Sieve size	Percent passing for			
	Foundation materials*	Bedding material	Pipe zone material	Final backfill material
2 inch	100	---	---	Native material which contains no sod, vegetation, rocks larger that 8" in diameter, asphalt or concrete chunks, etc.
3/4 inch	0 – 50	---	100	
No. 4	0 – 10	100	40 - 70	
No. 50	0 – 5	---	20 - 50	
No. 200	0 – 3	0 - 15	5 - 30	
*To be used only when the trench bottom is unstable. (The standard drawings show the typical trench backfill details.)				

C. SHEETING, BRACING, AND SHORING OF EXCAVATIONS: All excavations shall be sheeted, braced, and shored as required to protect the workers and existing utilities and improvements from sliding, sloughing or settling of the trench walls while the work is in progress. All such sheeting, bracing and shoring shall comply with the requirements of the Utah State Industrial Commission. All damage resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Contractor, and the Contractor shall effect all necessary repairs or reconstruction resulting from such damage.

D. BLASING: Blasting will not be allowed except by written permit from the Iron County Fire Chief. If the permit is granted, the Contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property.

The contractor shall comply with the provisions outlined in the U.S. Bureau of Mines Bulletin No. 656 "Blasting Vibrations and their Effects on Structures", and other applicable ordinances as specified by the Fire Chief.

The contractor shall be fully responsible for all damage attributable to such blasting operations. Excessive blasting or overshooting will not be permitted and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed and properly replaced.

E. PIPELAYING AND BEDDING: Pipe will be carefully inspected in the field by District Inspectors before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be removed and replaced by the Contractor.

When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose the existing improvement before laying any pipe or conduit. The District Inspector shall be given the opportunity to inspect the existing pipe or conduit before the connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the plans will be made.

Pipe shall be laid up grade with the socket or collar ends of the pipe up grade unless otherwise authorized by the District Water Department and/or District Engineer.

Pipe shall be laid true to line and grade, with uniform bearing under the full length of the barrel of the pipe. Suitable excavation shall be made to receive the bell or collar, which shall not bear upon the subgrade or bearing. Any pipe which is not true to alignment or shows any settlement after laying shall be removed and re-laid to the proper grade and alignment. Wherever possible, sanitary sewers shall be installed on the down-hill side of the street.

1. REQUIREMENTS FOR LINE AND GRADE: All sewer and drainage pipe shall be installed accurately to the defined line and grade within the following limits:

    a. Variance from established line and grade shall be not greater than one thirty-second (1/32) of an inch per inch of pipe diameter.

    b. The total variance from line and grade shall not exceed one-half (1/2) inch, provided that such variation does not result in a level or reverse sloping invert.

    c. The variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, shall not exceed one sixty-fourth (1/64) of an inch per inch of pipe diameter.

    d. The total non-concentricity variance shall not exceed one-half (1/2) inch maximum.

2. INSTALLATION OF PIPE. A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an

elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom. Large rocks (over 6 inches in least dimension) near the surface shall be removed and the hole refilled with approved backfill in accordance with table 4.2.

3. SETTING OF BENDS, TEES, CROSSES AND REDUCERS: Bends, tees, crosses, and reducers shall be lowered into the trench, inspected, cleaned and joined to the pipe.

   Reaction or thrust blocking shall be applied at bends and tees, and at points of reducing or in fittings where changes in pipe diameter occur. The design of concrete thrust blocking shall be as shown in the Standard drawings or as directed by the District Water Department. The material for reaction or thrust blocking shall be Class C in accordance with Table 4.10 and Section 4.3 of these standards. Blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the fitting and on the ground shall in each instance be that required in the drawings or by the District Engineer. Unless otherwise directed by the District Engineer, the blocking shall be placed so that the pipe and fitting joints will be accessible for repair in accordance with the Standard Drawings. Restraining joints (mega-lug or equal) shall also be used to prevent movement wherever thrust blocks are required.

4. PLUGGING AND DEAD-ENDS: Spigot ends of fittings and plain ends of pipe shall be capped. A concrete reaction or thrust block shall be provided at all plugged outlet fittings in the sizes indicated on the standard drawings or as directed by the District Engineer. They also shall be tied to the pipe with restraining joints.

5. SERVICE LINES: All service lines shall be installed according to the details shown on the Standard Drawings.

6. PIPE TO BE KEPT CLEAN: All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean by means approved by the District Engineer during and after laying.

7. JOINT PIPE SECTIONS: The sealing surface of the pipe, the bell to be joined, and the elastomeric gaskets shall be cleaned immediately prior to assembly, and assembly shall be made as recommended by the manufacturer. When pipe laying is not in progress, the open ends of installed pipe shall be closed to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, enough backfill shall be placed on the pipe to prevent floating. Any pipe that has floated shall be removed from the

trench and the bedding restored. No pipe shall be laid when the trench conditions or the weather are unsuitable for proper installations as determined by the District Engineer.

8. CUTTING PIPE: The pipe shall be cut in a neat manner without amage to the pipe so as to produce a smooth end at right angles to the axis of the pipe.

9. END PREPARATION: Pipe ends shall be cut square, deburred and beveled in accordance with the pipe manufacturer's recommendations.

10. PUSH-ON-JOINTS: The push-on joint shall be a single elastomeric gasketed joint which shall be assembled by positioning the elastomeric gasket in the annular groove of the bell and inserting the spigot end of the pipe into the bell. The spigot end of the pipe shall compress the gasket radially to form a positive seal. The gasket and annular groove shall be designed, sized and shaped so that the gasket will resist displacement. Care shall be taken so that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell must be in accordance with the manufacturer's recommendations.

11. MECHANICAL JOINTS: The mechanical joint shall be a bolted joint of the stuffing box type, and installation recommendations from the manufacturer shall be followed. Each joint shall consist of:

    a. A bell provided with an exterior gland having bolt holes or slots and a socket with an annular recess for the sealing gasket and the spigot end of the pipe.

    b. A sealing gasket.

    c. A follower gland with bolt holes matching those in the fitting.

    d. Tee bolts and hexagonal nuts of cor-ten metal.

12. METER BOXES: All meter boxes shall be located behind the sidewalk, in the center of the lot. Any meter box covered or damaged during the construction operations shall be replaced or uncovered and raised to finish grade by the Contractor.

13. PIPE BEDDING. Pipe shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded in accordance with the bedding details in the standard drawings.

Pipe bedding materials shall be deposited and compacted in layers not to exceed six inches in compacted thickness. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved methods in such a manner that the bedding materials will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall conform to the requirements of table 4.2 of these standards and shall be free from roots, sod, or other vegetation.

In the event trench materials are not satisfactory for pipe bedding, imported bedding will be required. Imported bedding shall consist of placing compacted granular material on each side of and to the level of twelve inches above the top of the pipe. Imported bedding material shall be graded in accordance with table 4.2, under "bedding material".

F. BACKFILLING AND COMPACTION: Backfill shall be carefully placed around and over pipes and shall not be permitted to fall directly on a pipe from such a height or in such a manner as to cause damage. Backfill material shall be as required by table 4.2 or as approved by the District Engineer and shall not contain any wood, grass, roots, broken concrete, frozen soil, asphalt chunks, trash or debris of any kind that may cause unequal settlement or improper consolidation.

The backfill in all utility trenches under proposed or existing roadways, curb and gutter, sidewalks and driveways shall be compacted to the equivalent of 95% of maximum dry density for granular soils or 90% of maximum dry density for silty/clay soils as classified by AASHTO M-145 Soil Classification System. In shoulders and other street right-of-way areas, the in-place density shall be a minimum of 90% of the maximum dry density.

1. INITIAL BACKFILL PROCEDURE. Backfill of selected material which shall conform to the requirements of table 4.2 shall be placed carefully in eight-inch non-compacted horizontal layers and tamped to a depth of 8 to 12 inches over the top of the pipe. During compaction of the initial backfill, special care shall be taken so as to not move the pipe, either vertically or horizontally. All backfill operations shall be performed in such a manner so as to avoid any damage to the pipe, valves, laterals, etc. In the event such damage or displacement occurs, such damaged or displaced pipe shall be removed and replaced with undamaged pipe on proper grade and alignment.

2. FINAL BACKFILL PROCEDURE. The backfill above a point 8 to 12 inches above the top of the pipe shall be backfilled in horizontal layers 12 inches thick or less with materials containing no brush, perishable or objectionable material, or rocks, stones or boulders larger than 8-inches in the

greatest dimension. The material shall be mechanically compacted with appropriate vibrating compaction equipment.

3. MECHANICAL COMPACTION OF BACKFILL. The backfill shall be thoroughly compacted by consolidation or mechanical compaction.

Structural and trench backfill shall be deposited in horizontal layers and compacted by the following method in such manner that the compacted material will be homogeneous and free from lenses, pockets, streaks, and other imperfections.

The materials shall be deposited in horizontal layers (across the length or width of the excavation of not more than six inches compacted thickness. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability.

Prior to and during compaction operations, all backfill material shall have the optimum practicable moisture content and shall be uniform throughout each layer.

Moisturizing of the materials shall be performed at the site of excavation. If the moisture content is not optimum for compaction, the compaction operations shall be delayed until such time that the material has been brought the optimum moisture content. When the material has been properly conditioned, it shall be compacted by using appropriate mechanical compaction equipment as indicated below.

a. Vibrating Rollers shall consist of a self-propelled roller with a vibrating steel drum of at least one-ton capacity. The roller shall have an effective rolling width of at least 24 inches and shall deliver a compaction force of at least 700 pounds per square inch when vibrating.

b. Pneumatic rollers shall consist of a self-propelled roller with pneumatic tires arranged in a manner so as to provide a satisfactory compacting unit. The roller shall have an effective rolling width of at least 30 inches and shall give a compaction force of at least 500 pounds per inch of width of tread when fully loaded. The tires shall be uniformly inflated.

c. Vibrating plates shall consist of a pneumatic vibrating plate attached to the boom of a backhoe and capable of compacting an area of at least three square feet. The plate and backhoe combination shall together be capable of exerting a compactive force of at least 1,000

pounds per square inch.

d. Hand Compactors shall be used when hand-compacted methods are specified or required because the location of the area to be compacted does not permit the use of self-propelled mechanical compactors. Vibrating plates, "pogo-stick" tampers or other approved hand-compacting equipment shall be used.

e. Jetting and Flooding methods are not permitted.

4. FLOWABLE BACKFILLING: In the pavement sections on all streets and State highways, flowable fill shall be used (unless otherwise approved by the District Engineer) for backfill and shall be in conformance with the standards of "Flowable Fill" as described herein. Flowable fill shall be discharged from the ready mix truck by any reasonable means into the trench to be filled. The fill will be brought up to the bottom of the surface course and shall be finished to provide a uniform surface.

G. TRENCHES ON HIGHWAYS AND STREETS: Wherever trenches will be in, or must cross State highways or streets, the contractor shall obtain such excavation permits as are required for these crossings and shall become familiar with and abide by the rules and directions of the Utah Department of Transportation while working in these streets.

All contractors excavating in any Iron County public right-of-way shall obtain a Road Breaking Permit in compliance with the Iron County street ordinance prior to excavating. All asphalt cuts shall be made with a diamond or carbide-tipped masonry or asphalt cutting saw or with a steel asphalt-cutting wheel attached to a grader or back-hoe. No scarifier-tooth cuts, back-hoe, bucket rips, or jackhammer spade cuts will be allowed.

All backfilled trenches in roadways shall be patched with hot-mix asphalt within fourteen days of initial excavation unless otherwise directed by the County Engineer. The backfill section shall be according to the typical road sections of these standards.

All concrete or asphalt surfaces damaged or cut in trenching operations shall be restored to an as-good or better condition than prior to excavation.

During the entire trenching, backfilling and patching operations, the Contractor will be required to observe all safety and traffic control procedures as outlined in these standards.

The contractor shall be responsible for maintenance of the trench and patch for a period of 18 months from the date of the completion of the patching operation.

Unless otherwise approved by the County Engineer, not more than 400 feet of trench shall be left unfilled at any time in one continuous run.

All streets and roads trenched shall be kept free from dust and open to through traffic unless permission to close the street is obtained by the Contractor from the County Engineer. Up to one-half the width of any street or road shall be temporarily restored for use before excavation is commenced on the remaining portion of the street or road. All excavation, backfilling and temporary resurfacing on any portion of any street or road shall be completed in one working day so that no trenches are left open over night.

H. CLEANING AND DISINFECTION OF WATER SYSTEMS: Each line, after being tested and before being placed in service, shall be disinfected by chlorination. Prior to chlorination the entire line shall be flushed to insure that all dirt or foreign objects have been removed from the line. The line used to flush the line shall be six-inch minimum and no fire hydrants shall be used for flushing. Sufficient chlorine shall be added to insure a residual of twenty-five parts per million in the water after twenty-four hours standing in the pipe. Chlorine calcium hypochlorite dry chlorinating chemical solution may be used for this purpose. Methods of application shall be approved by the District Water Department. Following chlorination, all treated water shall be drained and the pipeline thoroughly flushed with clean water.

The entire line shall be flushed after the specified contact period, and such flushing shall be continued until the water is free from excess chlorine. The entire line, including hydrant laterals, branch lines, and dead-end mains shall be flushed. Chlorine residual must be tested after final flushing by the District Water Department. The discharge of flushed water shall be accomplished in such a manner that no erosion will occur and with no damage to streets or other property. Procedures for discharge will be subject to the review of the District Engineer and District Water Department.

3.01 QUALITY CONTROL

All underground pipelines shall be installed in accordance with these standards and tested as outlined below.

A. TRENCH BACKFILL MOISTURE DENSITY TESTING: Soil Proctor One determination for each significant change in soil type as necessary to provide required compaction testing. Tests shall be ASTM D1557 Method A or D (modified proctor).

B. TRENCH BACKFILL MOISTURE/DENSITY DETERMINATION: Tests are required for trench backfill for every 200 lineal feet of trench including service lateral trenches), or other utility trench or portion thereof, and each manhole, valve or set of valves within a 10-foot diameter that comes to the surface in the street section. Tests shall be run at the following trench elevations:

1. One test at top of pipe zone.

2. One test per 2 feet of depth measured from the bottom of the subgrade to the top of the pipe zone. Tests shall be evenly spaced vertically through the trench with one test at top of trench (bottom of subgrade).

3. Additional testing may be required by the District Engineer or soils testing lab to verify compaction.

4. Tests shall be according to ASTM D1556 or D2922 and D3017.

C. WATER SYSTEM TESTING AND ACCEPTANCE: The Owner and/or Contractor shall disinfect and test all water mains prior to final acceptance by the Central Iron County Water Conservancy District. This shall include the repairing of existing facilities that must be included in the test but are not capable of holding test pressures. All concrete reaction blocks shall be in place at least five days before the initial filling of the line, unless high early strength concrete is used which will require three days in place. In some cases filling can take place the same day if precast reaction blocks are used.

1. PRESSURE TEST: After the pipe has been laid, including fittings, valves, corporation stops, services, and hydrants, and the line has been backfilled in accordance with these standards, each valved section, unless otherwise directed by the District Water Department, shall be subjected to hydrostatic pressure of not less than 200 pounds per square inch. The duration of each such test shall be two hours. Water added to maintain the pressure shall not exceed 0.4 gallons per inch diameter per 1000 lineal feet of main being tested during the two-hour test period.

   Each valved section of pipe shall be slowly filled with water, and the specified test pressure measured at the lowest point of elevation. This shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the Owner. Gauges and measuring devices must meet with the acceptance of the Water Department and the necessary pipe taps shall be made as directed. Before applying the specified test pressure, all air shall be expelled from the pipe by drilling small holes at points of highest elevations and afterward tightly plugging those holes with brass plugs.

   Any cracked or defective pipes, fittings, valves, or hydrants discovered in the pressure test shall be removed and replaced with sound material in the manner provided. The test shall be repeated until the water main passes the pressure test and is accepted by the District or District Engineer.

2. OPERATIONAL INSPECTION: At the completion of the project and in the presence of the District Engineer, the Owner shall operate all valves, hydrants, and water services to ascertain that the entire facility is in good working order; that all valve boxes are centered and valves are operational; that all hydrants operate and drain properly and that water is available at all meter boxes.

- END OF SECTION -

SECTION 02110

GENERAL IMPROVEMENT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section presents the general requirements for improvements of public utilities in Central Iron Water Conservancy District (CICWCD). The improvements shall pertain to public need, which include, but not limited to: improvement of streets, water, sewer, and drainage systems. The necessary improvements shall extend from the nearest acceptable point of existing improvements. The layout must allow possible future extension to adjacent properties and shall be compatible with appropriate District master plans. All water lines shall be installed to the boundary lines of the development. The recommendations from geotechnical investigation must be followed.

1.02 CONSTRUCTION DRAWINGS

A. A complete and detailed construction plans and drawings of improvements shall be submitted to the District Engineer. No construction shall be started until plans have been checked and approved by the District Engineer, and other appropriate District officials. The following instructions are provided for the purpose of standardizing the preparation of drawings and to obtain uniformity in appearance, clarity, size and style:

1. One set of construction plans shall be submitted to the District Engineer for checking and returned to the Owner/Contractor for correction. When all corrections have been made and the set approved, the approved set shall remain with the District Engineer.

2. The plans and designs shall meet the standards defined in the Specifications and Drawings hereinafter outlined.

3. All drawings and/or prints shall be clear and legible and conform to good engineering and professional drafting room practice. Size of drawings shall be 24" X 36".

4. The developer shall provide all as-built drawings in AutoCad format on a 3.5" floppy disk with a .dxf or .dwg extension file format upon completion of the project.

B. General: The following shall be included on the drawings:

a. North arrow (plan).
b. Scale and elevations referenced to USGS datum.
c. Stationing and elevations for profiles.
d. Title block, located on the right side of the sheet to include:
    i. Project title;
    ii. Type of project and
    iii. Professional Engineer stamp (licensed in the State of Utah).
e. Separate sheets for sewer, water, drainage, streets, details and other improvements as required areas.

C. Culinary water: Culinary water drawings should show the following:

1. Size and location of all existing and proposed water mains, valves and hydrants, and service laterals.
2. Type of pipe (only pipe types approved by CICWCD may be used).
3. Minimum cover (36-inches to top of pipe).
4. Typical trench section showing backfill, compaction and shoring requirements

D. Detailed sheets: Each set of plans shall be accompanied by a separate sheet of details for structures which will be constructed. Detail sheets shall include the following information:

1. Drawing size: 24" X 36".
2. Scale of each detail.
3. Title block on the right side of the sheet (same format on all sheets).
4. Name of the development.
5. All details must be completely dimensioned and described.
6. All details shall conform to the details shown in the standard drawing section of these standards.

1.03 INSPECTION, TESTING AND QUALITY CONTROL

A. All construction work involving the installation of improvements in Central Iron County Water Conservancy District shall be subject to District inspection and testing as outlined in the quality control section of each specification.

1. Request for inspection: Requests for inspections shall be made to the District Engineer or Inspectors by the person responsible for the construction. Notice shall be given 24 hours in advance before the starting of work. Any site to be backfilled or covered shall not start prior to inspection.

2. Construction completion inspection: A final inspection shall be made by the District Engineer, or a representative upon receipt of a request by the owner after all

construction work is completed. Any faulty or defective work shall be corrected by the persons responsible for the work, within thirty (30) days from the date of the District Engineer's Inspection Report.

3. Quality control testing: Material testing shall be conducted by an independent laboratory, approved by the District Engineer at the owner's expense. All testing shall comply with current ASTM, AASHTO, AWWA or Public Drinking Water Regulation standards and shall meet the minimum testing requirements as outlined in the specifications. The cost of any testing and/or re-testing required to incorporate materials into the specification shall be borne by the owner or contractor. The time and locations of all tests shall be approved by the District Engineer's office. If determined necessary by the District Engineer or a representative, additional testing can be required.

4. Test reports: A written test results will be required for review by the District Engineer after each portion of the work (i.e. pipeline construction, earthwork, curb, gutter and sidewalk, roadway construction).

5. Final report: Upon completion of the project, a final report certified by a registered professional engineer in Utah must be submitted by the firm employed by developers for testing. This report will include: number of tests required and number of tests actually conducted, number of repeated tests for each type, all test results and other pertinent items required herein.

6. As-built drawings: Before final inspection, the developer shall provide a complete set of as-built drawings that includes all items specified in Section 2.3 for construction drawings. The as-built drawings shall show all improved dimensions as they were constructed in the field. The as-built drawings shall be submitted on 24"X 36" bond paper and on CD in AutoCAD with .dxf or .dwg extension file format. No bond retainer shall be released until as-built drawings are received.

7. Guarantee of work: The owner shall warrant and guarantee that the improvements provided for hereunder, and every part thereof, will remain in good condition for a period of one year after the date of the acceptance of the project by Central Iron County Water Conservancy District. The owner shall make all repairs to and maintain the improvements and every part thereof in good condition during the specified time at no cost to the District.

8. Repair and maintenance: The determination for the necessity of repairs and maintenance of the work shall rest with the District Engineer. Such decision upon the matter shall be final and binding upon the owner. The guarantee hereby stipulated shall extend to and include, but shall not be limited to, the entire road base, all pipes, joints, valves, manholes, backfill and compaction as well as the working surface, curbs, gutters, sidewalks, and other accessories that shall be constructed by the owner. Whenever, in the judgment of the District Engineer, said work shall be in need

of repairs, maintenance, or rebuilding, written notice shall be served upon the owner and thereupon the owner shall undertake and complete such repairs, maintenance or rebuilding. If the owner fails to do so within thirty days from the date of the service of such notice, the District Engineer shall have such repairs made, and the cost of such repairs shall be paid by the owner together with 25 percent of the cost of the repairs in addition thereto, as stipulated damages for such failure on the part of the developer to make the repairs. Any omission on the part of the Engineer to condemn defective work or material at the time of construction shall not be deemed an acceptance. The contractor and/or owner will be required to correct defective work or material at any time before final acceptance and within one year thereafter.

9. Barricades and warning signs. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs, and other traffic control devices. All necessary precautions shall be taken to protect the work and to safeguard the public. Streets closed to traffic shall be protected by effective barricades, and obstructions shall be illuminated during hours of darkness. Suitable warning signs shall be provided to control and direct traffic properly. All traffic control operations and signing shall be performed in accordance with the instructions outlined in the latest edition of "Manual on Uniform Traffic Control Devices". A traffic control plan will be required for submittal and approval on each project.

10. Improvement sequence: District improvements shall be installed in the following numerical sequence, unless otherwise directed by the District Engineer.

1. Rough grading	2. Sanitary Sewer	3. Culinary Water
4. Storm Sewer	5. Private Utilities (In Right-of-Way)	6. Sub Base
7. Curb and Gutter	8. Road Base	9. Asphalt
10. Private Utilities (In Easement)	11. Sidewalks	12. Manholes and Valve Grades
13. Survey Monument	14. Street Signs	15. Clean-up
Private Utilities are Electric, Natural gas, Telephone and Cable T.V. Services		

Contractors and developers shall ensure that all improvement items previous to Item 9 are installed before the asphalt. Prior to asphalt installation, developers will provide to the District Engineer a sign-off sheet signed by the electric, telephone, natural gas and cable T.V. utilities verifying that their utility or appropriate conduits have been installed. The engineer and material testing firm employed by the developer shall also sign-off and stamp verifying all City required underground improvements (i.e. sewer, water, storm drains, etc.) have been installed and tested according to the approved construction drawings. No road breaking permits will be issued on new District streets for 2 years from the date the road was accepted by the District.

- END OF SECTION -

SECTION 02221

EXCAVATION AND BACKFILL FOR BURIED PIPELINES

PART 1 GENERAL

1.01 DESCRIPTION

A. This item shall consist of excavating all pipeline trenches to the lines and grades indicated directed by the District Engineer in the field, and the backfilling of all pipeline trenches. Excavation shall include the removal of all materials of whatever nature encountered to the depths shown on the Drawings, or as modified in the Field by the District Engineer.

1.02 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referred. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 88- Particle Size Analysis of Soils
AASHTO T 180- Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop
AASHTO T 191- Density of Soil In-Place by the Sand-Cone Method
AASHTO T 205- Density of Soil In-Place by the Rubber-Balloon Method
AASHTO T 238- Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
AASHTO T 239- Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422- Particle-Size Analysis of Soils
ASTM D 698- Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1556- Density of Soil in Place by the Sand-Cone method
ASTM D 1557- Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487- Classification of Soils for Engineering Purposes
ASTM D 2922- Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017- Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.03 SITE CONDITIONS

A. WEATHER SOFTENED SUBGRADE: Contractor shall remove and replace soft subgrade materials resulting from adverse weather conditions.

B. PROTECTION OF GRADED AREAS: Contractor shall protect all graded areas from traffic and erosion and shall keep these areas free of trash and debris. Work required to repair and reestablish grades in settled, eroded, and rutted areas shall be completed to specified tolerances at Contractorôs expense.

C. RECONDITIONING COMPACTED AREAS: All areas compacted to required specifications that become disturbed by subsequent construction operations or weather conditions shall be scarified, moisture conditioned and re-compacted to the required density prior to further construction.

PART 2 PRODUCTS

2.01 PIPE BACKFILL

A. Pipe Zone Backfill shall consist of the bedding material schedule shown in Table 2.01 (A) below. All backfill material shall be free of frozen material, organic material, and debris.

Table 2.01 (A)
Backfill Materials

SIEVE SIZE	PERCENT PASSING FOR:			
	FOUNDATION MATERIAL*	BEDDING MATERIAL	PIPE ZONE MATERIAL	FINAL BACKFILL MATERIAL
2 inch	100	---	---	Native material which contains no sod, vegeta-tion, rocks larger that 8" in diameter, asphalt or concrete chunks, etc.
3/4 inch	0 ï 50	---	100	
No. 4	0 ï 10	100	40 - 70	
No. 50	0 ï 5	---	20 - 50	
No. 200	0 ï 3	0 - 15	5 - 30	

B. Trench backfill above the pipe zone shall be Import or Native (as approved by the Engineer) Granular Backfill Borrow meeting the requirements of APWA Section 02055 for Granular Backfill Borrow. No backfill material in the remainder of the trench shall have rocks larger than 2-inches in diameter. All backfill material shall be free of frozen material, organic material and debris.

C. Within State Roadways, backfill placed above 12" over the top of the pipe shall be controlled low strength material (CLSM)/(flowable fill) as required by UDOT.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.

B. Blasting will not be allowed except by written permit from the Iron County Fire Chief. If the permit is granted, the Contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property. The contractor shall comply with the provisions outlined in the U.S. Bureau of Mines Bulletin No. 656 "Blasting Vibrations and their Effects on Structures", and other applicable ordinances as specified by the Fire Chief.

C. The contractor shall be fully responsible for all damage attributable to such blasting operations. Excessive blasting or overshooting will not be permitted and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed and properly replaced.

D. Pipe will be carefully inspected in the field by District Inspectors before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be removed and replaced by the Contractor.

E. When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose the existing improvement before laying any pipe or conduit. The District Inspector shall be given the opportunity to inspect the existing pipe or conduit before the connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the plans will be made.

F. Pipe shall be laid up grade with the socket or collar ends of the pipe up grade unless otherwise authorized by the District Water Department and/or District Engineer.

3.02 SAFETY

A. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29 CFR1926). The Contractor is responsible for assessing safety needs to meet such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all such safety requirements.

B. The Contractor is responsible for assessing safety needs related to confined space entry, as defined by OSHA. The Contractor shall meet all such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all confined space safety requirements.

3.03 TRENCH WIDTH

A. The bottom of the trench shall have a minimum width equal to two (2) times the outside diameter of the pipe.

B. The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting, and bracing, and the handling of special units as necessary. See standard drawing sheet number W-04 for trench detail.

3.04 TRENCH PREPARATION

A. Each trench shall be excavated so that the pipe can be laid to the alignment and grade as required. All excavations shall be sheeted, braced, and shored as required to protect the workers and existing utilities and improvements from sliding, sloughing or settling of the trench walls while the work is in progress. All such sheeting, bracing and shoring shall comply with the requirements of the Utah State Industrial Commission. All damage resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Contractor, and the Contractor shall affect all necessary repairs or reconstruction resulting from such damage. All trenches shall be drained so the pipe laying may take place in dewatered conditions.

B. The trench bottom shall be given a final trim using a string line, laser, or another method approved by the District Engineer for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Bell holes shall be provided at each joint to permit the jointing to be made properly. The trench grade shall permit the pipe spigot to be accurately centered in the preceding-laid pipe joint, without lifting the pipe above the grade, and without exceeding the permissible joint deflection.

C. Pipe shall be bedded a minimum of 6-inches with sand or gravel meeting the bedding requirements. In unstable ground areas, where the native soils are unsuitable for the type of pipe being installed or as directed by the District Engineer, an additional 12-inches of free draining gravel shall be required beneath the 6-inches of bedding material.

3.05 REMOVAL OF WATER

A. Contractor shall provide and maintain at all times ample means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation.

B. Contractor shall obtain all necessary permits required for discharge of water.

C. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a menace to public health and convenience. No water shall be drained into work built or under construction without prior consent of the District Engineer.

D. Dewatering shall be accomplished by well points, sumping, or any other acceptable method which will ensure a dewatered trench. Any dewatering method shall be subject to the approval of the District Engineer.

3.06 PIPELINE TRENCH BACKFILL

A. Pipeline trenches shall be backfilled to a level 12-inches above the top of the pipe with Import Select Fill material as specified in paragraph 2.01. Such material shall be compacted to 90% minimum Modified Proctor density (ASTM D-1557) in six inch maximum lifts. See standard drawing sheet W-04 for trench detail.

B. After the pipe has been installed and approved and the initial portion of backfill has been placed as specified above, backfilling of the remainder of the trench may proceed. All backfill above the protected pipe shall be carefully placed and compacted. Compaction shall be by mechanical tamping in 12-inch maximum lifts. All backfill material shall be free of frozen material, organic material, and debris. Backfill placed above 12-inches over the pipe in improved areas, and additional areas as designated on the drawings, shall be compacted to 90% minimum Modified Proctor density (ASTM D-1557).

C. Backfill requirements for piping beneath the well pump house shall comply with the more stringent of the requirements designated in this Section (02221) and those designated in Section 02222 - Excavation and Backfill for Structures.

3.07 MAINTENANCE OF BACKFILL

A. All backfill shall be maintained in satisfactory condition, and all places showing signs of settlement shall be filled and maintained during the life of the contract and for a period of one year following the day of final acceptance of all work performed under the contract. When Contractor is notified by the District Engineer that any backfill is hazardous, Contractor shall correct such hazardous condition at once. Any utility, road and/or parking surfacing damage by such settlement shall be repair by Contractor to the satisfaction of the District Engineer. In addition, Contractor shall be responsible for the cost of all claims for damage filed with the Court, actions brought against the District for, and on account of, such damage.

3.08 FINISH GRADING, CLEANUP

A. Contractor shall grade the trench line to a smooth grade to effect a neat and workmanlike appearance of the trench line.

B. All tools, equipment and temporary structures shall be removed. All excess dirt and rubbish shall be removed from the site by Contractor.

C. Contractor shall restore the site to at least as good as original condition, including but not limited to final trench grade, native vegetation and restoration of affected public and private facilities whether in the public right of way or on private property. Any exception to this requirement must be in writing from the District Engineer for the job specific conditions. See standard drawing sheet W-08 for trench detail.

3.09 COMPACTION TESTS

A. Compaction Quality Control Testing shall be scheduled a minimum of 24 hours (or as otherwise specified) notice must be given to with the District.

B. It shall be the responsibility of the Contractor to accomplish the specified compaction for backfill, fill, and other earthwork. It shall be the responsibility of the Contractor to control his operations by performing any additional tests necessary to verify and confirm that Contractor has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

1. Testing of Backfill Materials

a. Characteristics of backfill materials shall be determined in accordance with the requirements of Section 2.01.

b. The Contractor shall demonstrate the adequacy of compaction equipment and procedures before exceeding 200 linear feet of trench backfill.

c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.

d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.

e. Periodic compliance tests may be made by the District Engineer to verify that compaction is meeting the requirements previously specified at no cost to the Contractor. The District Engineer may require retesting of backfill that has

settled from water penetration in the trench. Contractor shall remove the overburden above the level at which the District Engineer wishes to test and shall backfill and re-compact the excavation after the test is complete at no additional cost.

f. If compaction fails to meet the specified requirements, the Contractor shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the District Engineer. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by the Contractor. The Contractor's confirmation tests shall be performed in a manner acceptable to the District Engineer. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

- END OF SECTION -

SECTION 02222

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers excavating, backfilling and compacting for structures as directed by District Engineer.

1.02 REFERENCES

A. The latest edition of the following publications form a part of these specifications to the extent referred. The publications are referred to in the text by basic designation only.

AASHTO T 88-	Particle Size Analysis of Soils
AASHTO T 180-	Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop
AASHTO T 191-	Density of Soil In-Place by the Sand-Cone Method
AASHTO T 205-	Density of Soil In-Place by the Rubber-Balloon Method
AASHTO T 238-	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
AASHTO T 239-	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422-	Particle-Size Analysis of Soils
ASTM D 698-	Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.5-kg) Rammer and 12-in. (305-mm) Drop
ASTM D 1556-	Density of Soil in Place by the Sand-Cone method
ASTM D 1557-	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487-	Classification of Soils for Engineering Purposes
ASTM D 2922-	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017-	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.03 SUBMITTALS

A. If requested by the District Engineer, the developer/contractor shall furnish a certified test result from an approved laboratory showing that the free draining gravel material and granular backfill material conforms to the Specification requirements of the District.

B. The following shall be submitted:

1. Copies of Field Density Test reports shall be submitted to the District Engineer at the beginning of each work day for the previous dayôs testing of subgrades, gravel and structural fill.

PART 2 PRODUCTS

2.01 WALL BACKFILL

A. Wall backfill material shall be free from frozen lumps, rocks larger than 4 inches in the largest dimension, roots, trash, lumber and organic material.

2.02 STRUCTURAL FILL

A. Structural fill material placed below foundations shall be non-expansive granular soil with less than 15 percent passing the No. 200 sieve, a maximum size of not greater than 2-inches, and a liquid limit of less than 30 percent.

B. Fill to support the floor slab shall be well-graded, structural fill consisting of non-expansive granular soil with less than 15 percent passing the No. 200 sieve and a maximum size of not greater than 2-inches. A 6-inch thick layer of free draining gravel (less than 5 percent passing the No. 200 sieve and a maximum size of not greater than 2-inches) shall be placed below the floor slab for the Pump House.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.

3.02 BACKFILL

A. Backfill and structural fill material shall not be placed against concrete structure that have not been properly cured

B. Backfill and structural fill material shall be placed in no more than 6-inch loose lifts.

C. Structural fill placed beneath footings and the floor slab shall be placed and compacted to at least 95 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.

D. All other backfill material shall be placed and compacted to at least 90 percent of maximum dry density at a moisture content within 2 percent of optimum moisture content in accordance with ASTM D-1557.

E. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and recompacted to the minimum required compaction prior to placing any additional fill material.

F. Unless otherwise specified, the developer/contractor shall be responsible for arranging for the placing and compacting of approved fill material in accordance with these Specifications. If the Testing Agency should determine that the developer/contractor is failing to meet the minimum requirements, the developer/contractor shall stop operations and make adjustments as necessary to produce a satisfactorily compacted.

G. Sufficient personnel, equipment, sumps or other means should be provided to maintain the site in an acceptable dry condition for the duration of this contract.

H. Excavations shall be so braced and supported as needed to prevent the ground, adjacent to the excavation, from sliding or settling.

3.03 REMOVAL OF WATER

A. The developer/contractor shall provide and maintain at all times ample means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation.

B. Water shall be disposed of in a suitable manner without damaging the adjacent property or without being a menace to public health and convenience. No water shall be drained into work built or under construction without prior consent of the District Engineer.

C. Dewatering shall be accomplished by well points, sumping, or any other acceptable method which will insure a dewatered trench. Any dewatering method shall be subject to the approval of the District Engineer.

D. developer/contractor shall obtain all necessary permits required for discharge of water.

3.04 FINISHED GRADE

A. The finished subgrade and grade of the fill shall not vary more than 0.05 feet from the established grades and cross-sections shown on the Drawings.

3.05 COMPACTION TESTS

A. Compaction Quality Control Testing shall be provided and paid for by the developer/contractor. A minimum of 24 hours (or as otherwise specified) notice must be given to schedule all tests.

B. It shall be the responsibility of the developer/contractor to accomplish the specified compaction for backfill, structural fill, and other earthwork. It shall be the responsibility of the developer/contractor to control his operations by performing any additional tests necessary to verify and confirm that developer/contractor has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

1. Testing of Backfill Materials

a. Characteristics of backfill materials shall be determined.

b. The developer/contractor shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:

(1) One (1) test per 1.5 feet of backfill thickness placed per structure.

c. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.

d. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.

e. Periodic compliance tests may be made by the District Engineer to verify that compaction is meeting the requirements previously specified at no cost to the developer/contractor. The District Engineer may require retesting of backfill (by developer/contractorôs Testing Agency) that has settled from water penetration in the trench. Developer/contractor shall remove the overburden above the level at which the District Engineer wishes to test and shall backfill and re-compact the excavation after the test is complete at no additional cost.

f. If compaction fails to meet the specified requirements, the developer/contractor shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the District Engineer. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by the developer/contractor. The developer/contractor's confirmation tests shall be performed in a manner acceptable to the District Engineer. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

C. Field density tests shall be made in accordance with ASTM D-1557.

- END OF SECTION -

SECTION 02500

REMOVAL AND REPLACEMENT OF SURFACE IMPROVEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section presents the restoration, removal and replacement of surface improvements as established in this specification, as directed by the ENGINEER.

1.02 RELATED SECTIONS

A. Related work specified in other sections includes but is not limited to:

Section 02221 - Excavation and Backfill for Buried Pipelines
Section 02745 - Hot-Mix Asphalt Concrete Paving

1.03 REFERENCES

A. The most recent edition of the Utah Public Works General Conditions and Standard Specifications for Construction.

B. The most recent edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

C. The following are also references applicable to this section.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1557-	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2487-	Classification of Soils for Engineering Purposes
ASTM D 2922-	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017-	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.04 DEFINITIONS

A. Class A Road Repair: This term shall consist of construction of a bituminous surface course, aggregate base and bituminous prime and tack coats as defined in Section 02745 - Hot-Mix Concrete Asphalt Paving.

B. Class B Road Repair: This term shall consist of construction of a gravel road surface.

C. Site Drainage: This section pertains to the restoration of storm water naturally draining across or falling on the project site and irrigation water.

1.05 SUBMITTALS

A. Prior to placement of asphalt concrete, the CONTRACTOR shall submit to the ENGINEER for review and acceptance, full details, including design and calculations for the asphalt concrete mix he proposes to use.

B. Laboratory mix design for proposed seal coat application.

C. Quality assurance tests for asphalt and aggregate material sources.

D. Copies of weight and delivery tickets shall be submitted during progress of the work.

E. Untreated Base Course - 3/4" gradation.

1.06 MEASUREMENT AND PAYMENT

A. Removal and Replacement of Surface Improvements shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

2 PRODUCTS

2.01 BITUMINOUS MATERIAL

A. The bituminous material shall be as specified in Section 02745, Hot-Mix Asphalt Concrete Paving.

B. Mix design testing shall be responsibility of the CONTRACTOR and shall be paid by the CONTRACTOR. Field sampling and testing shall be the responsibility of the OWNER.

2.02 TACK COAT

A. Tack coat material shall conform to all requirements of APWA Section 02709.

2.03 UNTREATED BASE COURSE

A. Untreated Base Course (UBC) shall be 3/4".

3 EXECUTION

3.01 CLASS A ROAD REPAIR

A. Class A Roads shall be constructed in accordance with Section 02745 Hot-Mix Asphalt Concrete Paving. Asphalt pavement replacement shall be of the same thickness as the adjacent pavement (3-inch minimum) and shall match as nearly as possible the adjacent pavement in texture, unless otherwise indicated.

B. The CONTRACTOR shall install temporary asphalt pavement or the first course of permanent pavement replacement immediately following backfilling and compaction of trenches that have been cut through existing pavement. Except as otherwise provided, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required permanent pavement is installed. Temporary paving removed shall be hauled from the jobsite and disposed of at the CONTRACTOR's expense.

C. Where a longitudinal trench is partly in pavement, the pavement shall be replaced to the original pavement edge, on a straight line, parallel to the center line of the roadway.

D. Where no part of a longitudinal trench is in the pavement, surfacing replacement will only be required where existing surfacing materials have been removed.

E. Existing asphalt pavements to be removed for trenches or other underground construction or repair shall be cut (a minimum of one foot outside the edge of the proposed excavation line) by a wheel cutter, clay spade, asphalt grinder, or other device capable of making a neat, reasonably straight and smooth cut without damaging adjacent pavement that is not to be removed. The cutting device operation shall be subject to the approval of the ENGINEER.

F. The existing pavement shall be cut and trimmed after placement of required UBC and just prior to placement of asphalt concrete for pavement replacement, and the trimmed edges shall be painted with a light coating of asphalt cement or emulsified asphalt immediately prior to constructing the new abutting asphalt pavements. No extra payment will be provided for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.

G. Any existing base, surfacing, or pavement shall be thoroughly cleaned immediately prior to receiving the plant-mixed surfacing. Where existing pavement is being widened or extended, it shall be cut to a straight vertical face prior to the paving operations and treated with asphalt paint binder.

H. The ENGINEER shall be notified of the source of the asphalt to be used. The ENGINEER will specify the temperature limits for the asphalt cement, aggregate mix and lay-down.

3.02 ASPHALT WORK BETWEEN OCTOBER 15 AND APRIL 15

A. Asphalt cuts not repaired prior to October 15 shall be repaired using a temporary patch, unless written approval is provided from the OWNER or ENGINEER as specified above. Temporary patches may consist of either asphalt cold patch or concrete. Temporary patches shall be completely removed after April 15 and repaired in accordance with these specifications at no additional expense to the Owner.

3.03 CLASS B ROAD REPAIR

A. No aggregate base course material shall be placed on the subgrade until it has been checked and accepted by the ENGINEER.

B. Prior to excavation on graveled roads, the graveled surface shall be graded off the road and away to the downhill side of the trench, far enough from the trench that the subsurface materials will not pollute the salvaged gravel material. After completion of the pipeline work and backfill operations, the road shall be graded smooth and the salvaged gravel shall be mixed with additional untreated base course material to allow for a uniform 8-inch thick layer over the entire trench surface, graded smooth, and compacted to 95% minimum modified proctor density (ASTM D-1557).

3.04 CONCRETE WORK

A. Concrete work shall meet the specifications for installation as noted in APWA Section 02770, Concrete Driveway, Sidewalk, Curb and Gutter.

B. All flat work in streets tying into existing flatwork shall be doweled into the existing concrete. Dowels to be spaced at 12" O.C. and be No. 5 x 14" for slabs up to 8 inches in thickness and No. 8 x 18" for slabs over 8 inches.

- END OF SECTION -

SECTION 02745

HOT-MIX ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. This section addresses the requirements for installing hot-mix and lot-laid asphalt concrete.

1.02 RELATED SECTIONS

A. Related work specified in other sections includes but not limited to:

Section 02705 - Asphalt Concrete (APWA)
Section 02708 - Prime Coat (APWA)
Section 02709 - Tack Coat (APWA)
Section 02500 ï Removal and Replacement of Surface Improvements

1.03 REFERENCES

A. The 1991 Edition of the Utah Public Works General Conditions and Standard Specifications for Construction.

B. The 1997 Edition of the American Public Works Association (APWA) and Associated General Contractors of America Standard Plans and Standard Specifications.

C. The following are also references applicable to this section.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T230: Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1559: Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures. (Rice Test Method)
ASTM D 2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Method.
ASTM D 3665: Standard Practice for Random Sampling of Construction Methods.

1.04 SUBMITTALS

A. Laboratory mix design for proposed hot-mix asphalt concrete paving.

B. Means and methods for removal, reprocessing, and placement of existing asphalt surfaces as base course material.

C. Laboratory mix design for proposed prime coat application.

D. Laboratory mix design for proposed tack coat application.

E. Quality assurance tests for asphalt and aggregate material sources.

F. Copies of batch delivery tickets shall be submitted during progress of the work, and shall show the following information:
Name of production facility; Serial number of ticket
Date and truck number; Name of CONTRACTOR
Job name and location; Weight of asphalt concrete
Loading temperature; Signature or initial of plant representative
Type and grade of asphalt cement; Type and grade of aggregate
Applicable mix design method; Separate weights of aggregate and asphalt

G. Submit type and number of rollers required for compacting asphalt concrete.

H. The maximum theoretical specific gravity (ASTM 2041) and rut and fatigue testing using the asphalt analyzer will be submitted at the expense of the Contractor.

1.05 SITE CONDITIONS

A. Pave only when air and roadbed temperatures in the shade are greater than 50 deg. F. The temperature restrictions may be waived only upon written authorization from ENGINEER.

B. Do not pave during rain or unsuitable weather or when surface is wet.

1.06 ACCEPTANCE

A. Acceptance of hot-mix asphalt concrete paving is based upon minimum density, minimum thickness, smoothness, and surface appearance.

PART 2 PRODUCTS

2.01 BITUMINOUS MATERIAL

A. The bituminous material shall be ***AC-20*** asphalt cement (or Engineer approved).

B. The hot-mix asphalt cement design shall meet heavy traffic classification.

C. Sampling and testing shall be the responsibility of the CONTRACTOR.

2.02 PRIME COAT

A. Prime coat material shall be rapid cure cutback asphalt, and shall conform to all requirements of APWA Section 02708.

2.03 TACK COAT

A. Tack coat material shall conform to all requirements of APWA Section 02709.

PART 3 EXECUTION

3.01 PREPARATION

A. Preparation shall conform to all requirements of Section 02745 of the APWA specifications.

B. CONTRACTOR shall map and mark all existing surface utilities within the line of work, and shall lower fixtures if pavement machine is not capable of passing over structure.

C. All asphalt and concrete surfaces within the line of work are to be removed and disposed of properly by the CONTRACTOR. The CONTRACTOR may, upon written authorization of the OWNER, use processed asphalt materials as base course material. Excess materials shall be removed and disposed by the CONTRACTOR.

D. Existing asphalt pavements and drive approach extensions to be removed shall be cut by a wheel cutter, clay spade, or other device capable of making a neat, reasonably straight and smooth cut without damaging adjacent pavement and/or concrete that is not to be removed. The cutting device operation shall be subject to the approval of the ENGINEER.

3.02 BASE COURSE

A. Base course material shall be placed in accordance with 02278 of these specifications.

B. Base course surfaces shall be maintained in an acceptable condition for both moisture and density until the overlying hot-mix asphalt cement materials have been placed, at no additional expense to the OWNER.

3.03 PLACEMENT OF PRIME COAT

A. Apply prime coat to all untreated base course surfaces in accordance with Section 02708 of the APWA Specifications.

3.04 PLACEMENT OF TACK COAT

A. Apply tack coat to all existing asphalt concrete or portland cement concrete surfaces preparatory to placing asphalt concrete pavement in accordance with Section 02709 of the APWA Specifications.

3.05 PLACEMENT OF HOT-MIX ASPHALT CONCRETE

A. Spreading shall be as nearly continuous as possible.

B. Placement shall also allow for line, grade, elevations, and thickness specified herein and as shown on the drawings.

C. When asphalt concrete is laid against vertical surfaces such as gutters, the face of the vertical surface shall be roughened for proper bonding, cleaned, and then painted with a light coating of asphalt cement or emulsified asphalt.

D. At terminations of new surface course, the asphalt concrete shall be feathered into the existing surface over such a distance as may be required to produce a smooth riding transition. Base course and single course construction shall be joined by vertical butt joints finished and rolled to a smooth surface.

E. Asphaltic concrete shall not be placed when frozen materials are present in the base or subbase.

F. Asphaltic concrete shall not be placed during adverse conditions, i.e., rain or when a roadway surface is wet.

G. Asphaltic concrete shall be placed between April 15 and October 15. Asphalt concrete shall not be placed after October 15 and before April 15 of the following year unless roadway surface temperatures are 50° F and rising in the shade. Approval to place the asphalt concrete after October 15 and before April 15 of the following year requires written approval from the OWNER.

H. Roadways not completed prior to October 15, and not meeting the requirements of this section, shall be repaired by placing a temporary 2-inch thick asphalt (or other

ENGINEER approved surface) course over all exposed, earthen surfaces. These temporary surfaces shall be completely removed and repaired in accordance with these specifications at no additional expense to the OWNER.

I. Asphalt rolling shall be in accordance with Section 02745 of the APWA Specifications. The CONTRACTOR shall establish and document a rolling pattern for obtaining densities. The test strip shall be no shorter than 300 feet. Establishment of rolling patterns are for the purpose of establishing minimum rolling patterns, and shall not release the CONTRACTOR of meeting all requirements of these specifications and drawings.

J. The target density for asphalt placement shall be 96 percent of laboratory density. If an individual test result falls below 94 percent of maximum density, the material represented by that test will be considered defective, and shall be removed and replaced by the CONTRACTOR at no additional cost to the OWNER.

K. The minimum acceptable thickness of completed roadways shall be 3 inches, as verified by core samples. Areas found to contain less than 3 inches shall be removed and replaced, or overlain with an additional 1.5-inch minimum thickness asphalt at no additional expense to the OWNER.

L. The completed finish shall be as specified in Section 02745 of the APWA Specifications.

M. CONTRACTOR shall adjust the height of all street fixtures to match final grade. Concrete collars shall be placed around all surface street fixtures (i.e. manholes, valve boxes, monuments, etc.) as shown on the Drawings.

N. CONTRACTOR shall complete all concrete collars within 2 weeks of completion of paving each roadway section.

3.06 SITE SAFETY AND TRAFFIC CONTROL

Site safety and traffic control shall be the responsibility of the CONTRACTOR.

The CONTRACTOR shall verify full compliance with all applicable local, county, state and/or federal regulations.

- END OF SECTION -

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the work necessary to furnish, install and complete the concrete formwork.

1.02 MEASUREMENT AND PAYMENT

A. Concrete formwork shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

1.03 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Concrete Institute (ACI) -ACI 347R- Concrete Formwork.
2. American Hardboard Association (AHA) -AHA A135.4- Basic Hardboard.
3. Department of Commerce (DOC) -DOC PS 1- Construction and Industrial Plywood.
4. ACI 350R-89 - Environmental Engineering Concrete Structures.

1.04 DESIGN

A. Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the finish specified in Section 03300 Cast-In-Place Concrete. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.05 SUBMITTALS

A. The following shall be submitted:

1. Drawings showing details of forming, shoring and bracing for footings, walls, and floors shall be submitted to the District Engineer at least 3 weeks prior to their use. Drawings showing details of formwork shall include joints, supports, studding and shoring, and sequence of form and shoring removal.

2. If requested by the District Engineer, design analysis and calculations shall be submitted for form design and methodology used in the design. The analysis and calculations shall verify the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, or any other part of forming, shoring or bracing which may be considered critical by the District Engineer.

3. Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

4. Manufacturer's recommendation on method and rate of application of form releasing agent.

B. The District Engineer's review will not relieve the deleloper/contractor from any responsibility as to the adequacy of the forming, shoring and bracing design. Any formwork installed by deleloper/contractor shall be solely at deleloper/contractor's risk. The District Engineer's review will not lessen or diminish the deleloper/contractor's liability. The turn-around time of the District Engineer's review will be 2 weeks from date of receipt of each written submittal.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Form surfaces shall be in "new and undamaged" condition and may be plywood, hard plastic finished plywood, overlaid waterproof particle board, and steel of sufficient strength and surface smoothness to produce the specified finish. The deleloper/contractor shall verify that form surfaces and panel sizes satisfy all requirements of these specifications.

B. The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

2.02 FORM TIES

A. Form ties on exposed surfaces shall be located in a uniform pattern. Snap ties shall not be broken until the concrete has reached the design concrete strength. The use of tie wires as form ties will not be permitted. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used.

B. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical

recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess.

2.03 FORM RELEASING AGENTS

A. Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 EXECUTION

3.01 INSTALLATION

A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 Concrete. Forms shall be used, whenever necessary, to confine the concrete, to shape the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating. The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar.

B. The surfaces of all forms in contact with the concrete shall be clean, rigid, tight and smooth. All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited therein.

C. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be thoroughly cleaned of mortar from previous concreting and of all other dirt and foreign matter before reuse. Form ties that are to be completely withdrawn shall be coated with a non-staining bond breaker.

D. Bulkheads to form vertical wall joints shall be strong enough to withstand concrete pressures during pouring and vibrating, and shall be properly placed between the forms to avoid mortar seepage. Holes shall be provided in the bulkheads to permit passage of horizontal mild steel reinforcing where required by the Drawings. Unless these are specifically called for on the Drawings, no chamfer strips shall be placed in the corners of vertical construction joints.

3.02 COATING

A. Form inside surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.03 ALIGNMENT AND TOLERANCES

A. Forms shall be properly aligned and adequately supported to produce concrete surfaces conforming to construction tolerance given in Table 3-1, Tolerances for Formed Surfaces.

TABLE 3-1
TOLERANCES FOR FORMED SURFACES

1	Variations from the plumb:	In any 10 feet of length..... 1/4 inch
	a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length..... 1 inch
	b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length..... 1/4 inch Maximum for entire length..... 1/2 inch
2	Variation from the level or from the grades indicated on the drawings	In any 10 feet of length..... 1/4 inch In any bay or in any 20 feet of length ..... 3/8 inch
3	Variation of the linear building lines from established position in plan	In any 20 feet .....1/2 inch Maximum..... 1 inch
4	Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation
5	Variation in the thickness of slabs and walls	Minus ..... 1/4 inch Plus ..... 1/2 inch

3.04 FORM REMOVAL

A. Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Forms shall not be removed until approval is given by the District Engineer. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement.

B. Deleloper/contractor shall remove all wood splinters on concrete surfaces after stripping of wood forms.

- END OF SECTION -

SECTION 03110

CLEARING, GRUBBING AND STRIPPING

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of removing and disposing of all trees; shrubs; brush; stumps; windfalls; roots; and other vegetation, including dead and decayed matter; and debris that exist within the designated construction limits, borrow areas, and soil stockpile areas and which are not specifically designated to remain.

1.02 DEFINITIONS

A. Clearing: Clearing operations shall consist of cutting, removing and disposing of trees, shrubs, bushes, windfalls and other vegetation within the construction limits, borrow areas, soil stockpile areas and existing ditch along the south side of the Well 15 site. All brush shall be cut off within six inches of the ground surface. All existing piles of vegetative debris will also be disposed of.

B. Grubbing: Grubbing operations shall consist of removing and disposing of stumps, roots, debris deleterious materials, and other remains (such as organic and metallic materials) which if left in place would interfere with proper performance or completion of the contemplated work, would impair its subsequent use or form obstructions therein. Organic material from clearing or grubbing operations shall not be incorporated in fill or backfill.

C. Stripping: Stripping operations shall consist of removing all soil material containing sod, grass, or other vegetation and topsoil to a minimum depth of six (6) inches from all areas that will receive fill or over all trenches in field or yard areas.

1.03 MEASUREMENT AND PAYMENT

A. Measurement and payment for cleaning, grubbing and stripping shall not be paid as an unit item, but considered as included in the contract unit or lump sum prices for the various items of the contract to which it relates.

2 PRODUCTS (not applicable)

3 EXECUTION

3.01 CLEARING

A. All trees, stumps, shrubs, bushes, windfalls and other vegetation (except such trees and vegetation as may be indicated or directed by the ENGINEER to be left standing) shall be cut off to within six inches of the ground surface and shall be removed from the construction limits and from the existing ditch along the south side of the Well 15 site. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by such means as the circumstances require.

3.02 GRUBBING

A. All stumps, roots, debris, deleterious and other organic or metallic materials not suitable for foundations shall be removed completely from the construction limits, borrow areas and soil stockpile areas. Unless otherwise permitted by the ENGINEER, stumps shall be removed completely. If any stumps are permitted to remain, they shall be cut off not more than six inches above the ground.

3.03 STRIPPING

A. Soil material containing sod, grass, or other vegetation and topsoil shall be removed to a minimum depth of six (6) inches from all areas to receive fill, from the area within lines 5 feet outside all foundation walls, over all trenches, and from beneath pavement and curb and gutter areas. The stripped material shall be deposited in such locations as are acceptable to the ENGINEER. Topsoil shall be placed over designated areas to be landscaped, and over all trench areas (outside of paved areas).

B. All areas to be reseeded will have a minimum of 3 inches of topsoil.

3.04 DISPOSAL

A. No open burning of combustible materials will be allowed.

B. All trees, timber, stumps, roots, debris, shrubs, bushes, and other vegetation removed during the clearing and grubbing operations shall be removed from the project site and disposed of by CONTRACTOR subject to specific regulations imposed by laws and ordinances and in a manner that will not create a public nuisance nor result in unsightly conditions. CONTRACTOR shall assume full responsibility for acceptable disposition of the material as well as for any damages resulting from his disposal operations.

- END OF SECTION -

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the reinforcing steel bars, wire fabric or rod mats for cast-in-place concrete.

1.02 MEASUREMENT AND PAYMENT

A. Concrete reinforcement shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1. 301 Specifications for Structural Concrete for Buildings.
2. 315 Details and Detailing of Concrete Reinforcement.
3. 318 (1989; 318R-89) Building Code Requirements for Reinforced Concrete
4. 350R Environmental Engineering Concrete Structures

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. A 82 Standard Specifications for Steel Wire, Plain, for Concrete Reinforcement.
2. A 184 (1988) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
3. A 185 (1988) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
4. A 615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

1. DA4 (1990; 25th Ed) Manual of Standard Practice

1.04 SUBMITTALS

A. The following shall be submitted:

1. Drawings of Concrete Reinforcement System with details showing reinforcing steel schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

2. Reinforcing Steel with certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel.

1.05 DELIVERY AND STORAGE

A. Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.01 DOWELS

A. Dowels shall conform to ASTM A 615, Grade 60.

2.02 FABRICATED BAR MATS

A. Fabricated bar mats shall conform to ASTM A 184.

2.03 REINFORCING STEEL

A. Reinforcing steel shall be deformed bars conforming to ASTM A 615 grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. When no grade is indicated use 60 ksi grade steel. Special coated bars (epoxy and zinc) may be specified for use in a highly corrosive atmosphere where concrete cover is not considered sufficient. In which case reference to ASTM A 767 and A 775 will be included.

2.04 WELDED WIRE FABRIC

A. Welded wire fabric shall conform to ASTM A 185 or ASTM A 497.

2.05 WIRE TIES

A. Wire ties shall be 16-gauge or heavier black annealed steel wire.

2.06 SUPPORTS

A. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI DA4 and shall be steel or precast concrete blocks. Precast concrete blocks shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 EXECUTION

3.01 REINFORCEMENT

A. Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete.

B. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life or safety.

C. Placement:

1. Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.

2. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

D. Splicing:

1. Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6-inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.02 WELDED-WIRE FABRIC

A. Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost cross wires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.03 DOWELS

A. Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately aligned parallel to the finished concrete surface and rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

- END OF SECTION -

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. This section covers cast-in-place concrete.

1.02 RELATED WORK

A. Related work specified in other sections includes but is not limited to:

Section 02222 - Excavation and Backfill for Structures
Section 03100 - Concrete Formwork
Section 03200 - Concrete Reinforcement

1.03 MEASUREMENT AND PAYMENT

A. Cast-in-place concrete shall not be measured or paid as a separate item, but shall be included as part of the various items to which it relates.

1.04 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN CONCRETE INSTITUTE (ACI)

1. 117 Standard Tolerances for Concrete Construction and Materials
2. 211 Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. 301 Structural Concrete for Buildings
4. 305R Hot Weather Concreting
5. 306R Cold Weather Concreting
6. 318 Building Code Requirements for Reinforced Concrete
7. 350R Environmental Engineering Concrete Structures

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. C 31 Making and Curing Concrete Test Specimens in the Field
2. C 33 (1990) Concrete Aggregates
3. C 39 Compressive Strength of Cylindrical Concrete Specimens
4. C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

5. C 78 Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
6. C 94 Ready-Mixed Concrete
7. C 109 Compressive Strength of Hydraulic Cement Mortars(Using 2-in. or 50-mm Cube Specimens)
8. C 143 Slump of Hydraulic Cement Concrete
9. C 150 Portland Cement
10. C 171 Sheet Materials for Curing Concrete
11. C 172 Sampling Freshly Mixed Concrete
12. C 173 Air Content of Freshly Mixed Concrete by the Volumetric Method
13. C 192 Making and Curing Concrete Test Specimens in the Laboratory
14. C 231 Air Content of Freshly Mixed Concrete by the Pressure Method
15. C 260 Specification for Air-Entraining Admixtures for Concrete
16. C 309 Liquid Membrane-Forming Compounds for Curing Concrete
17. C 494 Chemical Admixtures for Concrete
18. C 618 Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
19. C 1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable)

1.05 DEFINITIONS

A. Average Strength (f_{cr}): The required average strength for 30 consecutive strength tests which statistically assures not more than the permissible proportions of tests will fall below Specified Strength.

B. Specified Strength (f_c'): The indicated strength.

1.06 SUBMITTALS

A. The following shall be submitted in accordance with Section 01300 - Contractor Submittals.

B. The results of trial mix designs along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory. Indicate whether mixes have been designed for pumping. Include in the report the following information:

1. Water-cement ratio.

2. Proportion of materials in the mix.

3. Source and type of cement.

4. Analysis of water to be used unless potable.

5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.

6. Slump, air content and temperature of samples.

7. Unit weight of fresh and dry light weight concrete.

C. Pre-approved Mix Design Data: If supplier has on record, an developer/contractor approved mix design, submit name and address of supplier for each mix design 1 day prior to using concrete mix.

D. Certified copies of laboratory test reports, including all test data, for aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials.

E. Cementitious Materials showing Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the specification under which it is furnished, for cement and pozzolan.

1.07 QUALITY ASSURANCE

A. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or aggregate without District Engineer's approval.

B. In proportioning materials for mixing, use scales certified by the State of Utah. Do not use volume measurement except for water and liquid admixtures.

C. Do not change the quantity of cement per cubic yard for approved mix design without written approval of District Engineer.

D. Use of admixtures will not relax hot or cold weather placement requirements.

E. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C-94 and requirements in this Section.

F. Tolerances for concrete construction and materials shall be in accordance with ACI117.

1.08 PRODUCT STORAGE AND HANDLING

A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and contaminants.

B. Stockpile aggregate to avoid segregation and prevent contamination.

C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

PART 2 PRODUCTS

2.01 ADMIXTURES

A. Air Entrainment: ASTM C 260.

B. Later Reducing and Set Retarding Agents: ASTM C494.

1. Type A: Set water reducing.
2. Type B: Set retarding.
3. Type C: Set accelerating.
4. Type D: Water reducing and set retarding.
5. Type E: Water reducing and set accelerating.
6. Type F: High range water reducing (super plasticizer).*
7. Type G: High range water reducing and set retarding.*

* The relative durability factor of water reducing admixtures shall not be less than 80 and the chlorides content (as C1-) expressed as a percent of the cement shall not exceed .1 percent by weight.

C. Calcium Chloride: None allowed.

D. Pozzolan: Pozzolan conforming to the requirements of ASTM C 618, Class F, is allowed as a Portland cement replacing agent under the following conditions:

1. The maximum percentage of Portland cement replacement is:
   a. 15 percent, for concrete exposed to weather.
   b. 20 percent, for interior concrete.

2. Pozzolan should not exceed 25% by weight of the cement plus Pozzolans.

3. The minimum cement content shall be used in the design formulas before replacement is made.

4. Loss of ignition of pozzolan is less than 3 percent and the water requirement does not exceed 100 percent.

5. All other requirements of this section still apply.

6. Mix designs including trial batches are required for each aggregate source and for each concrete class.

2.02 CEMENTITIOUS MATERIALS

A. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall conform to one of the following:

1. Cement: Use Portland cement, ASTM C 150, Type II, Type IIA, or Type V, low alkali, unless noted otherwise.

2. Portland - Pozzolan Cement: ASTM C-595, Type IP-A(MS). Do not use Pozzolan cement unless approved by the District Engineer.

B. Only one brand of cement from one manufacturing plant may be used.

2.03 AGGREGATES

A. Aggregates shall be natural aggregates, free from deleterious coatings, and shall conform to the requirements of ASTM C 33, except as modified herein. Aggregates shall not be potentially reactive as defined in Appendix XI of ASTM C 33. The CONTRACTOR shall import nonreactive aggregates if local aggregates are reactive.

B. Fine Aggregates

1. Fine aggregate shall consist of clean, sharp, natural sand and shall conform to the requirements of ASTM C 33. Fine aggregate shall be graded as follows:

SIEVE SIZE	PERCENT PASSING BY WEIGHT

3/8 inch	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10

2. Fine aggregates shall have no more than two percent by weight passing #200 sieve.

C. Coarse Aggregate

1. Coarse aggregate shall be washed gravel or crushed stone, or a combination of these materials, consisting of hard, tough, durable particles free from adherent coatings. It shall contain no more than 15 percent flat or elongated particles. A thin, flat or elongated particle is defined as a particle having a maximum dimension in excess of five times its minimum dimension. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered in the work under consideration shall be not be used. Coarse aggregate shall be graded as follows (ASTM C 33):

SIEVE SIZE	PERCENT PASSING BY WEIGHT
1-1/2 inch	100
1 inch	95-100
1/2 inch	25-60
#4	0-10
#8	0-5

2. Coarse aggregates shall have no more than 1.75 percent by weight passing #200 sieve. Proof of gradation will be provided to District Engineer by the CONTRACTOR.

2.04 ACI MIX DESIGN

A. The amount by which the average strength (f_{cr}) of a concrete mix exceeds the specified compressive strength (f'_c) shall be based upon no more than 1 in 100 random individual strength tests falling more than 500 psi below the specific strength.

B. Proportion the materials in accordance with ACI 211.1, 211.2 or 211.3 as applicable to produce concrete having the properties or limitations of Table No. 03300-A.

2.05 HAND MIXING

A. Do not hand mix batches exceeding 0.5 cubic yards.

B. Hand mix only on watertight platform. Mix cement and aggregate prior to adding water.

C. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.

2.06 HEATING, WATER AND AGGREGATE

A. Do not allow products of fuel combustion to contact the aggregate.

B. Heat mixing water 150 degrees F. maximum. Heat aggregates uniformly.

C. Do not mix cement with water and aggregate at a mix temperature greater than 100 degrees F.

2.07 WATER

A. Water shall be potable, except that nonpotable water may be used if it produces mortar cubes having 7- and 28-day strengths at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on mortars, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water for curing shall not contain any substance injurious to concrete, or which causes staining.

2.08 PROPORTIONS OF MIX

A. Mixture Proportioning, Normal Weight Concrete: All concrete that must be watertight and resistant to freeze-thaw cycles and to naturally occurring or commonly used chemicals should be air entrained. All materials should be proportioned to produce a well-graded mixture of high density and maximum workability with a minimum specified 28 day compressive strength of 4000 psi. Trial batches shall contain materials proposed to be used in the project. Trial mixtures having

proportions, consistencies and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios. Trial mixes shall be proportioned to produce concrete strengths specified. In the case where ground iron blast-furnace slag is used, the weight of the slag will be substituted in the equations for the term P which is used to denote the weight of pozzolan. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results a curve shall be plotted showing the relationship between water-cement ratio and strength. Maximum water-cement or water-cement plus Pozzolan Ratio: 0.45.

B. Average Strength: In meeting the strength requirements specified, the selected mixture proportion shall produce an average compressive strength exceeding the specified strength by the amount indicated below. Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths within 1000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at other test age designated for determination of the specified strength.

2.09 CONCRETE PROPERTIES

A. Exterior Cast-in-Place Concrete Structures: Class 4000 minimum in accordance with the following table and ACI 318, unless a different strength of concrete is indicated.

B. Interior Cast-in-Place Concrete: Class 3000 minimum in accordance with the following table and ACI 318, unless a different strength of concrete is indicated.

TABLE NO. 03300-A

CONCRETE MIX PROPERTIES (e)				
CONCRETE PROPERTIES	CONCRETE CLASSIFICATION(S)			
	Class 5000	Class 4000	Class 3500	Class 3000
Specified Compressive Strength $f_{c'}$ at 28 days, min., psi	5000	4000	3500 (d)	3000 (d)
Compressive Strength at 7 days, min., psi (a)	3550	2680	2345	2010
Cement content (94 lb. sacks of cement per cubic yard of concrete), min. (b)	7.0	6.0	5.75	5.5
Entrained air content, (% by volume).	6±1	6±1	6±1	6±1
Slump Range, in. (c)		1 - 4 (f)	2 - 4	2 - 4

(a) Used for monitoring purposes only.
(b) May include pozzolan replacements if approved by District Engineer.
(c) Not more than 8 inches after adding high range water reducing admixture (super-plasticizer) at site.
(d) Not allowed if concrete is exposed to freezing and thawing temperatures. Use Class 4000 or higher compressive strength and 6±1.0 percent air entrainment.
(e) All mix designs must be approved by District Engineer.
(f) 1-3" for footings, substructural walls and 1-4" for slabs, beams, reinforced walls and columns.

PART 3 EXECUTION

3.01 PREPARATION OF SURFACES

A. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance.

B. Foundations: Earthwork shall be as specified. Flowing water shall be diverted without washing over freshly deposited concrete. Rock foundations shall be cleaned by high velocity air-water jets, sandblasting, or other approved methods. Debris and loose, semi-detached or unsound fragments shall be removed. Rock surfaces shall be

moist but without free water when concrete is placed. Semiporous subgrades for foundations and footings shall be damp when concrete is placed. Pervious subgrades shall be sealed by blending impervious material with the top 6 inches of the in-place pervious material or by covering with an impervious membrane.

C. Preparation of Previously Placed Concrete: Concrete surfaces to which other concrete is to be bonded shall be roughened in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be moist but without free water when concrete is placed.

3.02 INSTALLATION OF EMBEDDED ITEMS

A. Embedded items shall be free from oil, loose scale or rust, and paint. Embedded items shall be installed at the locations indicated and required to serve the intended purpose. Voids in sleeves, slots and inserts shall be filled with readily removable material to prevent the entry of concrete.

3.03 BATCHING, MIXING AND TRANSPORTING CONCRETE

A. Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating units shall comply with NRMCA TMMB-1. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA-QC 3.

B. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quantity and quality of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the District Engineer.

C. Truck mixers and their operation must be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when the specified slump is 3 inches or less, or more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to used the unit will be permitted.

D. Admixtures: Admixtures shall be batched within an accuracy of 3 percent. Where two or more admixtures are used in the same batch, they shall be batched separately

and must be compatible. Retarding admixture shall be added within one minute after addition of water is complete or in the first quarter of the required mixing time, whichever is first. Superplasticizing admixtures shall be added at the project site, and the concrete with the admixture shall be mixed 4 to 5 minutes before placing as recommended by manufacturer. Concrete that shows evidence of total collapse or segregation caused by the use of admixture shall be removed from the site.

E. Control of Mixing Water: No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch. No water shall be added at the jobsite without the approval of the District Engineer.

3.04 SAMPLING AND TESTING

A. Sampling and Testing of the concrete will be by the developer/contractor or his representatives. The CONTRACTOR shall assist the developer/contractor's representative at the site with concrete testing.

1. Aggregates: Aggregates for normal weight concrete shall be sampled and tested in accordance with ASTM C 33.

2. Sampling of Concrete: Samples of concrete for air, slump, unit weight, and strength tests shall be taken in accordance with ASTM C 172.
   a. Air Content: Test for air content shall be performed in accordance with ASTM C 173 or ASTM C 231. A minimum of 1 test shall be conducted each time a slump test is made.
   b. Slump: At least 1 slump test shall be made on randomly selected batches of each mixture of concrete for every 50 cubic yards of ready-mixed concrete delivered to the job site. Also note the time batched at the plant and the starting time when unloading began at the site. Tests shall be performed in accordance with ASTM C 143.
   c. Temperature: Concrete and air temperatures shall be measured and recorded with each set of cylinders and the air temperature shall also be recorded when the air temperature at the site is 40 degrees F or below and/or 90 degrees F or above.

3. Evaluation and Acceptance of Concrete
   a. Frequency of Testing: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 50 cubic yards of concrete, nor less than once for each 3000 square feet of surface area for slabs or walls. If this sampling frequency results in less than 5 strength tests for a given class of concrete, tests shall be made from at least 5 randomly selected trucks or from each truck if fewer than 5 truck loads are used. Field cured specimens for determining form removal time or when a structure may be put in service shall be made in numbers directed to

check the adequacy of curing and protection of concrete in the structure. The specimens shall be removed from the molds at the age of 24 hours and shall be cured and protected, insofar as practicable, in the same manner as that given to the portion of the structure the samples represent.

b. Testing Procedures: Cylinders for acceptance tests shall be molded and cured in accordance with ASTM C 31. Cylinders shall be tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at another specified test age.

c. Evaluation of Results: Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the required strength by more than 500 pounds per square inch.

d. Unless noted otherwise, make a minimum of four (4) concrete cylinders each time a test is required. When concrete is being placed in suspended slabs, beams and retaining walls make two (2) extra cylinders which must be cured on site. The extra cylinders will be used to determine when to remove forms and/or when to backfill.

B. Investigation of Low-Strength Test Results: When any strength test of standard-cured test cylinder falls below the specified strength requirement by more than 500 pounds per square inch, or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C 597, ASTM C 803 or ASTM C 805 may be permitted by the District Engineer to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection. When strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the District Engineer to least impair the strength of the structure. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for seven days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C 42. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to or at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. If the core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be directed by the

District Engineer in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to the District Engineer. All investigations, testing, load tests, and correction of deficiencies shall be performed, and approved by the District Engineer, at the expense of the CONTRACTOR.

3.05 CONVEYING CONCRETE

A. Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients.

1. Chutes: When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.

2. Buckets: Bucket design shall be such that concrete of the required slump can be readily discharged. Bucket gates shall be essentially grout tight when closed. The bucket shall provide means for positive regulations of the amount and rate of deposit of concrete in each dumping position.

3. Belt Conveyors: Belt conveyors may be used when approved. Belt conveyors shall be designed for conveying concrete and shall be operated to assure a uniform flow of concrete to the final place of deposit without segregation or loss of mortar. Conveyors shall be provided with positive means for preventing segregation of the concrete at transfer points and point of placement.

4. Pumps: Concrete may be conveyed by positive displacement pumps when approved. Pump shall be the piston or squeeze pressure type. Pipeline shall be steel pipe or heavy duty flexible hose. Inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place. After each use, the equipment shall be thoroughly cleaned. Flushing water shall be wasted outside the forms.

3.06 CONCRETE PLACEMENT

A. Mixed concrete which is transported in truck mixers or agitators or concrete which is truck mixed, shall be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by the District Engineer if the concrete is of such slump after the 1-1/2 hour time or 300 revolution limit has been reached that it can be placed, without the addition of water to the batch. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the truck.

1. Placing Operation: Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the CONTRACTOR prevent proper consolidation, finishing and curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 4 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Concrete should not be allowed to drop through a cage of reinforcing steel. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screened to the proper level to avoid excessive shimming or grouting.

2. Consolidation: Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 8000 vibrations per minute, and the head diameter and amplitude shall be appropriate for the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then withdrawn slowly. The use of form vibrators must be specifically approved. Vibrators shall not be used to transport concrete within the forms.

Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique.

B. Cold Weather Requirements: Special protection measures, approved by the District Engineer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. Provisions should be made to keep the concrete at a minimum temperature of 50 degrees F for 7 days. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. No concrete shall be placed on frozen ground. The temperature of the concrete when placed shall be not less than 55 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used.

C. Hot Weather Requirements: The temperature of the concrete placed during hot weather shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

3.07 CONSTRUCTION JOINTS

A. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the District Engineer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete is no longer plastic, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints are required, a strip of 1-inch square-edge lumber, beveled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph 3.1, PREPARATION OF SURFACES.

3.08 FINISHING CONCRETE

A. Formed Surfaces

1. Repair of Surface Defects: Surface defects shall be repaired within 24 hours after the removal of forms. Honeycombed and other defective areas shall be cut back to solid concrete or to a depth of not less than 1 inch, whichever is greater. Edges shall be cut perpendicular to the surface of the concrete. The prepared areas shall be dampened and brush-coated with neat cement grout. The repair shall be made using mortar consisting of not more than 1 part cement to 2-1/2 parts sand. The mixed mortar shall be allowed to stand to stiffen (approximately 45 minutes), during which time the mortar shall be intermittently remixed without the addition of water. After the mortar has attained the stiffest consistency that will permit placing, the patching mix shall be thoroughly tamped into place by means approved by the District Engineer and finished slightly higher than the surrounding surface. For Class A and Class B finished surfaces the cement used in the patching mortar shall be a blend of job cement and white cement proportioned to produce a finished repair surface matching, after curing, the color of adjacent surfaces. Holes left after the removal of form ties shall be cleaned and filled with patching mortar. Holes left by the removal of tie rods shall be reamed and filled by dry-packing. Repaired surfaces shall be cured as required for adjacent surfaces. The temperature of concrete, mortar patching material, and ambient air shall be above 50 degrees F while making repairs and during the curing period. Concrete with defects which affect the strength of the member or with excessive honeycombs will be rejected, or the defects shall be corrected as directed.

2. Class A Finish: Where a Class A finish is indicated, fins shall be removed immediately upon removal of forms. A mortar mix consisting of one part portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be prepared. White cement shall be used to replace part of the job cement. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by brick rubbing, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads until all visible grout film is removed. The rubbing pads shall have on their surfaces the same sand-cement mix specified above but without any mixing water. The finish of any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas.

3. Class B Finish: Where a Class B finish is indicated, fins shall be removed. Concrete surface shall be smooth with a texture at least equal to that obtained through the use of Grade B-B plywood forms.

4. Class C Finish: Where a Class C finish is indicated, fins shall be removed. Concrete surfaces shall be relatively smooth with a texture imparted by the forms used.

5. Class D Finish: Where a Class D finish is indicated, fins exceeding 1/4 inch in height shall be chipped or rubbed off. Concrete surfaces shall be left with the texture imparted by the forms used.

B. Unformed Surfaces: In cold weather, the air temperature in areas where concrete is being finished shall not be less than 50 degrees F. In hot windy weather when the rate of evaporation of surface moisture, as determined by methodology presented in ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour; coverings, windbreaks, or fog sprays shall be provided as necessary to prevent premature setting and drying of the surface. The dusting of surfaces with dry materials or the addition of water during finishing will not be permitted. Finished surfaces shall be plane, with no deviation greater than 5/16-inch when tested with a 10-foot straightedge. Surfaces shall be pitched to drains.

1. Rough-Slab Finish: Slabs to receive fill or mortar setting beds shall be screened with straightedges immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible.

2. Float Finish: Slabs to receive a steel trowel finish and slabs where indicated shall be given a float finish. Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened to permit the operation and the water sheen has disappeared, it shall be wood floated. Concrete that portrays stickiness shall be finished with a magnesium float in lieu of a wood float, and left free of ridges and other projections. Float finish is normally specified for surfaces that will receive other treatment such as built-up roofing, nonslip surfacing material. Float Finish shall not be used on wearing surfaces.

3. Trowel Finish: Slabs where indicated, shall be given a trowel finish immediately following floating. Surfaces shall be troweled to produce smooth, dense slabs free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. A final hard steel troweling shall be done by hand. Trowel finish shall be used on wearing surfaces and where a smooth finish is required.

4. Broom Finish: After floating, slabs where indicated, shall be lightly trowelled, and then broomed with a fiber-bristle brush in a direction transverse to that of the main traffic.

3.09 CURING AND PROTECTION

A. General: All concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
Concrete with Type II or IIA, or V, low alkali cement	7 days
Concrete with Type IP-A(MS) cement blended with pozzolan	10 days

B. Immediately after placement, concrete shall be protected from premature drying extremes in temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. All materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time. Curing shall be accomplished by any of the following methods, or combination thereof, as approved.

C. Moist Curing: Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap. Once the moist curing has started the concrete surface must not be allowed to become surface dry for the entire curing period.

D. Membrane Curing: Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete; except a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible

with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. Surfaces shall be thoroughly moistened with water and the curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. Compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be re-sprayed by the method and at the coverage specified. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun for the duration of the curing period. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

- END OF SECTION -

SECTION 03480

PRECAST CONCRETE UNITS

PART 1 GENERAL

1.01 DESCRIPTION

A. Section includes pre-cast concrete units, complete with required connecting and supporting devices.

1.02 REFERENCES

A. The latest edition of the following publications form a part of this specifications to the extent referenced. The publications are referred to in the text to by basic designation only.

AMERICAN WATER WORKS ASSOCIATION

AWWA C-502	Standard for Fire Hydrants

AMERICAN CONCRETE INSTITUTE

ACI 318	Building Code Requirements for Reinforced Concrete.

AMERICAN STANDARD FOR TESTING AND MATERIALS

ASTM A 36	Standard Specification for Structural Steel.
ASTM C 478	Standard Specification for Precast Reinforced Concrete Manhole Sections.
ASTM C 858	Standard Specification for Underground Precast Concrete Utility Structures.

AMERICAN WELDING SOCIETY

AWS D1.1	Structural Welding Code Steel.
AWS D1.4	Structural Welding Code Reinforcing Steel.

PORTLAND CEMENT INSTITUTE

PCI	Design Handbook.
PCI MNL-116	Quality Control and Assurance for Plant Production of Prestressed Concrete.
PCI MNL-117	Quality Control and Assurance for Plant Production of Architectural Precast Concrete.

1.03 SUBMITTALS

A. Submit catalog cuts on all fittings, valves, meters, fire hydrants, or other items shown on the Drawings referencing each item by mark number. Information shall indicate manufacture specification compliance and dimensional data.

1.04 MEASUREMENT AND PAYMENT

A. There shall be no separate measurement and payment for items contained in this section. Full compensation for items contained in this section shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which they relate.

1.05 MANUFACTURER AND ERECTOR QUALIFICATIONS

A. Manufacture and transportation only by company experienced in providing precast products and services normally associated with precast and prestressed concrete construction.

B. CICWCD recommends Amcor precast concrete vaults or approved equivalent.as

C. Welders: certified in accordance with AWS D1.1 and AWS D1.4.

1.06 DELIVERY, STORAGE AND HANDLING

A. Handle precast units in positions consistent with their shape and design. Lift and support only from support points indicated on Shop Drawings.

B. EMBEDDED LIFTING OR HANDLING DEVICES: Capable of supporting units in positions anticipated during manufacture, storage, transportation and erection.

C. Provide edges of units with adequate protection to prevent staining, chipping or spalling of concrete.

D. Unless otherwise approved in writing, do not deliver units to job site until required for installation.

PART 2 PRODUCTS

2.01 CONCRETE

A. CONCRETE FOR ABOVE GROUND STRUCTURES: Class 5000 minimum, in accordance with Section 03300 and ACI 318, unless a different strength of concrete is indicated.

B. CONCRETE FOR UNDERGROUND STRUCTURES: Class 4000 minimum in accordance with Section 03300 and ASTM C 478 or ASTM C 858.

2.02 ACCESSORIES

C. CONNECTING AND SUPPORTING DEVICES: Steel, in accordance with ASTM A 36.

D. CONCRETE REINFORCEMENT: Grade 60 reinforcing for all precast units unless approved in writing by District Engineer.

2.03 FABRICATION

A. Maintain plant records and quality control program during production of structural precast concrete. Make records available to District Engineer.

B. Use molds which are rigid and constructed of material that will result in uniform finished products.

C. Deposit and vibrate concrete to ensure proper consolidation, elimination of unintentional cold joints, and minimize entrapped air on surface.

D. Fabricate required connecting devices, plates, angles, items fit to steel framing members, bolts and accessories.

E. Ensure reinforcing steel, anchors, inserts, plates, angles and other cast-in items are sufficiently embedded, anchored and properly located.

F. Ensure finished surfaces of precast structural units are uniform.

G. Cure units under identical conditions to develop specified concrete quality, and minimize appearance blemished such as nonuniformity, staining or surface cracking.

2.04 DESIGN DEVIATIONS

A. DEVIATION: Provide installation equivalent to basic intent. Deviations from exact required cross-section will be permitted only with approval from District Engineer.

B. MANUFACTURERôS PROPOSED DESIGN: Supported by complete design calculations and drawings. When requested, submit design calculations for review, bearing seal and signature of Professional Engineer.

2.05 FINISHES

A. GENERAL: The required finished will be described in one of the following paragraphs. If no finish is indicated or selected by District Engineer; standard.

B. STANDARD FINISH: Produced in forms such as plastic or metal lined that impart a smooth finish to the concrete. Small surface holes, normal form joint marks, minor chips and spall are acceptable if approved. Major or unsightly imperfections, honeycomb or structural defects are not acceptable.

C. COMMERCIAL FINISH: Produced in forms such as plywood or lumber that impart texture to concrete. Remove fins and large projections and fill large holes. Faces: true and well defined. Correct exposed ragged edges by rubbing or grinding.

D. ARCHITECTURAL GRADE A FINISH: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch. Coat with neat cement paste using float. After paste coat has dried, rub with burlap to remove loose particles.

E. ARCHITECTURAL GRADE B FINISH: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch.

F. SPECIAL FINISHES: Sandblasting, acid washing, retarders or form liners as approved by District Engineer. Special finishes require submittal of two 12 x 12 inch samples showing a representative color and texture to be used.

G. PAINTED FINISHES: Use only paint compatible form release agents on concrete that is to be painted.

2.06 REPAIR

A. Repair of damaged units is acceptable if structural integrity or appearance is not impaired.

2.07 ALLOWABLE TOLERANCES

A. LENGTH: Plus or minus 3/4 inch, or plus or minus 1/8 inch per 10 feet of length, whichever is greater, or as indicated.

B. END SQUARENESS: ½ inch maximum.

C. BLOCKOUTS: 1 inch of centerline location indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install precast units until concrete has attained its design compressive strength.

B. Install members plumb, level and in accordance with PCI MNL-116 or PCI MNL-117 and indicated limits of erection tolerances.

C. Clean weld marks or other marks, debris or dirt from exposed surfaces of units.

3.02 PERFORMANCE REQUIREMENTS

A. Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast units as required.

B. REJECTION: Units may be rejected for any one of the following:
   1. Exceeding specified installation tolerances.
   2. Damaged during construction operations.
   3. Exposed-to-view surfaces which develops surface deficiencies.
   4. Other defects as listed in PCI MNL-116 or PCI MNL-117.

- END OF SECTION -

SECTION 04110

CONSTRUCTION STANDARDS

PART 1 PIPELINE CONSTRUCTION

1.01 SUMMARY

This section covers the requirements for material trenching, placement, backfilling, cleaning and testing of underground pipelines and incorporates the requirements of the AWWA Standards and Manufacturers Recommended Installation Procedures, whichever is more stringent. Backfill shall include filling of all trenches to the original ground surface or final grading elevation as shown on the drawings, or otherwise directed by the appropriate Central Iron County Water Conservancy District (CICWCD) departments.

1.02 MATERIALS

This section specifies acceptable pipe and accessories for public water pipeline construction within Central Iron County Water Conservancy District. The materials used for pipe and fittings shall be new and shall conform to the requirements for class, brand, size and material as specified.

A. Water pipe and fittings. The materials used for pipe and fittings shall be all new and shall conform to the requirements for class, brand, size and material as specified.

A copy of the manufacturer's installation recommendation for each kind of pipe shall be provided to each foreman prior to construction. These recommendations shall be followed during construction unless instructed otherwise by the District Inspector or Engineer. All pipe materials shall conform to the following requirement:

Pipe diameter	Pipe material
1/2" - 4"	Polyethylene Pipe SIDR-7, ASTM D2239 Type K Copper ASTM B88
4" - 12"	Polyvinyl Chloride (PVC) Pressure Pipe AWWA C-900
Over 12"	Ductile Iron Class 51 AWWA C151

B. Connection water meters: Only authorized employees of the CICWCD shall be allowed to connect or disconnect water meters. All boxes set in concrete shall be flanged to prevent settlement.

NOTE: Where the Standards refer to AWWA Standards, a copy of the standards should be available for review at the Central Iron County Water Conservancy District

C. Polyethylene (PE) pressure pipe (½ò-2ò): All Polyethylene (PE) Pressure Pipe shall be Pressure Class 200, SIDR 7, unless otherwise specified.

D. Polyvinyl chloride (PVC) pressure pipe (4ò-12ò): All Polyvinyl Chloride (PVC) Pressure Pipe shall be Pressure Class 200, DR-14, conforming to the latest edition of AWWA Specification C-900. Unless otherwise specified, all PVC pipe furnished under these specifications shall be constructed in accordance with ASTM D-1784.

1. All fittings used on rigid PVC pipe shall be ductile iron and conform with AWWA Specification C110.

2. Couplings used on rigid PVC pipe shall be solid sleeve or transition type with mechanical joints complying with AWWA Specification C110.

E. Ductile iron pipe: All ductile iron pipe, when required; shall be Class 51 conforming to the latest edition of AWWA Specifications C-151.

Unless otherwise specified, all Ductile Iron Pipe furnished under these Standards shall be designed in accordance with AWWA Specification C-150-76 "American National Standard for the Thickness Design of Ductile Iron Pipe."

1. Physical and mechanical properties: The Ductile Iron Pipe shall conform with all requirements of the ANSI Specification A21.51. The physical properties shall not be less than 60-42-10.

2. Marking: Each pipe shall be legibly marked "Ductile". The weight, a manufacturer's mark, and the year in which the pipe was produced shall be cast or marked on the pipe.

3. Joints: Ductile Iron Pipe shall be Mechanical Joints, Rubber Gasket Slip-on Joints, Flanged Joints, or a combination of the above as specified on the plans.

a. Mechanical joints: Mechanical joints and the rubber gaskets and lubricant for Ductile Iron Pipe shall comply with the requirements and be dimensioned in accordance with the latest edition of AWWA specifications C-104, C-110 and C-111.

Bolts and rubber gaskets shall be furnished with mechanical joint pipe in sufficient quantity for the amount of fittings ordered.

b. Rubber gaskets slip-on joint: Rubber gasket slip-on joints, and the rubber gaskets and lubricant for Ductile Iron Pipe shall comply with the general requirements of AWWA C-151 and C-111.

c. Flanged joints: Cast iron pipe flanges, and bolts and nuts therefore, shall be dimensioned in accordance with ANSI B-16.2 for Class 200. Threads for screw-on flange pipe shall comply with ANSI B-21. Flange bolts, nuts and gaskets shall be furnished with flange joint pipe in sufficient quantity to make each joint for the pipe ordered. Flanged fittings and spools shall conform to AWWA C-104, C-110 and C-115.

4. Lining and coating: The waterway surfaces of all Ductile Iron water pipe and fittings shall be coated in accordance with AWWA C-104.

   Ductile Iron Pipe or Fittings lined in the field will not be accepted as conforming to AWWA C-104.

5. Polyethylene wrapping: A polyethylene sleeve will be required on all ductile iron pipe unless otherwise specified by the District Engineer. The polyethylene sleeve tubing shall be cut to provide for a minimum of one foot of lap over both the adjoining pipes. The ends of the tubing shall be wrapped using three circumferential turns of plastic adhesive tape. The loose wrap on the barrel shall be pulled snugly around the barrel of the pipe and the excess folded over at the top. This fold shall be held in place by means of six-inch strips of plastic tape placed at intervals of three feet along the pipe barrel.

   Bends, reducers, and offsets shall be sleeved in the same manner as the pipe. Valves shall be sleeved by bringing the tube sleeve on the adjacent pipe over the bells of the valve and sealing with adhesive tape. The valve bodies shall then be wrapped with flat sheets passed under the valve bottom and brought up around the body to the stem and fastened with the tape.

F. Copper pipe: Where service lines are two-inch or less in diameter, type K copper pipe shall be used. Pipe which has outside dimensions greater than two-inch in diameter shall not be copper. All copper pipes shall conform to the following specifications:

1. Material: Pipe shall be used which conforms to the requirements of ASTM B88. The pipe shall be of a Type K only and shall be dimensioned so as to allow the connection to AWWA standard water service taps and fittings. The pipe shall have surfaces smooth and free from bumps and irregularities.

2. Service connections: The installation of service connections shall use only connections, equipment and practices recommended by the manufacturer. The service connection shall conform to the detail drawing shown in the standard drawings.

G. Fittings: Fittings shall be Copper and of a pressure rating as may be required by the

ASME B16.

H. Tapping/Repair clamp material specification:

1. Small Taps/Repair Clamps: For small tappings and repair clamps (3/4" through 3") on cast iron, steel or ductile iron pipe, the following materials shall be required:

a. Saddle castings: Small saddle tappings shall be similar to "Romac Stainless Steel Saddles" constructed of high tensile ductile (modular) iron, in accordance with ASTM specification 536-71, and shall be covered by a black nylon fused coat, approximately 10-12 mils thick, with an approximate dielectric strength of 1000 volts per mill.

b. Stainless steel strap: The stainless steel strap shall consist of a two-inch wide strap to spread out the clamping force on the pipe and shall come complete with sufficient bolts, nuts and washers (with five-eighths-inch N.C. Teflon coated roll threads) to properly clamp the strap to the pipe. M.I.G. welds shall be pasivated for resistance to corrosion.

c. Gaskets: Gaskets shall be made from virgin SBR compounded for water services.

I. Valves and boxes: All valves, twelve inches and smaller shall be of a resilient-seat-gate-valve type, and all valves over twelve inches shall be butterfly valves unless otherwise specified by the District Water Department.

1. Gate valves: Valves shall conform to the latest revision of AWWA Resilient Seated gate valve Standard C-509 and be UL listed, FM approved. All internal parts shall be accessible without removing the body from the line. The wedge shall be of cast iron completely encapsulated with resilient material. The resilient sealing material shall be permanently bonded to the cast iron wedge with a rubber tearing bond to meet ASTM D 429. NRS stems shall be cast bronze with internal collars in compliance with AWWA. OS&Y stems shall be bronze. The NRS stuffing box shall have two "O"-Ring seals above the thrust collar. These rings shall be field replaceable without removing the valve from service.

There shall be low friction thrust bearings above and below the stem collar. The stem nut shall be independent of the wedge and of solid bronze. The waterway in the seat area shall be smooth, unobstructed and free of cavities. Stuffing box shall be attached to the bonnet and the bonnet to the body with bolts and nuts. Blind bolts threaded directly into the body or bonnet will not be acceptable. The body and bonnet shall be coated interior and exterior with

corrosion resistant coating. Each valve shall be hydrostatically tested at 400 PSI to the requirements of both AWWA and UL/FM.

Valves shall be installed vertically in a horizontal run of pipe, and shall be provided with a two-inch square operating nut for manually operating the valve with a "T" handle wrench. The direction of rotation to open shall be to the left (counter-clockwise).

2. Butterfly valves: All butterfly valves shall be of the tight-closing, rubber-seat type with rubber seats that are securely fastened to the valve body. No metal-to-metal seating surfaces shall be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction, and shall be satisfactory for applications involving valve operation after a long period of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves twenty inches and smaller shall meet the full requirements of AWWA Standard C504 for Class 150B. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five years. All valves shall be similar to those as manufactured by the Henry Pratt Company or approved equal.

   Valve bodies shall be constructed of cast iron ASTM A-126 Class B (for flanged end valves) or ASTM A-48 Class 40 for safer type valves. Flange drilling shall be in accordance with ANSI B16.1 Standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be in strict accordance with AWWA Standard C504.

   Valve discs shall be constructed of alloy cast iron ASTM A436 Type I (Ni-Resist).

   Shafts of all valves shall be turned, ground and polished. Valve shafts shall be constructed of 18-8 Type 304 or Type 316 stainless steel. Shaft diameters shall meet minimum requirements established by AWWA Standard 75 lbs. pull under test procedure ASTM D-429, Method B.

   Valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearing load shall not exceed one-fifth of the compressive strength of the bearing of shaft material. Packing shall be self-adjusting Chevron type. Valve operators shall conform to AWWA C504.

   Manual operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical stop-limiting devices to prevent over-travel of the disc in the open and closed positions. Valves shall close with a (clockwise) rotation.

Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 lbs. on the handwheel or chain-wheel. Operator components shall withstand an input of 450 Ft. Lbs. at extreme operator position without damage.

3. Valve boxes: All valves shall be provided with a Cast Iron valve box of the extension sleeve type, and the correct adjustable height to bring the top of the valve box flush with the ground surface. The valve box shall not be less than five inches in diameter and shall have a minimum thickness of .375 inch. The box provided also shall be provided with a suitable base and cover. The word "WATER" shall be cast on the cover.

J. Water service laterals: The material used for water service connections shall comply with the following:

1. Service pipe: Copper or polyethylene (PE) pipe shall be seamless and suitable for use as underground service connections and shall conform to Section 4.1 of these Standards.

2. Corporation stops: Corporation stops shall be similar to those manufactured by Ford; shall be fitted with the proper adapter to the service line and shall conform to the designation shown below for the various sizes:

	Water service connection size					
	1/2"	3/4"	1"	1 1/2"	2"	3"
FORD	600	600	600	600	600	600

All services shall have a flare or compression type joint for the service pipe and threaded on the inlet end with an AWWA thread.

3. Meter setter yokes: Meter setters or meter yokes shall be 18" high, Ford 70 series copper setter or equal, and shall have an AWWA approval, built-in back-flow device, inlet angle ball valve, and grip joint compression couplings for copper tubing or PE pipe on both inlet and outlet. All internal parts shall be accessible without removing the valve from the line. Meters shall only be installed by District Water Department personnel.

4. Meter box and lid: The meter boxes shall be white, high density polyethylene ADS N-12 or equal, 18" X 30" (standard size). The meter lids shall be cast iron, auto read. D & L Supply L-2241 with 2" hole (O.A.E.).

5. Building service connections: At all points designated by the District Engineer, the owner shall install services for building connections, and shall

extend such services to the property line, unless otherwise indicated by the District Water Department. Individual water services shall be 1 inch from the water main to the meter setter for normal domestic service, but may be one-and-one-half or two-inches in diameter as directed by the District Water Department. Services shall have a minimum of three feet of cover and be laid as shown in the standard drawings.

K. Fire hydrants: Fire Hydrants shall be Mueller, Model A-423; Kennedy, Model K81A, or approved equal with 5 ½ò diameter 3 nozzle, foot valve and 6" mechanical joint connection. It shall be the responsibility of the Owner to furnish hydrants with finish paint above the ground line identical to the existing hydrant paint (red).

L. Flowable backfill: Flowable backfill material shall conform to the following:

1. Portland Cement - Type I or II Subsection 718.01.

2. Fly Ash - ASTM C-618, Class F, except loss on ignition shall not exceed three percent maximum, and shall come from a source approved by the District Engineer.

3. The coarse and fine aggregate for flowable fill shall be natural and consisting of mineral aggregate particles meeting the following:

Sieve Size	Percent Passing
3/4	100
200	0-10

4. Mix Design - meet the following:

Minimum compressive strength (28 days)	50 PSI
Maximum compressive strength (28 days)	150 PSI
Minimum fly ash per cubic yard	300 lbs.
Maximum cement per cubic yard	50 lbs.
Maximum slump	10 in.

PART 2 PIPELINE CONSTRUCTION METHODS

2.01 SUMMARY

This section covers the requirements for trenching, placement, and back filling of all underground pipelines. The methods employed in performing the work shall be the responsibility of the developer. The developer shall make such changes in the methods employed as are necessary to install an acceptable finished product. These methods shall include but are not limited to the following:

A. Control of groundwater: All trenches shall be kept free from water during excavation, fine grading, pipe laying, jointing, and embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of ground water, and in cases where the static ground water elevation is above the bottom of any trench or bell hole excavation, such ground water shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. Surface water shall be prevented from entering the trenches.

B. Excavation for pipelines: Trench excavation shall include all operations necessary for excavation of all materials of whatever nature falling within the designated lines of the trenches. Trenches shall be excavated to the lines shown on the drawings or otherwise established by the District Engineer, and to a depth so as to provide a minimum burial of three feet over the pipe unless otherwise specified. The bottom two feet of the trench walls shall be vertical. All finish grade excavation necessary for preparation of the trench bottom shall be made manually. No over-excavating shall be allowed without re-compaction of backfill in accordance with these Standards.

Excavation for trenches in ledge rock, cobble rock, or stones shall extend to a depth of at least four inches below the invert of the pipe. Bedding material as outlined in table 4.1 shall be placed and compacted to 95% of maximum dry density with pneumatic or vibratory tampers in six-inch lifts to provide a smooth, well compacted and stable foundation for the pipe or appurtenant works.

Trench bottoms shall be hand-shaped as specified and the maximum width of the trench, measured at the top of the pipe, shall be as narrow as possible, but not wider than 12 inches on each side of the pipe.

Where unstable earth, mud or muck is encountered in the excavation at the grade of the pipe, the unsuitable material shall be removed to a minimum of 12-inches below grade and the subsequent hole shall be backfilled with crushed rock or gravel (as called out in table 4.2 under "foundation material") to provide a stable subgrade. The gravel material shall be deposited over the entire trench width in a maximum of six-inch thick layers. Each layer shall be compacted by tamping, rolling, vibrating, spading, slicing, rodding or by a combination of one or more of these methods. In addition, the material shall be graded to produce a uniform and continuous support for the entire length of the installed pipe. When dealing with clays it may be required to replace all of the material with suitable fill(road base/sand) to provide a stable subgrade.

Table 4.1 Backfill materials

Sieve size	Percent passing for			
	Foundation materials*	Bedding material	Pipe zone material	Final backfill material
2 inch	100	---	---	Native material which contains no sod, vegetation, rocks larger that 8" in diameter, asphalt or concrete chunks, etc.
3/4 inch	0 ï 50	---	100	
No. 4	0 ï 10	100	40 - 70	
No. 50	0 ï 5	---	20 - 50	
No. 200	0 ï 3	0 - 15	5 - 30	
*To be used only when the trench bottom is unstable. (The standard drawings show the typical trench backfill details.)				

C. Sheeting, bracing, and shoring of excavations: All excavations shall be sheeted, braced, and shored as required to protect the workers and existing utilities and improvements from sliding, sloughing or settling of the trench walls while the work is in progress. All such sheeting, bracing and shoring shall comply with the requirements of the Utah State Industrial Commission. All damage resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Contractor, and the Contractor shall effect all necessary repairs or reconstruction resulting from such damage.

D. Blasing: Blasting will not be allowed except by written permit from the Iron County Fire Chief. If the permit is granted, the Contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property.

The contractor shall comply with the provisions outlined in the U.S. Bureau of Mines Bulletin No. 656 "Blasting Vibrations and their Effects on Structures", and other applicable ordinances as specified by the Fire Chief.

The contractor shall be fully responsible for all damage attributable to such blasting operations. Excessive blasting or overshooting will not be permitted and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed and properly replaced.

E. Pipelaying and bedding: Pipe will be carefully inspected in the field by District Inspectors before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be removed and replaced by the Contractor.

When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose the existing improvement before laying any pipe or conduit. The District Inspector shall be given the opportunity to inspect the existing pipe or conduit before the connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the plans will be made.

Pipe shall be laid up grade with the socket or collar ends of the pipe up grade unless otherwise authorized by the District Water Department and/or District Engineer.

Pipe shall be laid true to line and grade, with uniform bearing under the full length of the barrel of the pipe. Suitable excavation shall be made to receive the bell or collar, which shall not bear upon the subgrade or bearing. Any pipe which is not true to alignment or shows any settlement after laying shall be removed and re-laid to the proper grade and alignment. Wherever possible, sanitary sewers shall be installed on the down-hill side of the street.

1. Requirements for line and grade: All sewer and drainage pipe shall be installed accurately to the defined line and grade within the following limits:

    a. Variance from established line and grade shall be not greater than one thirty-second (1/32) of an inch per inch of pipe diameter.

    b. The total variance from line and grade shall not exceed one-half (1/2) inch, provided that such variation does not result in a level or reverse sloping invert.

    c. The variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, shall not exceed one sixty-fourth (1/64) of an inch per inch of pipe diameter.

    d. The total non-concentricity variance shall not exceed one-half (1/2) inch maximum.

2. Installation of pipe. A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom. Large rocks (over 6 inches in least dimension) near the surface shall be removed and the hole refilled with approved backfill in accordance with table 4.2.

3. Setting of Bends, Tees, Crosses and Reducers: Bends, tees, crosses, and reducers shall be lowered into the trench, inspected, cleaned and joined to the pipe.

   Reaction or thrust blocking shall be applied at bends and tees, and at points of reducing or in fittings where changes in pipe diameter occur. The design of concrete thrust blocking shall be as shown in the Standard drawings or as directed by the District Water Department. The material for reaction or thrust blocking shall be Class C in accordance with Table 4.10 and Section 4.3 of these standards. Blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the fitting and on the ground shall in each instance be that required in the drawings or by the District Engineer. Unless otherwise directed by the City Engineer, the blocking shall be placed so that the pipe and fitting joints will be accessible for repair in accordance with the Standard Drawings. Restraining joints (mega-lug or equal) shall also be used to prevent movement wherever thrust blocks are required.

4. Plugging and dead-ends: Spigot ends of fittings and plain ends of pipe shall be capped. A concrete reaction or thrust block shall be provided at all plugged outlet fittings in the sizes indicated on the standard drawings or as directed by the District Engineer. They also shall be tied to the pipe with restraining joints.

5. Service lines: All service lines shall be installed according to the details shown on the Standard Drawings.

6. Pipe to be kept clean: All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean by means approved by the District Engineer during and after laying.

7. Joint pipe sections: The sealing surface of the pipe, the bell to be joined, and the elastomeric gaskets shall be cleaned immediately prior to assembly, and assembly shall be made as recommended by the manufacturer. When pipe laying is not in progress, the open ends of installed pipe shall be closed to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, enough backfill shall be placed on the pipe to prevent floating. Any pipe that has floated shall be removed from the trench and the bedding restored. No pipe shall be laid when the trench conditions or the weather are unsuitable for proper installations as determined by the District Engineer.

8. Cutting pipe: The pipe shall be cut in a neat manner without amage to the pipe so as to produce a smooth end at right angles to the axis of the pipe.

9. End preparation: Pipe ends shall be cut square, deburred and beveled in

accordance with the pipe manufacturer's recommendations.

10. Push-on-joints: The push-on joint shall be a single elastomeric gasketed joint which shall be assembled by positioning the elastomeric gasket in the annular groove of the bell and inserting the spigot end of the pipe into the bell. The spigot end of the pipe shall compress the gasket radially to form a positive seal. The gasket and annular groove shall be designed, sized and shaped so that the gasket will resist displacement. Care shall be taken so that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell must be in accordance with the manufacturer's recommendations.

11. Mechanical joints: The mechanical joint shall be a bolted joint of the stuffing box type, and installation recommendations from the manufacturer shall be followed. Each joint shall consist of:

    a. A bell provided with an exterior gland having bolt holes or slots and a socket with an annular recess for the sealing gasket and the spigot end of the pipe.

    b. A sealing gasket.

    c. A follower gland with bolt holes matching those in the fitting.

    d. Tee bolts and hexagonal nuts of cor-ten metal.

12. Meter boxes: All meter boxes shall be located behind the sidewalk, in the center of the lot. Any meter box covered or damaged during the construction operations shall be replaced or uncovered and raised to finish grade by the Contractor.

13. Pipe bedding. Pipe shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded in accordance with the bedding details in the standard drawings.

    Pipe bedding materials shall be deposited and compacted in layers not to exceed six inches in compacted thickness. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved methods in such a manner that the bedding materials will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall conform to the requirements of table 4.2 of these standards and shall be free from roots, sod, or other vegetation.

In the event trench materials are not satisfactory for pipe bedding, imported bedding will be required. Imported bedding shall consist of placing compacted granular material on each side of and to the level of twelve inches above the top of the pipe. Imported bedding material shall be graded in accordance with table 4.2, under "bedding material".

F. Backfilling and compaction: Backfill shall be carefully placed around and over pipes and shall not be permitted to fall directly on a pipe from such a height or in such a manner as to cause damage. Backfill material shall be as required by table 4.2 or as approved by the District Engineer and shall not contain any wood, grass, roots, broken concrete, frozen soil, asphalt chunks, trash or debris of any kind that may cause unequal settlement or improper consolidation.

The backfill in all utility trenches under proposed or existing roadways, curb and gutter, sidewalks and driveways shall be compacted to the equivalent of 95% of maximum dry density for granular soils or 90% of maximum dry density for silty/clay soils as classified by AASHTO M-145 Soil Classification System. In shoulders and other street right-of-way areas, the in-place density shall be a minimum of 90% of the maximum dry density.

1. Initial backfill procedure. Backfill of selected material which shall conform to the requirements of table 4.2 shall be placed carefully in eight-inch non--compacted horizontal layers and tamped to a depth of 8 to 12 inches over the top of the pipe. During compaction of the initial backfill, special care shall be taken so as to not move the pipe, either vertically or horizontally. All backfill operations shall be performed in such a manner so as to avoid any damage to the pipe, valves, laterals, etc. In the event such damage or displacement occurs, such damaged or displaced pipe shall be removed and replaced with undamaged pipe on proper grade and alignment.

2. Final backfill procedure. The backfill above a point 8 to 12 inches above the top of the pipe shall be backfilled in horizontal layers 12 inches thick or less with materials containing no brush, perishable or objectionable material, or rocks, stones or boulders larger than 8-inches in the greatest dimension. The material shall be mechanically compacted with appropriate vibrating compaction equipment.

3. Mechanical compaction of backfill. The backfill shall be thoroughly compacted by consolidation or mechanical compaction.

   Structural and trench backfill shall be deposited in horizontal layers and compacted by the following method in such manner that the compacted material will be homogeneous and free from lenses, pockets, streaks, and other imperfections.

The materials shall be deposited in horizontal layers (across the length or width of the excavation of not more than six inches compacted thickness. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability.

Prior to and during compaction operations, all backfill material shall have the optimum practicable moisture content and shall be uniform throughout each layer.

Moisturizing of the materials shall be performed at the site of excavation. If the moisture content is not optimum for compaction, the compaction operations shall be delayed until such time that the material has been brought the optimum moisture content. When the material has been properly conditioned, it shall be compacted by using appropriate mechanical compaction equipment as indicated below.

a. Vibrating Rollers shall consist of a self-propelled roller with a vibrating steel drum of at least one-ton capacity. The roller shall have an effective rolling width of at least 24 inches and shall deliver a compaction force of at least 700 pounds per square inch when vibrating.

b. Pneumatic rollers shall consist of a self-propelled roller with pneumatic tires arranged in a manner so as to provide a satisfactory compacting unit. The roller shall have an effective rolling width of at least 30 inches and shall give a compaction force of at least 500 pounds per inch of width of tread when fully loaded. The tires shall be uniformly inflated.

c. Vibrating plates shall consist of a pneumatic vibrating plate attached to the boom of a backhoe and capable of compacting an area of at least three square feet. The plate and backhoe combination shall together be capable of exerting a compactive force of at least 1,000 pounds per square inch.

d. Hand Compactors shall be used when hand-compacted methods are specified or required because the location of the area to be compacted does not permit the use of self-propelled mechanical compactors. Vibrating plates, "pogo-stick" tampers or other approved hand-compacting equipment shall be used.

e. Jetting and Flooding methods are not permitted.

4. Flowable backfilling: In the pavement sections on all streets and State highways, flowable fill shall be used (unless otherwise approved by the District Engineer) for backfill and shall be in conformance with the standards of "Flowable Fill" as described herein. Flowable fill shall be discharged from the ready mix truck by any reasonable means into the trench to be filled. The fill will be brought up to the bottom of the surface course and shall be finished to provide a uniform surface.

G. Trenches on highways and streets: Wherever trenches will be in, or must cross State highways or streets, the contractor shall obtain such excavation permits as are required for these crossings and shall become familiar with and abide by the rules and directions of the Utah Department of Transportation while working in these streets.

All contractors excavating in any Iron County public right-of-way shall obtain a Road Breaking Permit in compliance with the Iron County street ordinance prior to excavating. All asphalt cuts shall be made with a diamond or carbide-tipped masonry or asphalt cutting saw or with a steel asphalt-cutting wheel attached to a grader or back-hoe. No scarifier-tooth cuts, back-hoe, bucket rips, or jackhammer spade cuts will be allowed.

All backfilled trenches in roadways shall be patched with hot-mix asphalt within fourteen days of initial excavation unless otherwise directed by the County Engineer. The backfill section shall be according to the typical road sections of these standards.

All concrete or asphalt surfaces damaged or cut in trenching operations shall be restored to an as-good or better condition than prior to excavation.

During the entire trenching, backfilling and patching operations, the Contractor will be required to observe all safety and traffic control procedures as outlined in these standards.

The contractor shall be responsible for maintenance of the trench and patch for a period of 18 months from the date of the completion of the patching operation.

Unless otherwise approved by the County Engineer, not more than 400 feet of trench shall be left unfilled at any time in one continuous run.

All streets and roads trenched shall be kept free from dust and open to through traffic unless permission to close the street is obtained by the Contractor from the County Engineer. Up to one-half the width of any street or road shall be temporarily restored for use before excavation is commenced on the remaining portion of the street or road. All excavation, backfilling and temporary resurfacing on any portion of any street or road shall be completed in one working day so that no trenches are left open over night.

H. Cleaning and disinfection of water systems: Each line, after being tested and before being placed in service, shall be disinfected by chlorination. Prior to chlorination the entire line shall be flushed to insure that all dirt or foreign objects have been removed from the line. The line used to flush the line shall be six-inch minimum and no fire hydrants shall be used for flushing. Sufficient chlorine shall be added to insure a residual of twenty-five parts per million in the water after twenty-four hours standing in the pipe. Chlorine calcium hypochlorite dry chlorinating chemical solution may be used for this purpose. Methods of application shall be approved by the District Water Department. Following chlorination, all treated water shall be drained and the pipeline thoroughly flushed with clean water.

The entire line shall be flushed after the specified contact period, and such flushing shall be continued until the water is free from excess chlorine. The entire line, including hydrant laterals, branch lines, and dead-end mains shall be flushed. Chlorine residual must be tested after final flushing by the District Water Department. The discharge of flushed water shall be accomplished in such a manner that no erosion will occur and with no damage to streets or other property. Procedures for discharge will be subject to the review of the District Engineer and District Water Department.

3.01 QUALITY CONTROL

All underground pipelines shall be installed in accordance with these standards and tested as outlined below.

A. Trench backfill moisture density testing: Soil Proctor One determination for each significant change in soil type as necessary to provide required compaction testing. Tests shall be ASTM D1557 Method A or D (modified proctor).

B. Trench backfill moisture/density determination: Tests are required for trench backfill for every 200 lineal feet of trench including service lateral trenches), or other utility trench or portion thereof, and each manhole, valve or set of valves within a 10-foot diameter that comes to the surface in the street section. Tests shall be run at the following trench elevations:

1. One test at top of pipe zone.

2. One test per 2 feet of depth measured from the bottom of the subgrade to the top of the pipe zone. Tests shall be evenly spaced vertically through the trench with one test at top of trench (bottom of subgrade).

3. Additional testing may be required by the District Engineer or soils testing lab to verify compaction.

4. Tests shall be according to ASTM D1556 or D2922 and D3017.

C. Water system testing and acceptance: The Owner and/or Contractor shall disinfect and test all water mains prior to final acceptance by the Central Iron County Water Conservancy District. This shall include the repairing of existing facilities that must be included in the test but are not capable of holding test pressures. All concrete reaction blocks shall be in place at least five days before the initial filling of the line, unless high early strength concrete is used which will require three days in place. In some cases filling can take place the same day if precast reaction blocks are used.

1. Pressure test: After the pipe has been laid, including fittings, valves, corporation stops, services, and hydrants, and the line has been backfilled in accordance with these standards, each valved section, unless otherwise directed by the District Water Department, shall be subjected to hydrostatic pressure of not less than 200 pounds per square inch. The duration of each such test shall be two hours. Water added to maintain the pressure shall not exceed 0.4 gallons per inch diameter per 1000 lineal feet of main being tested during the two-hour test period.

   Each valved section of pipe shall be slowly filled with water, and the specified test pressure measured at the lowest point of elevation. This shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the Owner. Gauges and measuring devices must meet with the acceptance of the Water Department and the necessary pipe taps shall be made as directed. Before applying the specified test pressure, all air shall be expelled from the pipe by drilling small holes at points of highest elevations and afterward tightly plugging those holes with brass plugs.

   Any cracked or defective pipes, fittings, valves, or hydrants discovered in the pressure test shall be removed and replaced with sound material in the manner provided. The test shall be repeated until the water main passes the pressure test and is accepted by the District Water Department or District Engineer.

2. Operational inspection: At the completion of the project and in the presence of the District Engineer, the Owner shall operate all valves, hydrants, and water services to ascertain that the entire facility is in good working order; that all valve boxes are centered and valves are operational; that all hydrants operate and drain properly and that water is available at all meter boxes.

- END OF SECTION -

SECTION 15062

DUCTILE IRON PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. Contractor shall furnish and install all pipe, fittings, closure pieces, supports, bolts, nuts, gaskets, jointing material and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.02 RELATED WORK

A. Related work specified in other sections:

Section 02221 - Excavation and Backfill for Pipelines
Section 02222 - Excavation and Backfill for Structures
Section 03300 - Cast-In-Place Concrete
Section 15100 - Mechanical Appurtenances

1.03 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.1 (1975) Cast-Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C 104	Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C 105	Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C 110	Standards for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C 111	Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C 115	Standard for Flanged Ductile-Iron Pipe with Threaded Flanges
AWWA C 150	Standard for the Thickness Design of Ductile-Iron Pipe

AWWA C 151	Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
AWWA C 600	Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C 651	Standard for Disinfecting Water Mains

1.04 SUBMITTALS

A. Submit catalog information on all fittings and valves shown on the Drawings, referencing each item by number as shown on the Drawings. Information shall indicate manufacture specification compliance and dimensional data.

B. Submit shop drawings on all fabricated piping and pipe supports.

1.05 MEASUREMENT AND PAYMENT

A. There shall be no separate measurement and payment for this section. Full compensation for Ductile Iron Pipe shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which Ductile Iron Pipe relates.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to the requirements of the "American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids" (ANSI A21.51 AWWA C151) and "American National Standard for the Thickness Design of Ductile Iron Pipe" (ANSI A21.50 AWWA C150). Pipeline thickness rating shall be minimum Class 53 for all pipe inside of the building and to a distance of at least 2 feet outside of the building. The pipeline thickness rating for all other ductile iron pipe shall be a minimum of Class 51. All pipe must be approved for potable water used by the National Sanitation Foundation and must bear the logo “NSF-pw” or “NSF-61” indicating such approval

B. Buried Ductile Iron Pipe shall be encased with 8 mil. Class C polyethylene, conforming to AWWA C105. All seams in the polyethylene encasement shall be taped with Polycan #900 Adhesive Tape to completely seal the seam.

2.02 FITTINGS

A. Fittings shall conform to the "American National Standard for Gray Iron and Ductile Iron Fittings for Water and Other Liquids" (ANSI/AWWA C110) and shall be 250 psi pressure rated.

B. Flanges shall conform to ANSI B16.1, class 125 and shall have either raised or plain faces.

C. All buried fittings shall be completely coated with Chevron FM Grease and shall be completely encased with 8 mil, Class C polyethylene, conforming to AWWA C105. All seams in the polyethylene encasement shall be taped with Polycan #900 Adhesive Tape to completely seal the seam.

2.03 DUCTILE IRON PIPE JOINTS

A. Ductile iron pipe shall be furnished with mechanical joints, push on or flanged joints as required and shall conform to the "American National Standard for Rubber-Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings" (ANSI A21.11 AWWA C111) and the "American National Standard for Flanged Cast Iron and Ductile Iron Pipe with Threaded Flanges" (ANSI A21.15 AWWA C115).

2.04 MECHANICAL-TYPE COUPLINGS

A. Mechanical-type couplings shall be designed for a water working pressure not less than the design pressure of the pipe on which they are to be installed. Restraints shall be provided as required.

2.05 SLEEVE-TYPE COUPLINGS

A. Sleeve-type couplings shall be provided where shown. Couplings shall be of ductile iron, without pipe stop, and shall be of sizes to fit the pipe and fittings shown. Couplings shall be the Class 350. Where sleeves are utilized, proper anchoring shall be provided.

2.06 DUAL PURPOSE CUTTING-IN SLEEVE

A. Dual Purpose Cutting-In Sleeves shall be furnished and installed as shown on the Drawings. Sleeves shall be of ductile iron (MJ x PE), and shall be of the proper sizes to fit the pipe and fittings shown. Where sleeves are utilized, proper restraint shall be provided.

2.07 GASKETS AND BOLTS

A. Except as otherwise provided, gaskets for flanged joints shall be 1/8-inch thick rubber fabric. Wherever blind flanges are shown, the gaskets shall consist of 1/8-inch thick cloth-inserted rubber sheet which shall cover the entire inside surface of the blind flange and shall be cemented to the surface of the blind flange. All buried fittings using steel bolts shall be coated with no-oxide wax and wrapped with polyethylene or as otherwise approved by the District Engineer.

2.08 CEMENT MORTAR LINING

A. Ductile iron pipe and fittings shall be lined with cement mortar in accordance with the requirements of the "American National Standard for Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water" (ANSI A21.4 AWWA C104) except that the lining thickness shall be not less than 1/8 of an inch.

2.09 PIPE SUPPORTS

A. Pipe supports shall be manufactured by Grinnell, and shall be Grinnell Adjustable Pipe Support Model No. 264 (or approved equal). All pipe supports shall have a 1-inch high grouted pad to be used as a leveling base.

2.10 THRUST BLOCKS / RESTRAINTS

A. All fittings shall have proper thrust blocks and restraints as noted for the type of installation required. Thrust blocks shall be concrete as noted on the Drawings and in Section 03300 of the Technical Specifications. Restraints shall be tie-rods, Megalug® or approved equal, or Engineer approved anchoring devices. See standard drawing sheet number W-03 for thrust block detail.

2.11 SAFETY TAPE

A. Safety tracer tape shall be a minimum of 3-inches wide by 5.0 mil overall thickness, with no less than a 50 gauge solid aluminum foil core. It shall be Safety Blue in color and shall be clearly labeled with the word “WATER”. Safety tape shall be as manufactured by Magnatec® or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Ductile iron pipe shall be installed in accordance with the "American National Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances" (ANSI/AWWA C600). All buried Ductile Iron pipe, fittings and valves shall be completely coated with Chevron FM Grease and shall be encased with polyethylene wrap and installed in conformance with AWWA C105 standards. All

seams in the polyethylene encasement shall be taped with Polycan #900 Adhesive Tape to completely seal the seam.

B. The pipe shall be plugged at the end of each work day or period of suspension.

C. Safety tracer tape shall be installed above pipe as required by the Drawings.

3.02 THRUST BLOCKS

A. Thrust blocks shall be installed at points where the pipe changes direction such as: at all tees, elbows, wyes, caps, valves, hydrants, reducers, etc. except where restrained joints are called for on the Drawings.

B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

C. Thrust blocks shall bear against solid undisturbed earth at the side and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.

D. Thrust blocks shall be sized and constructed as indicated on the Drawings.

3.03 PRELIMINARY CLEANING AND FLUSHING

A. Contractor shall flush the pipeline as the work progresses by a means in accordance with good practice to insure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible the flushing shall be made with an open pipe end.

3.04 TESTING OF PIPELINE

A. Source of Water

1. Contractor shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

B. Testing Procedure

1. Ductile Iron pipe shall be tested at a static pressure of 200 psi for 2 hours, and in accordance with the AWWA C600 standards.

2. In the case of pipelines that fail to pass the leakage test, contractor shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines, all at no additional cost to developer/contractor.

3. The District Engineer shall be notified at least 48 hours before the pipeline is to be tested so that he may be present during the test.

3.05 DISINFECTING

A. Source of Water

1. Contractor shall assume all responsibility to obtain the necessary water supplies for disinfection of the water line system.

B. Testing Procedure

1. Leakage and pressure testing must be completed prior to disinfection procedures.

2. All water piping installed under this Contract (including ductile iron pipe, fittings, valves, etc.) shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C651).

3. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfate ($NaHSO_3$) shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm.

4. After approval of disinfection, developer/contractor shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.

5. At the end of 24 hours, a bacteriological test will be performed by developer/contractor to insure adequate disinfection. If the initial disinfection fails to provide satisfactory bacteriological results, or shows the presence of coliform, then the line shall be rechlorinated, flushed, and retested until satisfactory results are obtained at the expense of Contractor.

- END OF SECTION -

SECTION 15065

POLYVINYL CHLORIDE PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. Developer/contractor shall furnish and install all pipe, fittings, closure pieces, supports, gaskets, jointing material, skids, seals, and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.02 RELATED WORK

A. Related work specified in other sections:

Section 02221 - Excavation and Backfill for Pipelines
Section 03300 - Cast-in-Place Concrete
Section 15062 - Ductile Iron Pipe
Section 15100 - Mechanical Appurtenances

1.03 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C 651	Standard for Disinfecting Water Mains
AWWA C 900	Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
AWWA M 23	Manual of Water Supply Practices - PVC Pipe - Design and Installation

1.04 SUBMITTALS

A. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

1.05 MEASUREMENT AND PAYMENT

A. There shall be no separate measurement and payment for this section. Full compensation for PolyVinyl Chloride Pipe shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which PolyVinyl Chloride Pipe relates.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE

A. All polyvinyl chloride pipe intended for use in public drinking water supply pipelines or in pressure pipeline systems shall be manufactured of material conforming to AWWA C905 PVC materials for the class required. All plastic pipe must be approved for potable water use by the National Sanitation Foundation and must bear the logo "NSF-pw" or "NSF-61" indicating such approval. Pipe sections shall be clearly marked to:

1. Identify manufacturer's name or trademark.
2. Nominal pipe size and OD base.
3. AWWA material code designation.
4. Dimension ratio.
5. AWWA pressure class.
6. AWWA specification designation.
7. Product record code.

B. All secondary water lines with diameters up to 12 inches shall be C-900 PVC Purple Reclaimed Water Pipe. All secondary with diameters greater than 12 inches shall be C-905 PVC Purple Reclaimed Water Pipe. Pipe sections shall be clearly marked to:

1. Identify manufacturer's name or trademark.
2 Nominal pipe size and OD base.
3 AWWA material code designation.
4 Dimension ratio.
5 AWWA pressure class.
6 AWWA specification designation.
7 Product record code.

2.02 POLYVINYL CHLORIDE JOINTS

A. All joints and accessories shall be as manufactured and furnished by the pipe supplier and have bell and/or spigot configurations, and have compatible pressure ratings with that of the pipe.

2.03 DUCTILE IRON FITTINGS

A. Ductile iron fittings shall comply with the requirements of Section 15062 Ductile Iron Pipe.

2.04 CONCRETE

A. Concrete for all thrust blocks shall comply with the requirements of Section 03300 Cast-In-Place Concrete.

2.05 SAFETY TAPE

A. Safety tracer tape shall be a minimum of 3" wide by 5.0 mil overall thickness, with no less than a 50 gauge solid aluminum foil core. For culinary water lines it shall be Safety Blue in color and shall be clearly labeled with the word ñWATERò. For secondary water lines it shall be Safety Purple in color and shall be clearly labeled with the words ñSECONDARY WATERò. Safety tape shall be as manufactured by Magnatec or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Polyvinyl Chloride pipe shall be installed in accordance with the "American Water Works Association Manual of Water Supply Practices - PVC Pipe - Design and Installation" (AWWA No. M23).

B. The pipe shall be plugged at the end of each work day, or period of work suspension.

C. Safety tracer tape shall be installed above pipe as required by the Drawings.

D. Ductile iron fittings shall be installed in accordance with the requirements of Section 15062 Ductile Iron Pipe.

3.02 THRUST BLOCKS

A. Thrust blocks shall be installed at points where the pipe changes direction or velocity such as: at all tees, elbows, wyes, caps, valves, hydrants, reducers, etc.

B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

C. Thrust blocks shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.

D. Thrust blocks shall be sized and constructed as indicated on the Drawings W-03.

3.03 PRELIMINARY CLEANING AND FLUSHING

A. Developer/contractor shall flush the pipeline as the work progresses by a means in accordance with good practice to insure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible the flushing shall be made with an open pipe end.

3.04 TESTING OF PIPELINE

A. Source of Water

1. Contractor shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

B. Testing Procedure

1. Polyvinyl Chloride pipe shall be tested at a static pressure of 200 psi for 2 hours in accordance with the "American Water Works Association Manual of Water Supply Practices - PVC Pipe -Design and Installation" (AWWA No. M23).

2. In the case of pipelines that fail to pass the leakage test, Contractor shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines, all at no additional cost to developer/contractor.

3. The District Engineer shall be notified at least 48 hours before the pipeline is to be tested so that he may be present during the test.

3.05 DISINFECTING (<u>This section does not apply to secondary water lines.)</u>

A. Source of Water

1. Contractor shall assume all responsibility to obtain the necessary water supplies for disinfection of the water line system.

B. Testing Procedure

1. Leakage and pressure testing must be completed prior to disinfection procedures.

2. All water piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C651).

3. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfate ($NaHSO_3$) shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm.

4. After approval of disinfection, Contractor shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.

5. At the end of 24 hours, a bacteriological test will be performed by developer/contractor t to insure adequate disinfection. If the initial disinfection fails to provide satisfactory bacteriological results, or shows the presence of coliform bacteria, then the line shall be re-chlorinated, flushed, and retested until satisfactory results are obtained at the expense of contractor.

- END OF SECTION -

SECTION 15065

POLYVINYL CHLORIDE PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. Developer/contractor shall furnish and install all pipe, fittings, closure pieces, supports, gaskets, jointing material, skids, seals, and appurtenances as shown and specified, and as required for a complete and workable piping system.

1.02 RELATED WORK

A. Related work specified in other sections:

Section 02221 - Excavation and Backfill for Pipelines
Section 03300 - Cast-in-Place Concrete
Section 15062 - Ductile Iron Pipe
Section 15100 - Mechanical Appurtenances

1.03 REFERENCES

A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C 651	Standard for Disinfecting Water Mains
AWWA C 900	Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
AWWA M 23	Manual of Water Supply Practices - PVC Pipe - Design and Installation

1.04 SUBMITTALS

A. Submit manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

1.05 MEASUREMENT AND PAYMENT

A. There shall be no separate measurement and payment for this section. Full compensation for PolyVinyl Chloride Pipe shall be considered as included in the contract unit or lump sum bid prices for the various items of the contract to which PolyVinyl Chloride Pipe relates.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE

A. All polyvinyl chloride pipe intended for use in public drinking water supply pipelines or in pressure pipeline systems shall be manufactured of material conforming to AWWA C905 PVC materials for the class required. All plastic pipe must be approved for potable water use by the National Sanitation Foundation and must bear the logo "NSF-pw" or "NSF-61" indicating such approval. Pipe sections shall be clearly marked to:

1. Identify manufacturer's name or trademark.
2. Nominal pipe size and OD base.
3. AWWA material code designation.
4. Dimension ratio.
5. AWWA pressure class.
6. AWWA specification designation.
7. Product record code.

2.02 POLYVINYL CHLORIDE JOINTS

A. All joints and accessories shall be as manufactured and furnished by the pipe supplier and have bell and/or spigot configurations, and have compatible pressure ratings with that of the pipe.

2.03 DUCTILE IRON FITTINGS

A. Ductile iron fittings shall comply with the requirements of Section 15062 Ductile Iron Pipe.

2.04 CONCRETE

A. Concrete for all thrust blocks shall comply with the requirements of Section 03300 Cast-In-Place Concrete.

2.05 SAFETY TAPE

A. Safety tracer tape shall be a minimum of 3" wide by 5.0 mil overall thickness, with no less than a 50 gauge solid aluminum foil core. It shall be Safety Blue in color and shall be clearly labeled with the word “WATER”. Safety tape shall be as manufactured by Magnatec or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Polyvinyl Chloride pipe shall be installed in accordance with the "American Water Works Association Manual of Water Supply Practices - PVC Pipe - Design and Installation" (AWWA No. M23).

B. The pipe shall be plugged at the end of each work day, or period of work suspension.

C. Safety tracer tape and tracer wire shall be installed above pipe as required by the Drawings.

D. Ductile iron fittings shall be installed in accordance with the requirements of Section 15062 Ductile Iron Pipe.

3.02 THRUST BLOCKS

A. Thrust blocks shall be installed at points where the pipe changes direction or velocity such as: at all tees, elbows, wyes, caps, valves, hydrants, reducers, etc.

B. Thrust blocks shall be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting.

C. Thrust blocks shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints or the pipe or fitting.

D. Thrust blocks shall be sized and constructed as indicated on the Drawings W-03.

3.03 PRELIMINARY CLEANING AND FLUSHING

A. Developer/contractor shall flush the pipeline as the work progresses by a means in accordance with good practice to insure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible the flushing shall be made with an open pipe end.

3.04 TESTING OF PIPELINE

A. Source of Water

1. Contractor shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

B. Testing Procedure

1. Polyvinyl Chloride pipe shall be tested at a static pressure of 200 psi for 2 hours in accordance with the "American Water Works Association Manual of Water Supply Practices - PVC Pipe -Design and Installation" (AWWA No. M23).

2. In the case of pipelines that fail to pass the leakage test, Contractor shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines, all at no additional cost to developer/contractor.

3. The District Engineer shall be notified at least 48 hours before the pipeline is to be tested so that he may be present during the test.

3.05 DISINFECTING

A. Source of Water

1. Contractor shall assume all responsibility to obtain the necessary water supplies for disinfection of the water line system.

B. Testing Procedure

1. Leakage and pressure testing must be completed prior to disinfection procedures.

2. All water piping installed under this Contract shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C651).

3. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfate ($NaHSO_3$) shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm.

4. After approval of disinfection, Contractor shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.

5. At the end of 24 hours, a bacteriological test will be performed by developer/contractor t to insure adequate disinfection. If the initial disinfection fails to provide satisfactory bacteriological results, or shows the presence of coliform bacteria, then the line shall be re-chlorinated, flushed, and retested until satisfactory results are obtained at the expense of contractor.

- END OF SECTION -

SECTION 15067

HIGH DENSITY POLYETHYLENE PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers furnishing and installation of high density polyethylene (HDPE) pipe for the pressurized piping system as shown on the drawings and specified herein.

1.02 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

ASTM D 1248	Standard Specifications for Polyethylene Plastics, Molding & Extrusion Materials.
ASTM D 2321	Underground Installation of Flexible Thermoplastic Sewer Pipe.
ASTM D 2837	Standard Method for Obtaining Design Basis for Thermoplastic Pipe Materials.
ASTM D 3261	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.

AMERICAN WATER WORKS ASSOCIATION

AWWA C 906	Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 63 In., for Water Distribution

PHILLIPS PETROLEUM DRISCOPIPE

Technical Note No. 35, "Hydrostatic Testing of HDPE Pressure Pipelines."

1.03 SUBMITTALS

A. The following shall be submitted:

1. Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.

1.04 MEASUREMENT AND PAYMENT

A. Measurement and payment for high density polyethylene pipe shall not be paid as an unit item, but considered as included in the contract unit or lump sum prices for the various items of the contract to which it relates.

PART 2 PRODUCTS

2.01 POLYETHYLENE PIPE

A. The piping material and fittings shall conform to AWWA C-906 and shall be be made from PE 2406, PE 3406, or PE 3408 as referenced in ASTM D 3350 and ASTM 2837. The high density polyethylene pipe shall have a manufacturer's recommended hydrostatic design stress rating of 800 psi based on a material with a 1600 psi design basis determined in accordance with ASTM D 2837. All high density polyethylene pipe shall be provided from a single manufacturer. All pipe must be approved for potable water used by the National Sanitation Foundation and must bear the logo “NSF-pw” or “NSF-61” indicating such approval.

B. High density polyethylene pipe shall have an SDR and minimum pressure rating as shown in Table 1. HDPE Pipe shall be SDR 11, 160 psi pipe, conforming to the DIPS sizing system. HDPE Pipe shall be Driscopipe series 4000 HDPE pipe or approved equal.

PART 3 EXECUTION

3.01 STORAGE AND HANDLING

A. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. Sections of pipe with deep cuts or gouges shall be removed and ends of pipes rejoined. Handling of the joined pipe shall be in such a manner that the pipe is not damaged by dragging over sharp or cutting objects.

B. Lifting of joined pipe sections shall preclude concentration of bending stresses at joints and shall be done in a manner which evenly distributes lifting stresses along the full length of the pipe.

C. Pipe shall be stored in a shaded area or covered to avoid temperature extremes which may cause the pipe to bow or warp.

TABLE 1
HDPE PIPE MINIMUM PRESSURE RATING

SDR	PRESSURE RATING (psi)
7	267
9	200
11	160
13.5	130
17	100
21	80

3.02 INSTALLATION

A. High density polyethylene pipe shall be installed according to the requirements of ASTM D-2321, and the manufacturer's requirements.

B. Care shall be exercised by the Contractor in placing the pipe to avoid damaging the pipe.

C. Any damage to the HDPE pipes shall be repaired at the developer/contractor's expense.

D. Stub ends and pipe fittings for butt fusion shall be fabricated of the same parent material as the HDPE pipe, and shall be of at least the same wall thickness and pressure rating as the pipe to be joined, unless otherwise recommended by the manufacturer.

E. Joining techniques and operating procedures shall follow written instructions provided by the pipe manufacturer and the joint equipment supplier. A copy of such instructions shall be present at any location in which butt fusion is being carried out.

F. Flanged joints shall be used for joining between HDPE and other materials or non-HDPE fittings. Flanged fittings shall have a pressure rating equal to or greater than the pressure rating of the pipe on which they are to be installed. Backup flanges for butt fused joints shall be epoxy-coated ductile iron, drilled to ANSI bolt circles and have a pressure rating of 160 psi. Backup flanges and bolts shall be as approved or supplied by the pipe manufacturer. It is the responsibility of the Contractor to ensure that the flange bolt circle diameter matches that of other flanged fittings used in the Work, and that bolt dimensions are suitable for the fittings to be joined.

G. The pipe shall be installed with uniform bearing under the full length of the pipe.

H. The pipe shall be plugged at the end of each work day, or period of work suspension.

3.03 PRELIMINARY CLEANING AND FLUSHING

A. The Developer/contractor shall flush the pipeline as the work progresses by a means in accordance with good practice to ensure that sand, rocks, or other foreign material are not left in any of the pipeline. If possible the flushing shall be made with an open pipe end.

3.04 TESTING OF PIPELINE

A. Source of Water

1. Developer/contractor shall assume all responsibility to obtain the necessary water supplies for pressure testing of the pipeline.

B. Testing Procedure

1. HDPE Pipe shall be tested hydrostatically at 200 psi for 2 hours in accordance with the AWWA standards.

2. In the case of pipelines that fail to pass the leakage test, developer/contractor shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines, all at no additional cost to district.

3. The District Engineer shall be notified at least 48 hours before the pipeline is to be tested so that he may be present during the test.

3.05 DISINFECTING

A. Source of Water

1. Contractor shall assume all responsibility to obtain the necessary water supplies for disinfection of the water line system.

B. Testing Procedure

1. Leakage and pressure testing must be completed prior to disinfection procedures.

2. All water piping installed under this Contract (including ductile iron pipe, fittings, valves, etc.) shall be disinfected using an approved disinfection method in accordance with the "American Water Works Association Standard for Disinfecting Water Mains" (AWWA C651).

3. Heavily chlorinated water shall not be discharged onto the ground. Upon completion of disinfection, Sodium Bisulfate ($NaHSO_3$) shall be applied to the heavily chlorinated water to neutralize thoroughly the chlorine residual remaining. Water shall be neutralized to less than 1 ppm.

4. After approval of disinfection, developer/contractor shall flush the new system until the chlorine residual is a maximum of 0.3 ppm.

5. At the end of 24 hours, a bacteriological test will be performed by developer/contractor to insure adequate disinfection. If the initial disinfection fails to provide satisfactory bacteriological results, or shows the presence of coliform, then the line shall be rechlorinated, flushed, and retested until satisfactory results are obtained at the expense of developer/contractor.

- END OF SECTION -

SECTION 15100

MECHANICAL APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

A. The developer/contractor shall furnish and install all piping and equipment.

1.02 RELATED WORK

A. Related work specified in other sections:

Section 15062 - Ductile Iron Pipe
Section 15065 - Polyvinyl Chloride Pipe
Section 15067 - High-Density Polyethylene Pipe

1.03 MEASUREMENT AND PAYMENT

A. Measurement and payment for mechanical appurtenances shall not be paid as an unit item, but shall be included in the item of work to which it pertains.

1.04 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text to by basic designation only.

B. AMERICAN WATER WORKS ASSOCIATION (AWWA)

1. C-500 Metal-Seated Gate Valves for Water Supply Services
2. C-502 Dry-Barrel Fire Hydrants
3. C-508 Swing-Check Valves for Waterworks Service, 2 In. through 24 In.
4. C-509 Resilient-Seated Gate Valves for Water Supply Service
5. C-512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
6. C-701 Turbine Meters

1.05 SUBMITTALS

A. Submit catalog cuts on all mechanical appurtenances including: fittings, valves, or other items shown on the Drawings referencing each item by mark number. Information shall indicate manufacture specification compliance and dimensional data.

PART 2 PRODUCTS

2.01 GATE VALVES

A. Gate valves shall conform to the latest revision of AWWA Resilient Seated gate valve Standard C-509 and be UL listed, FM approved. All internal parts shall be accessible without removing the body from the line. The wedge shall be of cast iron completely encapsulated with resilient material. The resilient sealing material shall be permanently bonded to the cast iron wedge with a rubber tearing bond to meet ASTM D 429. NRS stems shall be cast bronze with internal collars in compliance with AWWA. OS&Y stems shall be bronze. The NRS stuffing box shall have two "O"-Ring seals above the thrust collar. These rings shall be field replaceable without removing the valve from service.

B. There shall be low friction thrust bearings above and below the stem collar. The stem nut shall be independent of the wedge and of solid bronze. The waterway in the seat area shall be smooth, unobstructed and free of cavities. Stuffing box shall be attached to the bonnet and the bonnet to the body with bolts and nuts. Blind bolts threaded directly into the body or bonnet will not be acceptable. The body and bonnet shall be coated interior and exterior with corrosion resistant coating. Each valve shall be hydrostatically tested at 400 PSI to the requirements of both AWWA and UL/FM.

C. Valves shall be installed vertically in a horizontal run of pipe, and shall be provided with a two-inch square operating nut for manually operating the valve with a "T" handle wrench. The direction of rotation to open shall be to the left (counter-clockwise).

2.02 BUTTERFLY VALVES

A. All butterfly valves shall be of the tight-closing, rubber-seat type with rubber seats that are securely fastened to the valve body. No metal-to-metal seating surfaces shall be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction, and shall be satisfactory for applications involving valve operation after a long period of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves twenty inches and smaller shall meet the full requirements of AWWA Standard C504 for Class 150B. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five years. All valves shall be similar to those as manufactured by the Henry Pratt Company or approved equal.

B. Valve bodies shall be constructed of cast iron ASTM A-126 Class B (for flanged end valves) or ASTM A-48 Class 40 for safer type valves. Flange drilling shall be in accordance with ANSI B16.1 Standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be in strict accordance with AWWA Standard C504.

C. Valve discs shall be constructed of alloy cast iron ASTM A436 Type I (Ni-Resist).

D. Shafts of all valves shall be turned, ground and polished. Valve shafts shall be constructed of 18-8 Type 304 or Type 316 stainless steel. Shaft diameters shall meet minimum requirements established by AWWA Standard 75 lbs. pull under test procedure ASTM D-429, Method B.

E. Valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and

self-lubricating. Bearing load shall not exceed one-fifth of the compressive strength of the bearing of shaft material. Packing shall be self-adjusting Chevron type. Valve operators shall conform to AWWA C504.

F. Manual operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical stop-limiting devices to prevent over-travel of the disc in the open and closed positions. Valves shall close with a (clockwise) rotation. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 lbs. on the handwheel or chain-wheel. Operator components shall withstand an input of 450 Ft. Lbs. at extreme operator position without damage.

2.03 CHECK VALVE

A. The check valve shall be a Spring & Lever as manufactured by Mueller, Model A-2600-6-02, for installation at the location shown on the drawings. The pressure class shall be 150.

2.04 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

A. The RPZ Backflow Preventer valve assembly shall provide protection against backflow with exceptionally low head loss characteristics, shall operate on the reduced pressure principle, and shall be manufactured by Cla-Val Co., Model RP8L (no approved equal), for installation at the location shown on the drawings. The pressure class shall be 150.

B. The Reduced Pressure assembly shall consist of a differential pressure relief valve located between two independently acting check valves, two resilient seated non-rising stem or outside stem and yoke shut-offs and four test cocks. The main body shall have no threads tapped directly into it, and be a uni-body, ductile iron type construction with a 100% fusion epoxy coating.

C. No special tools shall be required for maintenance.

2.05 DRAIN LINE CHECK VALVE

A. Drain line check valves shall be as manufactured by Red Valve, and shall be the Tideflex Model TH-1 (no approved equal), low-head check valve for installation at the location shown on the drawings.

2.06 AIR/VACUUM VALVES

A. Air/Vacuum valves shall be APCO No. 145-C with a 2-inch orifice (no approved equals), and shall be installed as shown on the drawings.

2.07 WALL HYDRANT

A. The wall hydrant shall be a 316 Stainless Steel Mueller wall hydrant.

2.08 CORPORATION STOP

A. Corporation Stop type Ball Valves shall be full port, bronze body, PTFE coated ball and have a double O-ring stem. Outlets shall match the connection specified. Valves shall be rated at 300 psig maximum working pressure. They shall be Mueller Series 300 or approved equal.

2.09 AUTOMATIC SELF-CLEANING FILTER

B. The automatic self-cleaning filters shall be Model M104LP as manufactured by Filtomat (no approved equal) with 150 micron flat screens.

2.10 PRESSURE GAUGES

A. Pressure gauges shall be provided where shown. Gauges shall be industrial type with stainless steel movement, liquid filled, and stainless steel or Phenolic case. Unless otherwise shown, pressure gauges shall have a 4-1/2 inch dial, ½ inch threaded connection and a shut-off valve. Gauges shall be calibrated to read in applicable units, with an accuracy of ± 1 percent, to 150 percent of the working pressure. Gauges shall be manufactured by U.S. Gauge, Foxboro, Marsh, or equal.

B. Pressure gauges that connect to lines other than potable water shall have gauge guards to prevent corrosion and clogging. Gauge guards shall have a durable and flexible diaphragm which serves as a protective barrier between the process fluid and instrument. The diaphragm shall be either elastomer or Teflon and rated for the pressure of the gauge.

2.11 FIRE HYDRANTS

A. Fire hydrants and their related items such as auxiliary gate valves and valve boxes are to be furnished and installed as shown on the Drawings. Fire hydrants shall conform to AWWA C-502. The hydrants shall be Mueller Modern Centurion A-423 (O.A.E.).

2.12 PIPE SUPPORTS

A. Pipe supports shall be manufactured by Grinnell, and shall be Grinnell Adjustable Pipe Support Model No. 264 (or approved equal). All pipe supports shall have a 1-inch high grouted pad to be used as a leveling base.

2.13 VALVE BOXES

A. Valve boxes shall be provided with a Cast Iron valve box of the extension sleeve type, and the correct adjustable height to bring the top of the valve box flush with the ground surface. The valve box shall not be less than five inches in diameter and shall have a minimum thickness of .375 inch. The box provided also shall be provided with a suitable base and cover. The word "WATER" shall be cast on the cover, refer to Detail W-01

PART 3 EXECUTION

3.01 INSTALLATION

A. Valves, valve-operating units, stem extensions and other accessories shall be installed by the Contractor where shown, or where required in the opinion of the District Engineer, to provide

for convenience in operation. Where buried valves are indicated, the Contractor shall furnish and install valve boxes to 3-inches above grade in unimproved areas, or at grade with concrete collar as shown on the Drawings in improved areas. All gate valves and boxes shall be new and recently manufactured.

Install mechanical appurtenances as indicated on the plans and in accordance with the manufacturer's written instructions.

Valve boxes shall be installed with concrete collars as noted on the drawings.

- END OF SECTION -