



Springville

Standard Specifications and Drawings

Springville City Public Works

May 2018

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CHAPTER 1 - GENERAL REQUIREMENTS

1.1 PURPOSE OF DOCUMENTS

The purpose of these Standard Specifications and Standard Drawings is to govern any work done or improvements installed within Public right-of-ways or public easements. Construction work shall comply with Springville City Codes, specifically Title 11 Development Code and Title 14 Subdivision Code. Developers/Contractors should thoroughly read and understand these specifications and standards before constructing public improvements.

Anything not specified in these specifications shall be governed by the most current revision of the Utah APWA specifications. If conflicts arise, the Developer/Contractor shall notify the City Engineer or his representative for final direction.

The Developer/Contractor shall contact Public Works/City Engineering at the Springville City Offices, 110 South Main Street, Springville, Utah 84663 for all matters dealing with construction work within a City right-of-way or with any work connecting onto a City utility. SPECIAL PERMITS AND BONDING ARE REQUIRED FOR ALL SUCH WORK.

1.2 ENCROACHMENT PERMIT, FEES AND BONDING REQUIRED

It shall be unlawful to do any construction within the public right-of-way, within a public easement, or perform any work on public infrastructure in the City of Springville without an Encroachment Permit from the City to do so. The City of Springville and all utility companies are bound by these standard specifications. No work shall be started until a permit is secured. In order to obtain an Encroachment Permit, the Developer's/Contractor's authorized signature is required. If a contract to do such work for the City has been finalized, the contract fulfills this permit requirement.

1.2.1 Forward:

- 1) Statement of Intent: The purpose of this section is to describe Springville City Ordinance #10-8 and policies for issuing permits to work in the public right-of-way. These permits control excavation and construction operations. It is also implemented to cover special requirements for work in general, maintenance, private construction, and additions to utility systems in the public right-of-way. Nothing in this document will be construed as taking precedence over Ordinance #10-8.
 - a. Application: All conditions in this specification apply to all construction and maintenance work performed in the public right-of-way.
 - b. Revisions: This specification is subject to revision. The latest revision will always apply.
 - c. For the purpose of this specification, certain words and phrases are defined as in Springville City Ordinance #10-8 unless it shall be apparent from the context that different meaning is intended.

1.2.2 Policies:

- 1) Policy for Permit Required for Work in the Public Right-of-Way: It shall be unlawful to: interrupt or alter vehicular and pedestrian traffic, construct, reconstruct, or alter any opening, excavation, tunnel, sidewalk, curb gutter, driveway, street, or to perform any other work of any kind to the public right-of-way which will result in physical alteration thereof unless such person shall first have obtained a permit for the performance of such work and said work shall be performed in conformity with the terms and provisions of Springville City Standard Specifications and Ordinance #10-8 and of the permit or permits issued hereunder, accept as hereinafter specifically provided.
- 2) Policy for Permit Required for Occupation of Street with Building Material: It shall be unlawful for any person to occupy or use any portion of a public right-of-way for the storage of construction or landscaping material and/or equipment without first making application for and receiving a permit from the City. The permit may set forth such restrictions as required by ordinance or by the City Engineer. No fence construction pursuant to these ordinances and no building material shall remain in place in

any public right-of-way after the ending date of the permit, unless said permit is extended by the City Engineer.

- 3) Policy for Permit Required for Scaffold, Barricades Over/or in the Public Right-of-Way: It shall be unlawful for any person to erect, maintain, or use any scaffold, fence or any other temporary structure over or in the public right-of-way without first obtaining a permit for that purpose and paying the fee for such permit.
- 4) Policy for Permit of Water Service Line Replacement: Replacement of water line service from meter located in the public right-of-way requires a permit.
- 5) Policy for Required License and Bond: Persons desiring to perform work in the City's public right-of-way shall be properly licensed in the State of Utah and post a performance bond on a form provided by the City. A single bond may be posted by a permittee to guarantee performance for one or more permits if approved by the City Engineer and agreed to, in writing, by the bonding company. Refer to ordinance #10-8 and consolidated fee schedule.

Note: The City Engineer will review the license type to ensure it is applicable to the work being performed.

Exception: A license shall not be required by the City when the permittee is a property owner performing work in an area which abuts only his property of residence and the work does not exceed 500 square feet of drive approach, or 100 linear feet of sidewalk, or installing a sprinkler system.

- 6) Policy for Applications for Permits: Any person desiring to perform any work of any kind described in Ordinance #10-8, shall be subject to this specification and shall make application for a permit. Such application shall be filed with the Public Works/City Engineering Department on the form provided by the City. Any work involving installation or alteration of a permanent facility or structure in the public right-of-way will require the filing of engineered plans, traffic plans, and specifications showing the proposed work in sufficient detail to permit determination of such relationship and compliance, and the application shall not be deemed approved until such engineered and traffic plans or sketches are filed and approved. The City Engineer may deny issuance of permits to contractors, utility companies, or other permit Applicants who have shown by past performance that in the opinion of the City Engineer they will not consistently conform to this specification, Springville City standard specifications, or the requirements of ordinance #10-8. City Engineer may also require construction drawings and specifications for any permit application.
- 7) Policy for Requirement of Traffic Plan: Prior to City issuing a permit, a traffic plan must be submitted by the permittee for review and approval by City traffic personnel. Traffic plan is to be in conformance with current "MUTCD" and approved prior to excavation, construction, or any occupation of the Public right-of-way.
- 8) Policy for Commencement of Work: It is unlawful for any person to commence work in the public right-of-way until the City has approved the application and until a permit has been issued for such work, except as specifically provided to the contrary in this specification. Duration of the permit shall be set at the time of issuance of the permit. If work is not completed in forty-five (45) calendar days, the permit will expire. An extension may be applied for and must be issued prior to commencement of any further work.
- 9) Policy for Assessing Permit Fees: The City shall charge and the Permittee shall pay upon issuance of the permit, fees for costs associated with the work performed under the permit as outlined in the Fee Schedule adopted by the City Council. Such costs could include costs for reviewing the project and issuing the permit, inspections of the project, deterioration of the Public Right-of-Way, or diminution of the useful life of the Public Right-of-Way, and other costs to the City associated with the work to be done under the permit. All costs shall be assessed in a non-discriminatory manner.

- a. City Engineer may waive permit fees as outlined in this specification.
- b. Additional charges to cover the reasonable costs and expenses of any required engineering review, inspection, and work site restoration associated with each undertaking may be charged by the City to each permittee, in addition to the permit fee.

10) Policy for determining when “Permit Waivers” can be granted: Working in the public right-of-way without a permit violates Ordinance #10-8, unless the permit is waived by the City Engineer. Notwithstanding the waivers granted below, all persons working in the public right-of-way shall properly protect travelers thereon by compliance to the current Manual of Uniform Traffic Control Devices (MUTCD).

A “permit waiver” does not preclude the requirement of a traffic control plan approved by the City Engineer when traffic must be routed around or through construction sites. Waivers can be granted by the City Engineer when any of the following conditions occur:

- a. When routine maintenance work which is being done by City, State, County or public utility company personnel and work does not involve excavations in the City's public right-of-way, i.e., crack sealing, street resurfacing, snow plowing, sanding, salting, sweeping, garbage collection, storm drain cleaning, leaf pick up, above-grade work, street striping etc.
- b. Landscaping and Landscaping Maintenance.
- c. When work involves the installation of a sprinkling system, provided such work does not require the excavation of park strip area in excess of twenty-four (24) inches and provided such work does not result in usage of heavy equipment or cause damage to the public facilities and landscaping in the public right-of-way outside of the work area. Heavy equipment in this regulation means any tools other than hand tools and a power trencher as described in landscaping definitions.
- d. When minor adjustment to utility meter, valves, or manholes in the park strip area is required and provided that said adjustment does not result in:
 - i. excavation in the park strip area in excess of twenty-four (24) inches in depth or fifteen (15) square feet in area;
 - ii. Any alterations or damage to the public or private facilities.
 - iii. the use of heavy equipment,
- e. When a permittee allows other contractor or utility companies to perform work in the said permitted trench limits.
- f. When authorized materials are stored in the public right-of-way in compliance to the provisions of the Manual of Uniform Traffic Control Devices (MUTCD).

11) Policy for Issuing “No Fee” Permits: City Engineer reserves the right to issue “no fee” permits for work in the public right-of-way. A “no-fee” permit does not preclude the requirement of a traffic control plan approved by the City Engineer, nor does the fee waiver preclude notification for inspection forty-eight (48) hours in advance. The City Engineer may waive permit fees or penalties or portions thereof when he/she determines that such permit fee or penalty:

- a. Pertains to construction or rehabilitation of housing for persons whose income is below the median income level for the City; or
- b. Pertains to an encroachment on the Public Right-of-Way involving a beautification project which furthers specific goals and objectives set forth in the City’s strategic plan, master plans, or other official documents, including decorative street lighting, building facade lighting, flower and planter boxes, and landscaping.

12) Policy for Revoking "Permit Waivers" or “No Fee Permits”: "Permit Waivers" and “No Fee Permits” may be revoked by the City Engineer if the work is unsafe, defective or requires action or supplemental inspection by the City Engineer. Prior to revocation, the City Engineer will serve written notice defining the problems encountered and the time the permittee has to correct the problem, except for the

case of immediate safety, where a stop work order will be issued by the City Engineer. If the work is not satisfactorily corrected, in the time specified, the "permit waiver" will be revoked and the permittee will be required to secure a "Fee Permit" before proceeding with the work.

- 13) Policy for Completion of Work by City and Liability for Costs: If the work is unduly delayed by the permittee, or if the public interest or safety so demands, the City retains the authority to restore the public right-of-way to active use by providing backfill, road base, asphalt paving, concrete, etc. as deemed necessary by the City Engineer. The City shall do the work only after written notice has been given to the permittee and the permittee fails to respond to the City Engineer's request within the time frame outlined, except when public safety is jeopardized. The time, material, and equipment cost of such work incurred by the City shall be paid by the permittee or his bond.
- 14) Policy for Extending Permit Construction Time Limits: Subject to City Engineer's approval, permits which have expired may be extended up to 30 days from expiration date by submitting to the City Engineer acceptable reasoning for the delay. Extending time limits beyond normal working hours requires prior approval by City Engineer.
- 15) Policy When Construction Practices and Material do not Meet City Specifications: If the City Engineer determines construction practices and/or materials, i.e., backfill, road base, asphalt and/or concrete, do not meet City specifications, the City Engineer may:
 - a. Suspend or revoke the permit;
 - b. Issue a stop work order;
 - c. Order removal and replacement of faulty work;
 - d. Require an extended warranty period;
 - e. Negotiate a cash settlement to be applied toward future maintenance costs; and/or
 - f. Make demand upon the permittee's bond to correct faulty work.

Note: Settlement of trench backfill, road base, asphalt and/or concrete will be incontrovertible evidence of inadequate compaction of fill material.

- 16) Policy for Work in the Public Right-of-Way without a Permit: A stop work order may be issued by the City Engineer directed to any person or persons doing or causing any work to be done in the public right-of-way without a permit. Any person found to be doing any work in the public right-of-way without having obtained a permit, as provided in this specification, shall be required to pay a permit fee as well as penalties outlined in the fee schedule.
- 17) Policy for Other Highway Permits: Holders of Permits for work on highways owned or under the jurisdiction of other government entities, but located within the city limits, shall not be required to obtain permits from the City under the provisions of this ordinance, unless the work extends beyond the back side of the curb, or beyond any other designated jurisdictional boundary. **Any City permit shall not be construed to permit or allow work on another jurisdiction roadway within the City.**

1.2.3 General Conditions:

- 1) Right-of-way Improvement Drawings: Right-of-way improvement drawings shall conform with all respects to the City Engineers Design and Platting Standard Regulations. The City Engineer requires one (1) drawing showing proposed changes to curb, gutter, sidewalk, street pavement, or drainage facilities. A drawing and calculation for Surface and Storm Water Runoff must be included.
- 2) Utility Drawing Requirements: Whenever the work involves the extension, placement, or the relocation of a utility facility one (1) copy of the drawing shall be submitted to the City Engineer which details the location and type of proposed facility. Work involving maintenance of existing facility does not require

- a drawing. A drawing showing all existing utility lateral locations, sidewalk, edge of oil, and side lot lines is required on the permit form for any new laterals.
- 3) Permit and Drawings at Job Site: When the work is in progress, the permittee shall have at the work site a copy of the permit, traffic control plan and City approved drawings.
 - 4) Preconstruction Meeting: When trench length will equal or exceed fifty (50) linear feet or as determined by City Engineer, the permittee is required to schedule and attend a preconstruction meeting with City personnel prior to construction.
 - 5) Emergency Work: Maintenance of pipelines or facilities in the public right-of-way may proceed without a permit when emergency circumstances demand the work be done immediately provided a permit could not reasonably have been obtained beforehand. In the event that emergency work is commenced on or within any Public Right-of-Way of the City during regular business hours, the City Engineer shall be notified within one-half hour from the time the work is commenced. The person commencing and conducting such work shall take all necessary safety precautions for the protection of the public and the direction and control of traffic, and shall insure that work is accomplished according to City Engineering Regulations, the Manual on Uniform Traffic Control Devices (MUTCD) and other applicable laws, regulations, or generally recognized practices in the industry.
 - 6) Notification: It will be the responsibility of the permittee to notify Public Works, public utilities and businesses and residents affected by the work. Permittee shall coordinate work around school zones, garbage collection, postal service, and residents' homes. Except as otherwise allowed in emergency or road closure situations, Public Works will be notified by the permittee forty-eight (48) hours, prior to commencing work. The following information will be provided by phone: permit number, name, and telephone number of permittee, date/time work is to commence and cease, and location of work. For road closures permittee will be required to notify Fire Department and Police Department at least 48 hours in advance of all closures. Requirements and notifications shall be in accordance with Section 1.5.2.
 - 7) Resurfacing Time Limits:
 - a. Arterial or collector street pavement surfaces must be replaced within three (3) calendar days of excavation or on the same day in which backfill is completed. All other streets must be resurfaced within seven calendar days from beginning of excavation or on the same day in which backfill is completed. If work is expected to exceed the above duration, the permittee shall submit a detailed construction schedule for approval. The schedule will address means and methods to minimize traffic disruption and complete the construction as soon as reasonably possible. Work shall not proceed until the schedule is approved by the City Engineer and shall cease if the schedule is not maintained. In the event that the construction schedule or resurfacing time limit is exhausted and the work site is hazardous to citizens or impeding traffic, the City will take the necessary steps to make the work site safe and impose penalties daily, as outlined in the fee schedule.
 - b. Submittal: Upon the City's request, the permittee shall provide certification from an approved material testing laboratory that the materials to be installed under permit are within the City's specification. Only City approved materials shall be used in the work.
 - 8) Testing: Laboratory testing for materials, compliance, densities, and strength are the responsibility of the permittee. Testing service must be in accordance with Springville City standard specifications; Section 1.20. The City Engineer may require additional inspection or material testing as needed. At the City Engineer's discretion, testing requirements may be reduced based upon frequency of work performed in the City and successful testing performance in the past. All materials shall be tested for conformance to Springville City Standards, Specifications, and Drawings. Should it be necessary for the City to perform compliance testing, the City shall back charge the permittee for additional testing

- performed should any testing reveal noncompliance with City specifications. The back charge rate shall be the cost of time and equipment to conduct the testing. The City Engineer shall not back charge permittee if the testing confirms compliance with the City specifications.
- 9) Preconstruction Photographs/Video of Existing Public Right-of-Way Improvements: Prior to commencing the permit work, the permittee is encouraged to secure video tape or photographs which positively identify the condition and existing damages to the public right-of-way improvements such as curbing, sidewalk, landscaping and asphalt surfaces etc.
 - 10) Maintenance of Drainage Channels: Existing drainage channels such as pipes, gutters, or ditches shall be kept free of dirt, construction materials, or other debris such that natural flow will not be interrupted. When it is necessary to block or otherwise impede flow of the drainage channel, a proposed method of maintaining the flow must be submitted for approval by the City Engineer prior to a blockage of the channel. Permittee shall not allow dirt or other debris from his work to enter the City's storm drain system. Failure to comply may result in a penalty equal to cost incurred to correct or prevent damage. State and Federal penalties may be imposed as well.
 - 11) Failure to Comply; Default in Performance: Any permit may be revoked or suspended and a stop work order issued by the City Engineer, after notice to the permittee for:
 - a. Violation of any condition of the permit, the bond, or of any provisions of Springville City Ordinance
 - b. Violation of any provision of any other ordinance of the City or law relating to the work; or
 - c. Existence of any condition or the doing of any act which does constitute, may constitute, or cause a condition endangering life or property.

A suspension or revocation by the City Engineer, and a stop work order, shall take effect immediately upon entry thereof by the City Engineer and notice to the Person performing the work in the Public Right-of-Way. Notice to the Person performing the work shall be accomplished when the City Engineer has posted a stop work order at the location of the work. Subsequent to posting a stop work order, written notice will be mailed, return receipt requested, to the address indicated by the Permittee on the permit.

Whenever the City Engineer finds that a default has occurred in the performance or any term or condition of the permit, written notice thereof may be given to the principal and to the surety on the bond. Such notice shall state the work to be done, the estimated cost thereof, and the period of time deemed by the City Engineer to be reasonably necessary for the completion of the work.

In the event that the surety (or principal), within a reasonable time following the giving of such notice (taking into consideration the exigencies of the situation, the nature of the work, the requirements of public safety and for the protection of Persons and property) fails either to commence and cause the required work to be performed with due diligence, or to indemnify the City for the cost of doing the work, as set forth in the notice, the City may perform the work, at the discretion of the City Engineer, with City forces or contract forces or both, and suit may be commenced by the City against the Permittee (contractor) and bonding company and such other Persons as may be liable, to recover the entire amount due to the City, including attorney fees, on account thereof, in the event cash has been deposited, and suit brought for the balance due, if any.

1.2.4 Protection of Public During Construction:

- 1) Conformance to Existing Laws: The permittee shall be responsible for being fully informed of all Federal, State, and local laws, ordinances, rules and regulation which, in any manner, affect the work, and at all times shall observe and comply with such laws, ordinances, rules and regulations.
- 2) Traffic Interruption: Construction operations will be conducted in a manner that will minimize interference or interruption of roadway traffic, except during emergency conditions, or. Construction

operations such as excavation, backfill, and pavement restoration on arterial/major collector streets shall be discouraged during peak traffic hours of **7:00 to 9:00 a.m. and 3:00 to 6:00 p.m.** unless authorized in writing by the City Engineer. Permittee shall notify all local Emergency Response Services in the City forty-eight (48) hours in advance of all road closures.

- 3) Manual of Uniform Traffic Control Devices: All provisions of the current "MUTCD" shall be adhered to. This manual provides regulations concerning traffic control, construction barricades, road closures, public and private access, and traffic control signing. Traffic control devices, as required by the "MUTCD", must be in place before traffic disturbance or excavation begins. The devices shall be maintained throughout the construction period and not removed until all equipment and materials are removed, excavation is backfilled, and temporary or permanent surface is installed. Traffic Engineer may require certified traffic control personnel during set up and tear-down of all traffic control devices. Lighted early warning arrow boards will be required on all major arterial and collector streets. The permittee shall not obstruct the view of any traffic control devices. All disturbed traffic control devices shall be immediately replaced, cleaned or repaired as directed by the City.
- 4) Public Access: Permittee shall provide free and unobstructed access to all pedestrian crosswalks, handicap access ramps, driveways, mailboxes, trash receptacles, fire hydrants, water gates, valves, manholes, drainage or other public service structures and property that may be required for emergency use. Permittee shall not remove such public service facilities and property or relocate same without proper coordination with the authorities charged with control and maintenance of same. Barricades in conformance with "MUTCD" or covered walkways for the protection of the general public shall be provided whenever any work or storage of materials is being done.
- 5) Private Access: Temporary, all-weather roadways, driveways, walks, ADA access ramps and private rights-of-way for vehicles and pedestrians shall be constructed and continuously maintained by the permittee when public facilities are disturbed or when required by this specification or the permit.
- 6) Contractor Information: When personnel and equipment are not on-site, permittee shall clearly post on barricades in letters two (2) inches high, emergency information consisting of the name and emergency telephone number of permittee, bearing such information, be placed at every job site and maintained until the work is complete and formally accepted by the City. Copies of the permit shall be available from the City Engineer and be open to public inspection during office hours.
- 7) Right-of-Way Excavation in Winter: Excavation of City right-of-way during winter months (herein as defined as October 15 to April 15) will be allowed only if the work is a new service connection, required maintenance, emergency, or otherwise approved by the City Engineer. Permanent repair of City right-of-way excavated in the winter may be delayed for 60 days or 90 days with an approved extension but in no case later than twenty (20) days from the re-opening of the hot mix plant, provided the Permittee installs and maintains a temporary asphalt surface until such time as the permanent surfacing is accomplished. Permittee must submit information concerning the source, availability and type of patching material prior to obtaining a permit. Warranty will not commence until the temporary asphalt patching has been removed and a permanent surface is installed per Chapter 4, Division 1, Sub-Section G.

1.2.5 Excavation Operation:

- 1) Refer to Springville Standard Specifications, Division 2 - Trench Excavation and Backfill, for all excavation requirements.
- 2) Locating and Protecting Existing Utilities: The permittee shall notify Blue Stakes (1-800-662-4111) at least two (2) working days prior to commencing work, and use extreme caution to avoid conflict, contact or damage to existing utilities such as water lines, storm drain lines, power lines, gas lines, street lights, fiber optic lines, telephone lines, television lines, sewer lines, poles and appurtenances during the course of construction.

- 3) Protection of Paved Surfaces Outside of Excavation Area: In order to avoid unnecessary damage to paved surfaces, backhoes, outriggers, track equipment or any other construction equipment that may prove damaging to asphalt are required to use rubber cleats or paving pads when operating on or crossing said surfaces.
- 4) Jacking or Boring of Buried Conduits: Jacking or boring of service line laterals under paved surfaces is preferred to trench excavation and may be required in some City Streets as designated by City Engineer. If open excavation for service laterals is requested in a street which was paved or resurfaced within the last three (3) years, an engineering evaluation and explanation of why jacking is not feasible shall be presented to the City Engineer. City Engineer shall approve or disapprove the application based on the merits of the arguments presented.
- 5) Cutting Pavement: All pavements shall be cut in neat vertical straight lines prior to excavation. All excavations within thirty (30) inches of any structure, concrete, or edge of existing pavement surface shall remove and replace permanent surfacing to the concrete or structure. If more than 50% of the permanent surfacing of a traveled lane is impacted by the excavation, the entire lane width will be required to be saw cut, removed, and replaced as per City standards. Trenching or excavation is not permissible within eighteen (18) inches of any concrete or structure, unless permitted by the City Engineer. Any surface or underlying pavement outside the trench which is undermined or damaged by the trenching operation shall be removed to a neat, straight line, and replaced. In some areas where native, clean sands are present the City Engineer may require that trenching exceeding five (5) feet in depth be required to remove and replace surfacing for a minimum of two (2) times the depth unless direct contact shoring is provided to fully support the trench walls for full depth of the excavation.
- 6) Open Trench: All open trenching within the Public Right-of-Way shall be barricaded and covered in conformance with the Manual on Uniform Traffic Control Devices (MUTCD). No open trenching deeper than one and one half (1-1/2) inches will be allowed overnight. Any disturbed surfacing will be stable, compacted or temporarily surfaced at the end of each day. In certain circumstances the City Engineer may allow deeper trenches left overnight with proper protection, but in no case more than five (5) feet deep.

1.2.6 Backfilling Operation:

- 1) Refer to Chapter 2 - Trench Excavation and Backfill, for all backfilling requirements.
- 2) Compaction Equipment: The permittee shall not commence backfilling until approved compaction equipment is on-site. Should backfilling commence without having approved equipment on-site, the City Engineer may require the permittee to remove and replace the backfill materials and/or revoke the permit. Compaction equipment shall be capable of providing required compaction as outlined in Springville City Specifications.

1.2.7 Resurfacing:

- 1) Refer to Chapter 11 - Restoration of Surface Improvements, for all resurfacing requirements.
- 2) Pavement Restoration:
 - a. Excavations are prohibited in a street which has been paved, milled and overlaid, or reconstructed within the past three (3) years. In emergency situations which endanger life or property or that interrupt essential utility services excavations will require authorization by the City Engineer.
 - b. Trenching running parallel to the street (longitudinal) will require a 2” minimum mill and overlay to the adjacent lane line from the saw cut edge of the “T” patch trench repair for the purpose of locating the edge of the patch out of the wheel path. If the edge of the new “T”

- patch trench repair can be located in the central 5 feet of the lane (measured 2.5 feet either side of the centerline of lane), the 2” mill and overlay requirement may be waived at the discretion of the City Engineer. Longitudinal excavations of a street which has been paved, overlaid, or reconstructed within the past three (3) years requires authorization by the City Engineer and a half street 2” minimum mill and overlay to the center line of roadway from the saw cut edge of the “T” patch trench repair.
- c. Trenching running transverse (non-longitudinal, as determined by the City Engineer or his authorized representative) to the street will require a “T” patch restoration as shown in the Standard Drawings. Transverse excavations of a street which has been paved, overlaid, or reconstructed within the past three (3) years requires authorization by the City Engineer and a “T” patch restoration a minimum 2.5-feet beyond the trench limits (initial cut). The 2.5-foot “T” patch shall extend on all sides of the excavation and will be constructed in the same manner as the standard “T” patch shown in the Standard Drawings. The edge of the “T” patch trench repair running parallel to the centerline of road shall be extended to the nearest lane line as to locate the joint out of the wheel path.
 - d. Just prior to the conclusion of the one (1) year warranty period crack seal shall be applied along the perimeter of the trench patch including along lip of gutter if required by the City.
- 3) Restoration of Right-of-Way Improvements: All improvements and appurtenances impacted or damaged by the permittee shall be restored or replaced to an acceptable condition, equal in size, line and grade by the permittee. All restoration shall comply with Springville City Standard Specifications. Application for exceptions must be in writing and approved by the City Engineer.
- 4) Temporary Surfaces: Temporary asphalt surfacing will be utilized from October 15 through April 15. City Engineer may allow permanent surfacing in certain circumstances when weather permits and acceptable materials are available. Temporary surfacing shall be replaced as soon as conditions are suitable for permanent resurfacing but no later than twenty (20) days after re-opening of hot mix asphalt plants. If the permit expires before permanent surfacing is installed, a permit extension or a new permit will be required. Any expired permits with temporary surfacing in place later than May 15 will be assessed penalties, be required to obtain an additional permit, and will be required to replace the temporary surfacing within the time frame outlined. During the time temporary surfacing is in place, the surfacing shall be maintained by the permittee in good condition such that it does not create a tripping hazard or disrupt pedestrian or vehicular traffic. If the temporary surfacing is removed or destroyed, the surfacing shall be replaced and the surrounding area cleaned by the permittee. Temporary surfacing shall comply with the following:
- a. Temporary bituminous resurfacing three (3) inches thick shall be placed and maintained wherever excavation is made through street pavement or driveways. At major streets, intersections and other critical locations, a greater thickness may be required. In sidewalk areas, the temporary bituminous resurfacing shall be at least three (3) inches thick. When asphalt placement cannot be installed, minimum one (1) inch thick plating shall be temporarily installed over the excavation plus one (1) ft. minimum overlap on all sides and secured in place by tack welding or underpinning so as to eliminate displacement of the plates. The bituminous mixture used for temporary trench resurfacing may be furnished from stockpiles or directly from the plant mixer and may be laid hot or cold, at the option of the permittee. Asphalt millings are not allowed.

1.2.8 Environmental Control:

- 1) Dust and Debris: Permittee shall control dust and debris at the work site, adjacent neighborhoods, and right-of-ways at all times. If necessary, wet down dusty areas with water and provide containers for debris. The City Engineer may issue a stop work order if dust and debris is not controlled. Immediate stop work order with penalties may be issued for tracking mud, soil or debris into a public right-of-way or for washing any contaminant or debris into any storm drain, ditch, channel, pipe or gutter, etc. To

rescind the stop work order, the City Engineer may require facilities to be installed such to prevent further tracking of soil or debris into any public right-of-way.

- 2) Noise: Construction activities shall be limited to normal working hours between 7:00 a.m. and 7:00 p.m. unless otherwise approved or restricted by the City.
- 3) Clean up: Permittee shall remove all equipment, material, barricades and similar items from the right-of-way. Areas used for storage of excavated material shall be smoothed and returned to their original contour. Vacuum sweeping or hand sweeping is required when the City determines current cleaning method is ineffective or inadequate.
- 4) A land disturbance permit will be required of the a permittee for construction activities disturbing more than 10,000 square feet of land or activities that may affect sensitive areas (including lakes, streams, river sand wetlands) as determined by the City Engineer or his authorized representative.

1.2.9 Guarantees:

- 1) Street Maintenance: After completion of the work, the permittee shall exercise reasonable care in inspecting and repairing any injury or damage to public and private facilities resulting from work done under the permit. The obligation of permittee to repair work done under the permit shall continue for a period of one (1) year following completion of said work, or in the event of repairs thereto, **one (1) year from the date of the repairs.**
 - a. Upon notice from Public Works, the permittee shall repair damage to public or private facilities resulting from damages or failure of work done under the permit. All repairs are to be done in conformance with the Springville City Standard Specifications or the utility owner as outlined by the City Engineer, at the sole cost of the permittee.
 - b. In the event acceptable arrangements are not made by permittee within seven (7) working days after notice, Public Works may cause such repairs to be made and charge all costs including legal fees, penalties, time, equipment and material related costs to the permittee. By acceptance of the permit, the permittee agrees to comply with the above. The City will notify the permittee of costs prior to ordering or utilizing permittee’s bond with the City.
- 2) Liability Insurance: Permittee shall be responsible for any and all claims and liabilities for damages caused by any of the work permitted or caused by permittee’s failure to perform his obligations under the permit. In the event such claim for damages is made against or imposed upon the City, or any department, officer, or employee thereof, permittee shall, and by acceptance of the permit agrees to defend, indemnify and hold them harmless from such claim or liability in accordance with City Ordinance #10-8 “Excavation Permit.” The permittee agrees to take out such general liability insurance in the amount listed below:

General Liability Insurance*

MINIMUM COVERAGE	MINIMUM AMOUNT
Per Occurrence	\$1,000,000.00
Aggregate	\$2,000,000.00

*The City may increase or decrease the minimum insurance limits based on the potential liability of the project.

Before a permit is issued, the Applicant shall furnish to the City evidence that such Applicant has a comprehensive general liability and property damage policy that includes contractual liability coverage endorsed with the limits and provisions or with such alternative limits and provisions as may be approved by the City.

- 3) **Bonds:** The bond amount shall be a minimum of **\$10,000.00** and shall remain in full force and effect for a period of one year from the date the work is completed. A single bond may be posted by a permittee to guarantee performance for one or more permits if approved by the City Engineer and agreed to, in writing, by the bonding company. The minimum bond amount shall be increased based on the number of permits issued to each permittee over the past three year period, as per the following chart, subject to review and approval of the City Engineer:

<u>Number of Permits in Past 3 Years</u>	<u>Required Bond Amount</u>
1-10	\$10,000.00
11-20	\$15,000.00
21-50	\$20,000.00
51 or greater	\$25,000.00

The City may require an additional bond upon determination by the City Engineer that the scope of the work exceeds the minimum bond amount, in which case, the total bond amount will be equal to 125% of the scope of the work as estimated by the City Engineer. Conditions, Requirements and Warranty shall comply with Ordinance #10-8.

1.3 CONTRACTOR AND CONSTRUCTION PLAN APPROVAL

Before a Contractor performs any work within the City, the City shall approve the Contractor. Approval is granted for a period of one (1) year upon submission of the following:

- 1) Proof of a current Utah State Contractor’s License. Work will be restricted to that authorized by the license.
- 2) Proof of comprehensive general liability insurance. Bodily injury insurance will be in an amount of not less than one million dollars (\$1,000,000.00) for any one occurrence. Property damage insurance will be in an amount of not less than one million dollars (\$1,000,000.00) for any one occurrence and shall include underground exposure. Combined liability insurance will be in an amount of not less than two million dollars (\$2,000,000.00) for any one occurrence.
- 3) The performance bond owing to the City will be in effect for a period of one (1) year or one (1) year after the completion of work performed by the contractor, whichever is greater.
- 4) Submission of an approved Land Disturbance Permit with the City.

The City Engineer / Public Works Representative shall approve construction plans before any work begins. Developers/Contractors proceeding with work without such approvals shall have the project shut down until such approvals are obtained. Repeated offenses may result in the Contractor losing his pre-qualification to perform work in the City.

1.4 PRE-CONSTRUCTION MEETINGS

A pre-construction meeting with the Developer and the Contractor(s) involved in construction **within the public right-of-way** shall be held with the City Engineer / Public Works Representative prior to commencement of any work. The location of the meeting shall be at the Springville City Offices, 110 South Main Street, Springville, Utah 84663. The following items shall be furnished at the meeting:

- 1) A detailed outline showing the sequences of construction of principle items of work. The outline shall show the beginning and ending dates of the major items of work on the Project.
- 2) A list of names, titles, addresses, and telephone numbers of the Developer/Contractor's responsible personnel, indicating those who may be reached outside normal working hours.
- 3) A list of Sub-Contractors and Materials Suppliers to be involved with the project and the items of work they are going to perform or furnish materials for. The City will notify the Developer/Contractor of any concerns or pre-qualification deficiencies of the companies they plan to use.

Other items may be discussed at this pre-construction conference as determined by the Public Works Representative/ City Engineer. Official minutes of this meeting as prepared by the City Engineer / Public Works Representative shall become part of the project file for the project.

1.5 CONSTRUCTION OF PUBLIC IMPROVEMENTS

The Developer/Contractor shall perform in accordance with the approved construction documents and terms of the development agreement, and the Standard Specifications and Standard Drawings in effect at the date of City approval. The work shall be done in a timely manner.

1.5.1 Responsibility of the Developer:

The developer is responsible for the construction of the entire development, including all required off-site improvements, in accordance with the approved construction documents and development agreement until it is finalized and accepted by the City.

1.5.2 Construction Survey:

All improvements within the public right-of-way, including but not limited to utilities, placement of concrete, road surfacing, etc., shall be surveyed for location and elevation by a professional land surveyor licensed in the State of Utah or by someone under the direct supervision of a professional land surveyor licensed in the State of Utah.

All construction survey shall comply with the following requirements:

- 1) Stake Information - The stake shall include stationing, offset, and cut/fill information on the front of the stake (facing construction area) and the hub elevation on the back of the stake written legibly in permanent marker.
- 2) Concrete Curb and Gutter - Shall be staked at 50-foot intervals. Vertical curves shall be staked on 20-foot intervals. The offset shall not be greater than 5 feet, unless a greater distance is approved by the City Engineer.
- 3) Pressure Pipelines – Shall be staked at every fitting, bend, tee, etc., at all connections to existing pipelines, and as needed.
- 4) Gravity Pipelines – Shall be staked at all junction structures and as needed.
- 5)

1.5.3 Inspections:

All work within the public right-of-way shall be inspected by the Public Works Representative prior to the following:

- 1) Backfilling and compacting.
- 2) Placing concrete and asphalt
- 3) Placing any underground piping
- 4) Making any connection into a City utility line
- 5) Other work done in a public right of way or public easement.

1.5.4 Notification of Needed Inspections:

- 1) All inspections must be performed during regular working hours. Developer/Contractor is responsible to check with Public Works to verify seasonal inspection working hours.
- 2) Inspection performed during regular working hours must be requested a minimum of two (2) hours in advance.
- 3) Inspections requested after 3:30 p.m. must be requested by 1:00 p.m. on the day of the inspection.
- 4) Inspections needed on the weekend must be requested a minimum of 48 hours in advance.

- 5) All after-hours inspection requests are subject to approval.
- 6) A charge may be assessed for inspection call backs.
- 7) An additional charge will be assessed for inspections performed outside of the normal working hours in accordance with the City's adopted fee schedule.
- 8) Before burying any subsurface infrastructure (i.e. pipeline or fittings) Contractor shall contact the assigned Public Works Representative/Inspector to allow for inspection and GPS-survey of all items to document location. **Items buried without City approval will be re-excavated by the Contractor at no additional cost to the City.**

1.5.5 Definition of "City Engineer / Public Works Representative":

The term "City Engineer / Public Works Representative" as used in these specifications refers to the Public Works Director, Public Works Inspector, City Engineer, Engineering Division staff and others as designated by the City Engineer.

1.5.6 Conflict:

These Standard Specifications and Standard Drawings are the minimum requirements of the City of Springville. In the event that any provisions herein conflict with general industrial standards, or with other requirements specified by the City, the more stringent of the standards will apply.

1.5.7 Variance:

These Standards and Specifications were developed for use in the design and construction of public improvements, development activities and utility work within the public right-of-way. The intent of this document was to set a standard of design/construction for the Springville City that is consistent, effective, and efficient, and protects public safety.

It will at times be desirable and/or necessary to vary from the standards in this document to produce a good product. Deviations or variances from these standards may be considered; however, it shall be the responsibility of the applicant to demonstrate to the satisfaction of the City Engineer or his authorized representative the proposed variance meets or exceeds the minimum acceptable criteria and intent of the standard. Variances from these criteria shall be reviewed and approved on a case-by-case basis with the civil plan submittal.

When it becomes necessary or desirable to vary from the standards presented in this document, a variance may be requested from the City Engineer. Such a request shall be made in writing and will include:

1. The standard to be varied.
2. The proposed variation.
3. Justification for the variance.

Upon application, a specific variance to a substantive requirement of these standards may be granted, subject to the following criteria.

- 1) A variance may be granted when all of the following conditions are satisfied:
 - a. A literal application of the substantive requirement would result in an unreasonable hardship to the applicant that is not self-imposed or economic;
 - b. The alternative proposed by the applicant shall be adequate for the intended use and shall not substantially deviate from the performance that would be obtained by strict enforcement of the standards; and
 - c. The granting of the variance will not be detrimental to the public health, safety or welfare, nor injurious to adjoining or neighboring property.

1.5.7 Amendments:

Amendments to these standards may be requested by writing the City Engineer with details and justification for an amendment. The City Engineer will meet periodically to discuss proposed amendments and make recommendations to the City Council.

1.5.8 Acceptance of Improvements:

No work which may be defective in its construction or deficient in any of the requirements of these Standard Specifications will be accepted. The presence of the City Engineer / Public Works Representative shall not relieve the Contractor of the responsibility for the proper execution of the work in accordance with all requirements of these Standard Specifications and applicable Development Agreements. Compliance is a responsibility of the Contractor/Developer and said responsibility shall not be avoided by any act or omission on the part of the City Engineer / Public Works Representative.

1.6 ELECTRONIC AND RECORD DRAWINGS

Plat and improvement drawings shall be furnished electronically to the City in Adobe Acrobat Portable Document Format (*.pdf). These electronic files shall be provided to the City after final approval but before recording of the Plat.

Prior to construction of any improvements, the developer will pay an “as-built” fee as established in the City’s fee schedule. The purpose of this fee is to cover the costs of City staff surveying the “as-built” improvements and will take the place of the Developer/Contractor providing “record drawings.”

1.7 TEMPORARY SERVICES

Any temporary services and utilities such as telephone, electrical, water toilet facilities, etc., shall be the responsibility of the Developer/Contractor.

1.8 CODES AND STANDARDS

Where codes and standards are referred to they shall be current, approved copies. It shall be the duty of the supplier of any material on this work to submit evidence, if requested, that its material is in compliance with the applicable codes and standards.

1.9 STATE AND LOCAL LAWS

The Developer/Contractor shall conform to all applicable state and local laws in carrying out its obligations under the Contract.

This shall include, but is not limited to, compliance by the Developer/Contractor with the requirements of Chapter 30, of Title 34, of the Utah Code Annotated, 1953 as Amended. If the provisions of Section 34-30-1, of the Utah Code Annotated, 1953 as amended, are not complied with, this Contract shall be void.

1.10 COMPLIANCE WITH GOVERNMENTAL REGULATIONS

The Developer/Contractor's personnel, equipment, and operations shall comply fully with all applicable standards, regulations, and requirements of existing Federal, Utah State, and Local governmental agencies. This shall include, but not necessarily be limited to, the following:

1.10.1 United States Occupational Safety and Health Administration Regulations:

Title 29 of the Code of Federal Regulations, Part 1926 (29 CFR Part 1926), Safety and Health Regulations for Construction.

1.10.2 Utah State Industrial Commission Regulations:

The Utah Occupational Safety and Health Act (1973) and Employer-Employee Safe Practices for Excavations and Trenching Operations (Jan. 1, 1974), as published by the Utah State Industrial Commission, including any and all amendments or revisions effective prior to performance of the work.

1.10.3 City Ordinances:

The Developer/Contractor shall be required to comply with all Springville City Ordinances.

1.10.4 UDOT Requirements:

When crossing or working within Utah Department of Transportation rights-of-way the Developer/Contractor shall be responsible to obtain all necessary permits and comply with all appropriate UDOT regulations including applicable sections in "State of Utah Standard Specifications for Road and Bridge Construction," latest edition.

1.10.5 Permits:

The Developer/Contractor is responsible to obtain all required approvals and permits (including Land Disturbance Permit) applicable to this project. Developer/Contractor shall be subject to the conditions of all permits and agreements between the Owner and the permitting agencies.

1.11 FEDERAL, STATE, AND LOCAL INSPECTING AGENCIES

The site of construction is to be open at all reasonable times and places for periodic observation by accredited representatives of the Federal, State, and local agencies who have regulatory or supervisory authority over any part of the work proposed or regulated thereto.

1.12 PUBLIC SAFETY AND CONVENIENCE

The convenience of the general public and the protection of persons and property are of prime importance and shall be provided for by the Developer/Contractor during this project. The Developer/Contractor shall use every reasonable precaution to safeguard persons and property. Failure of the Owner or the City Engineer / Public Works Representative to notify the Developer/Contractor of any deficiencies in providing for public safety and convenience shall not relieve the Developer/Contractor from its responsibility. The Developer/Contractor shall be required to comply with the requirements of the **Manual on Uniform Traffic Control Devices (MUTCD)**.

1.12.1 Compliance with Rules and Regulations:

The Developer/Contractor shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets, or highways, to the use of public traffic. The Developer/Contractor shall, at all times, conduct its work so as to insure the least possible obstruction to traffic and normal commercial pursuits.

1.12.2 Road Closures and Obstructions:

No road shall be closed by the Developer/Contractor to the public except by express permission of the City Engineer / Public Works Representative. If conditions justify, the City Engineer / Public Works Representative may authorize the Developer/Contractor to close general traffic to not more than two (2)

City blocks at any given time. No such closure shall be made without authorization of the City Engineer / Public Works Representative. Closure of streets or highways shall be in conformance with the **MUTCD**.

1.12.3 Protection of the Traveling Public:

All obstructions within the public right-of-way shall be protected by signs, barricades, and lights where necessary for the safety of the traveling public in conformance with the **MUTCD**. Failure of the Owner or the City Engineer / Public Works Representative to notify the Developer/Contractor to maintain barricades, barriers, lights, flares, danger signals, or guards shall not relieve the Developer/Contractor from his responsibility. If flaggers and guards are required they shall be UDOT trained and shall hold current certification and shall be equipped with signs, flags, etc. as required by the Utah State Department of Transportation (UDOT) regulations.

1.13 CONFINEMENT OF WORK AND ACCESS TO RIGHT-OF-WAY AND EASEMENTS

The Developer/Contractor will be required to confine construction operations within the dedicated right-of-way for public thoroughfares or within areas for which construction easements have been obtained unless it has made special arrangements with the affected property owners in advance. The Developer/Contractor will be required to protect stored materials, lawn, trees, and other features located adjacent to the proposed construction site. During construction operations, the Developer/Contractor shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to their residences or places of business for a period exceeding eight (8) hours, unless the Developer/Contractor has made special arrangements with the affected persons prior to commencing work in the area.

1.14 NOTIFICATION OF RESIDENTS

All property owners and residents adjacent to the streets or easements affected by the construction shall be notified by the Developer/Contractor at least forty-eight (48) hours in advance of time construction begins. The Developer/Contractor can satisfy this requirement by placing a written notice on the door of each residence or business reading "Notice of Construction Operation. (Developer/Contractor) will be working on the construction of street improvements on your street starting about _____." The Developer/Contractor shall provide a copy of the notification form at the pre-construction meeting and the method to be used (hang on door, etc.)

1.15 WEATHER CONDITIONS

In the event of temporary suspension of work, or during inclement weather, the Developer/Contractor will, and will cause its Sub-Developer/Contractors to, protect any project work or materials against damage from the weather. If, in the opinion of the City Engineer / Public Works Representative, any Project work or materials become damaged by reason of failure on the part of the Developer/Contractor or any of its Sub-Developer/Contractors to so protect its work, such work or materials shall be removed and replaced at the expense of the Developer/Contractor.

1.16 LAND MONUMENTS

The Developer/Contractor shall preserve existing City, County, State, and Federal land monuments whenever possible. When these monuments cannot be preserved, the Developer/Contractor shall notify the owner of the monument and the City Engineer / Public Works Representative at least two (2) weeks in advance of the proposed construction in order that the monument owner will have ample opportunity to reference these monuments to verify location of later replacement by the Developer/Contractor. Monuments shall be reestablished by a professional land surveyor licensed in the State of Utah. The cost of the replacement of these monuments shall be the responsibility of the Developer/Contractor. When a county monument is disturbed a "Utah County Monument Excavation Permit" must be obtained. Work may not proceed until the procedure and requirements outlined in the Permit have been followed and complied with.

1.17 SOURCE OF MATERIALS

All materials furnished or incorporated in this project shall conform to the requirements of these Specifications.

The Developer/Contractor shall acquire the necessary rights, at its own expense, to take material from aggregate sources and to use properties for plant site, hauling roads, and other purposes.

The Developer/Contractor may select areas for disposal of surplus materials; however, the Developer/Contractor will be responsible for acquiring the necessary right, at its own expense, to use the property for such purpose.

1.18 OPERATION AND MAINTENANCE MANUALS

The Developer/Contractor shall furnish the City Engineer / Public Works Representative with two (2) sets of all operation and maintenance manuals, drawings, diagrams, etc., for all pumps, motors, control panels, valves, meters, etc., for use in the Operation and Maintenance Manual.

1.19 INTERFERING STRUCTURES, UTILITIES AND FACILITIES

The Developer/Contractor shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. While these structures and utilities may be shown on the improvements plans, the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented simply as a guide to possible difficulties. The Developer/Contractor shall notify all utility offices concerned at least forty-eight (48) hours in advance of construction operations in which a utility agency's facility may be involved. Notification to Blue Stakes does not necessarily cover all buried lines. This shall include, but not be limited to: irrigation, water, telephone, electric, sewer, storm drain, gas, and cable television. The Developer/Contractor shall be responsible for any and all changes to, relocation of, or re-connection to public utility facilities encountered or interrupted during the execution of the work, and all costs relating thereto shall be at the Developer/Contractor's expense. The Developer/Contractor shall contract with and pay Public Utility Agencies for work required in connection with all utility interference's and handle all necessary notifications, scheduling, coordination and details.

It shall be the responsibility of the Developer/Contractor to relocate and expose all existing underground structures and utilities in such a manner as to prevent damage to the same. Any structure or utilities damaged by the Work shall be repaired or replaced at the Developer/Contractor's expense.

If the Developer/Contractor encounters existing structures that will prevent construction, it shall notify the City Engineer / Public Works Representative before continuing with the construction in order that the Developer's Engineer or City Engineer / Public Works Representative may make such field revisions as necessary to avoid conflict with the existing structures.

1.20 MATERIAL AND COMPACTION TESTING

During the course of the work, a UDOT certified Geotechnical Engineer/Testing Company shall perform such tests as are required to identify materials, and to determine the following: gradation, compaction characteristics, moisture, and density of all fills in place. The Geotechnical Engineer/Testing Company shall also perform all tests required by these specifications.

These tests will be used to verify that the construction conforms to the requirements of the specifications. Such tests are not intended to provide the Developer/Contractor with the information required by them for the proper execution of the work and their performance shall not relieve the Developer/Contractor of the necessity of completing the construction in accordance with these specifications and Standard Drawings. Copies of the tests shall be furnished to the City upon completion of each test. Developer/Contractor will get copies of the test results from the company performing the tests. Before final release of the bond, the UDOT certified Geotechnical Engineer/Testing Company

shall furnish the Public Works Representative/Engineer with a letter certifying that the test results have been in compliance with these Standard Specifications and Drawings and that the recommendations set forth in the geotechnical report were carried out. "Open tests" shall have been retested and/or the resolution thereof specifically addressed in the letter.

Within the public right-of-way the in-place density shall be a minimum of 95% of laboratory standard the maximum dry density as determined by AASHTO T-180 (Modified Proctor). In other areas the in-place density shall be a minimum of ninety percent (90%) of the maximum dry density as determined by AASHTO T-180 (Modified Proctor).

If the required relative density is not attained, Developer/Contractor will be required to make any adjustments in compaction equipment, thickness of layers, moisture content and compactive effort necessary to attain the specified minimum relative density.

1.20.1 Guarantee:

- 1) In addition to the Guarantee Provisions, as outlined in the General Conditions, the following applies:
 - a. Settlement of the fill material within the contract guarantee period is incontrovertible evidence of inadequate compaction of backfill.
 - b. Correct the deficient conditions, including the replacement and/or repair of the surfacing materials and damaged facilities.
 - c. The method of construction repair shall be proposed in writing by the contractor for approval by the Engineer prior to correcting the failed condition.

1.20.2 Test Schedule:

- 1) Gradation Analysis: As required if in the opinion of the Engineer the material varies from that as approved.
- 2) Proctor Analysis: As required if in the opinion of the Engineer the material varies from that as approved.
- 3) Density Testing: A minimum of two (2) tests are required.
 - a. Curb and gutter with grade: One (1) random test per lift per 200 lineal feet.
 - b. Sidewalk: One (1) random test per lift per 200 lineal feet.
 - c. Trenches: One (1) random test per lift per 200 lineal feet.
 - d. Roadways: One (1) random test per lift per 100 linear feet measuring along centerline.
 - e. Landscaped strips: No testing required.
 - f. Structural Backfill: Comply with Chapter 2 – Trench Excavation and Backfill.
 - g. Additional testing may be required by Engineer.

1.20.3 Duties of Contractor:

- 1) Furnish labor to assist testing agency in obtaining and handling samples at site or sources of materials.
- 2) Advise testing agency and Engineer 48 hours in advance of backfilling operations to allow for testing of pre-placement conditions, completion of quality tests, and for assignment of personnel.
- 3) Contractor shall bear all costs associated with all remedial or additional work required to bring the material into minimum conformance with the specified degree of compaction and moisture content required as a result of failed density testing.

1.21 TELEVISIONING OF GRAVITY FLOW PIPELINES

Prior to the City accepting newly-constructed gravity flow pipelines the Contractor/Developer shall provide the City with a video of the televising of the pipeline (performed in the presence of the Public Works Representative). The televising equipment used must record on the video a continuous distance from the point of beginning.

1.22 LOT CORNER AND SUBDIVISION MONUMENT

All lot corners shall be marked with an approved type of metal peg at least 5/8” in diameter and twenty-four inches in length with a surveyor’s plastic cap installed on the exposed end. All lot corners adjacent to street frontage shall be projected to curb and gutter and indicated by a copper rivet in the top of the concrete curb. Corner markers and subdivision monuments must be installed prior to issuance of any building permits. A minimum of two (2) subdivision monuments are required on each subdivision plat with a clear line of sight between any given two (2) monuments. Monuments shall be installed at all residential – collector/arterial intersections.

CHAPTER 2 - TRENCH EXCAVATION AND BACKFILL

2.1 GENERAL

This section covers the requirements for trenching and backfilling for underground pipelines. Unless otherwise shown or ordered, pipe shall be laid in an open trench. All incidental clearing, preliminary grading, structure removal, and benching shall be considered a part of the trenching operation.

2.2 SHEETING, BRACING AND SHORING OF EXCAVATIONS

All trench excavations shall comply with current Occupational Safety and Health Administration (OSHA) regulations.

The Developer/Contractor shall be fully responsible for the adequacy of methods and materials used in trench sheeting, bracing, shoring, and other systems provided to protect workers. Injury to or death of workers resulting from inadequate trench safety measures shall be the full and complete responsibility of the Developer/Contractor. All damages resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Developer/Contractor, and the Developer/Contractor shall perform all necessary repairs or reconstruction at its own expense resulting from such damage.

2.3 CONTROL OF GROUNDWATER

All trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater is above the bottom of any trench or bell hole excavation, such groundwater 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. When dewatering is required, the Contractor shall be required to obtain the Utah State Dewatering Permit (General Permit for Construction Dewatering & Hydrostatic Testing). Under no circumstances shall the sanitary sewer be used for disposal of trench water. Surface water shall be prevented from entering trenches as well.

2.4 TRENCH EXCAVATION

Excavation for pipelines shall be located as shown on the Drawings or as staked in the field. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

2.4.1 Authorized Over-Excavation:

Where ledge-rock, cobble rock, stones or other material render the trench material unsuitable for pipe bedding, as determined by the City Engineer / Public Works Representative, bedding material shall be imported and placed. The trench shall be excavated to a minimum depth of six-inches (6") below the bottom of pipe.

Where unstable material is encountered in the excavation, foundation material shall be required in order to stabilize the bottom of the trench. It is the Contractors responsibility in such cases to provide and place sufficient material to stabilize the bottom of the trench to allow for proper placement of the pipe.

2.4.2 Unauthorized Over-Excavation:

Any excavation carried below the elevation required to install the pipe as specified in these Specifications, or directed by the City Engineer / Public Works Representative, shall be considered to be unauthorized. Such excavation shall be backfilled in accordance with these Specifications for "Imported Granular

Material" and "Gravel Foundation for Pipelines and Pipeline Structures," all at the Developer/Contractor's expense.

2.4.3 Trench Width:

The trench shall be excavated such that the pipe is always centered in the trench. The minimum clear trench width at the horizontal diameter of the pipe must not be less than the outside diameter of the pipe plus twelve inches (12") on each side of the pipe.

Trench width for pipeline structures, valves, or other accessories shall be sufficient to leave at least twelve inches (12") clear between their outer surfaces and the trench. Backfill with earth under structures or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structures shall be backfilled in accordance with these specifications for "Imported Granular Materials," and "Gravel Foundation for Pipe & Pipeline Structures," at the Developer/Contractor's expense.

2.4.4 Trenches in Embankments:

Before laying pipes that are to be in fill or embankment areas, the embankment shall first be placed and compacted to the specified density to a depth of not less than two feet (2') above the top of the proposed pipe. After placing and compacting the embankment, the trench for the pipe or conduit shall be excavated through the fill and fine graded and the pipe installed as specified.

2.4.5 Placement of Excavated Material:

All excess material shall be hauled away from the construction site and disposed of in an area obtained by the Developer/Contractor and approved by the City Engineer / Public Works Representative. The Developer/Contractor shall be responsible for all rights-of-way, easements, and access associated with the disposal of excess excavated material. It shall further be responsible to obtain permission from the property owner or person controlling the property where the Developer/Contractor plans to dispose of excavated material. No compensation will be made to the Developer/Contractor for disposal of excess excavated material.

Non-excess excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters and irrigation ditches shall be kept clear or other satisfactory provisions shall be made for street drainage and continuity of irrigation.

Grading of the area surrounding the trenches, including excavated materials, shall be performed as necessary to prevent surface water from flowing into trenches, or other excavations. Control of groundwater shall be as specified in section 2.05, Control of Groundwater.

2.4.6 Fine Grading the Trench Bottom:

The bottom of the trench shall be accurately graded and prepared to provide uniform bearing and support on undisturbed soil or compacted granular bedding at every point along the entire length of the pipe. Bell holes shall be excavated after the trench bottom has been fine graded. Bell holes shall be only large enough to permit making the joints and to assure that any portion of the joint or bell does not support the pipe.

2.5 TRENCH BACKFILL

Trench backfill for piping consists of three (3) zones: foundation, pipe embedment, and backfill.

Foundation - is defined as the region below the pipe embedment.

Pipe Embedment - is a commonly used term that refers to the region including the bedding and pipe zones, or any region within one foot (1') of any pipe, pipeline structure, or accessory.

Granular Backfill - is defined as the region above the pipe embedment zone to the bottom of the structural street cross section.

All fill materials shall be compacted as specified in this section.

The City Engineer / Public Works Representative shall determine the suitability of excavated materials for use as foundation or backfill. When the excavated materials are not satisfactory the Developer/Contractor shall provide imported granular material.

2.5.1 Imported Granular Material:

Imported granular material for foundation, bedding, and backfill shall be cleaned crushed rock or gravel, free from sod, vegetation, and other organic or deleterious material. Slag will not be allowed in the pipe embedment. Imported granular material shall conform to the following gradation specifications:

- 1) Foundation Material: One hundred percent (100%) less than six-inch (6") and maximum of five percent (5%) less than three-quarter-inch (3/4"). Recycled concrete will not be allowed in the public right-of-way.
- 2) Pipe Embedment Material:
 - a. Storm Drain and Sanitary Sewer: Washed aggregate, maximum size one-and-one-half-inch (1 1/2"), minimum size three-quarter-inch (3/4"). Recycled concrete will not be allowed in the public right-of-way.
 - b. Culinary Water and Pressure Irrigation: Washed sand (for all mains and services, regardless of pipe material). Recycled concrete will not be allowed in the public right-of-way.
 - c. Washed Sand: Friable river or bank aggregate, free of loam and organic matter. Graded as follows.

Sieve	Percent Passing by Weight
3/8	100
100	1 - 10

- 3) Granular Backfill Material: Three-inch to four-inch (3"-4") well-graded engineered fill meeting A-1-a, (AASHTO M 145 or ASTM D3282). Recycled concrete will not be allowed in the public right-of-way.

Sieve	Percent Passing by Weight
4"	100
2"	80 -95
1"	55- 85
3/8"	40 – 70
No. 4	25 – 55
No. 10	20 – 50
No. 40	10 – 30
No. 200	2 - 10

AASHTO Soil Classification System (from AASHTO M 145 or ASTM D3282)											
General Classification	Granular Materials (35% or less passing the 0.075 mm sieve)							Silt-Clay Materials (>35% passing the 0.075 mm sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	---	---	---	---	---	---	---	---	---	---
0.425 (No. 40)	30 max	50 max	51 min	---	---	---	---	---	---	---	---
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	---		---	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min*
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			
*Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL - 30.											

Note (1): Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL - 30

2.5.2 Foundation Material Placement:

When over-excavation is authorized by the City Engineer / Public Works Representative, foundation material shall be placed in the foundation zone and below. The foundation material shall be placed so that the trench can be properly fine graded as specified. The foundation material shall be deposited over the entire trench width and compacted in layers. The layers shall have a maximum uncompacted thickness of six-inches (6”).

The material shall then be fine graded in accordance with the specification for fine grading herein.

2.5.3 Pipe Embedment Material Placement:

- 1) Storm Drain: After the pipe is in place, embedment material shall be placed at any point below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe up to one-half the diameter of the pipe (i.e. to the spring-line of pipe). (See Standard Trench Detail drawing.) Embedment material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Embedment material shall be scattered alongside the pipe and not dropped into the trench in compact masses.

- 2) Sanitary Sewer: After the pipe is in place, embedment material shall be placed at any point below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe up to one-half the diameter of the pipe (i.e. to the spring-line of pipe). Pipe shall then be “haunched” for the entire length of the pipe prior to placement of remaining embedment material. (See Standard Trench Detail drawing.) Embedment material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Embedment material shall be scattered alongside the pipe and not dropped into the trench in compact masses.
- 3) Culinary Water and Pressure Irrigation: After the pipe is in place, the embedment material shall be deposited over the entire trench width and shall have a maximum un-compacted thickness of eight-inches (8”) per lift. Each lift shall then be compacted to the specified density requirement before placement of additional lift(s). (See Standard Trench Detail drawing.) Embedment material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Embedment material shall be scattered alongside the pipe and not dropped into the trench in compact masses.

2.5.4 Granular Backfill Material Placement:

Granular backfill shall be from top of embedment material to the level shown on the Drawings. The backfill material shall be deposited over the entire trench width and shall have a maximum un-compacted thickness of twelve-inches (12”) per lift. Each lift shall then be compacted to the specified density requirement before placement of additional lift(s). (See Standard Trench Detail drawing.) Backfill shall be compacted by means of sheepfoot rollers, pneumatic tire rollers, vibrating rollers, or mechanical tampers.

2.5.5 Compaction:

Within the public right-of-way the in-place density shall be a minimum of 95% of laboratory standard the maximum dry density as determined by AASHTO T-180 (Modified Proctor). In other areas the in-place density shall be a minimum of ninety percent (90%) of the maximum dry density as determined by AASHTO T-180 (Modified Proctor).

If the required relative density is not attained, Developer/Contractor will be required to make any adjustments in compaction equipment, thickness of layers, moisture content and compactive effort necessary to attain the specified minimum relative density.

2.6 PRIVATE PROPERTY ACCESS AND RESTORATION

At road crossings or where existing driveways occur on a road, the Developer/Contractor shall make provisions for trench crossings either by means of backfill, tunnels, or temporary bridges.

Any disturbance to property caused by the Developer/Contractor’s activity shall be restored to the satisfaction of the owner of the property. If necessary, shrubs, fences, or other objects shall be removed carefully. If work must occur on a lawn, the lawn shall be cut to a width of two feet (2’) wider than the intended work area (one foot (1’) on each side). The lawn sod shall be stacked separately from and shall not be mixed with other excavated material.

After the sod is removed, if excavation is necessary, the topsoil shall be removed to a depth of twelve inches (12”), or the actual depth of the topsoil, whichever is less. The topsoil shall be stored separately from and shall not be mixed with other excavated material.

Following completion of the backfilling and the compaction of the trench, the Developer/Contractor shall replace topsoil, lawn sod, shrubs, fences, and other items that may have been removed from within the work area and shall clean up and remove any rocks, dirt or any other debris that remain from the construction work. The Developer/Contractor shall obtain a release from the property owner stating that the repairs have been made to the

satisfaction of the Owner. A copy of said release shall be delivered to the City Engineer / Public Works Representative.

2.7 RESTORATION OF CONSTRUCTION SITE

During the progress of the Work, the Developer/Contractor shall clean up all construction debris, excess excavation, and excess materials, and shall restore all fences, irrigation structures, ditches, culverts, and similar items. The Developer/Contractor shall stockpile the excavated trench material so as to do the least damage to adjacent grassed areas, or fences, regardless of whether these are on private property or public rights-of-way. All excavated materials shall be removed from grassed and planted areas and these surfaces shall be left in a conditions equivalent to their original surface and free from all rocks, gravel, boulders, or other foreign materials.

2.8 DEVELOPER/CONTRACTOR'S RESPONSIBILITY

The Developer/Contractor will be responsible to see that the backfilling and compaction are properly and adequately done. Settlement of trenches within a period of one (1) years after final acceptance of the project shall be considered incontrovertible evidence of inadequate compaction, and the Developer/Contractor shall be responsible for correcting the condition in accordance with the provisions of these Specifications. This includes the replacement of sidewalk, curb and gutter, and other surface improvements.

CHAPTER 3 - PRESSURE IRRIGATION

3.1 GENERAL

This division covers furnishing and installing pressure pipe as shown on the Drawings or established in the field, and all flushing, testing, repairing, as required to ensure adequate and safe operation of the water system.

All utilities must have a minimum cover of thirty inches (30") from finished grade of pavement.

3.2 PVC PIPE

3.2.1 Materials:

Pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900 standards latest revision, "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water:" PVC pipe fourteen inches (14") and larger shall be manufactured in accordance with AWWA C905 standards latest revision, "AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch." All PVC pipe four-inch (4") and larger shall be dimension ratio (DR) 18 with a working pressure of 150 psi. The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter. Pressure Irrigation pipe shall be purple in color for easy identification.

3.2.2 Joints:

Joints shall be the push-on rubber-gasket type. Lubrication shall be water soluble, non-supporting of bacteria growth, and have no deteriorating effect on the PVC pipe or rubber gaskets.

3.2.3 Fittings:

All fittings to be used with the PVC pipe shall be the same as fittings for ductile iron pipe and shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58. Pipe fittings shall be Mechanical-Joint-(MJ)-type with retainer gland (Megalug or equivalent) unless otherwise specified by the City Engineer / Public Works Representative. All fittings shall be greased with FM grease and encased in 8 mil protective plastic.

A megalug-type retainer gland system shall be used on all mechanical joints and shall meet Uni-B-13 for PVC and be UL/FM approved through twelve (12) inch diameter for both ductile iron and PVC pipe. The restraint mechanism shall consist of individually activated gripping surfaces to maximize restraint capability. Twist-off nuts, sized the same as the tee-head bolts, and shall be used to ensure proper activating of restraining devices. The gland shall be manufactured of ductile iron conforming to ASTM A-536-80. The retainer-gland shall have a pressure rating equal to that of the pipe on which it is used (through fourteen inches) with a minimum safety factor of 2:1. Gland shall be Megalug by EBAA Iron, Inc. or approved equal. The type and model of retainer and amount for each connector is shown on standard drawings.

3.2.4 Detectable Caution Tape:

All pipe shall include a three-inch (3") wide detectable caution tape installed in the pipeline trench approximately twelve inches (12") above the top of pipeline. This tape shall be prepared with white or black printing on a purple field, color Panatone 512C, having the words:

CAUTION: NONPOTABLE WATER - DO NOT DRINK.

3.2.5 Tracer Wire:

All pipes shall include a 12 gauge solid THHN tracer wire installed according to NESC standards. The tracer wire shall be installed and secured to the top center of the pipe. The tracer wire shall be installed on

all service lines per the standard drawings. The tracer wire shall also be brought up along the outside of, and then through, the top of the valve box through a drilled hole (as specified on the standard drawings), unless directed otherwise by the City Engineer or his designee. All connections shall be made with waterproof grease nut connectors to help ensure continuity. A continuity test shall be conducted by the City to verify the integrity of the tracer wire installed by the Contractor. It is the responsibility of the Contractor to ensure that the continuity test is performed by the City prior to any paving operations. Failures in the continuity are the responsibility of the Contractor and shall be repaired by the Contractor and verified by the City prior to any paving operations.

3.3 RESILIENT SEATED GATE VALVE

Valves in sizes 4" through 10" shall be of the iron body, non-rising bronze stem, resilient seated type, manufactured to equal or exceed all applicable AWWA standards latest revision and all specific requirements outlined in these specifications.

All gate valves shall be WATEROUS Series 2500 or MUELLER A-2361.

3.4 BUTTERFLY VALVE

Valves in sizes 12" and larger shall be butterfly valves manufactured to equal or exceed all applicable AWWA standards latest revision and all specific requirements outlined in these specifications.

All butterfly valves shall be M&H 4500 or MUELLER LINESEAL III or approved equal

3.5 VALVE BOXES

Valves and valve boxes shall be installed as required in these Specifications and Standard Drawings. Valves and valve boxes shall be set plumb. Valve boxes shall be centered directly over the valve. If the top of the valve nut is greater than eight (8) feet below finished grade a valve nut extension shall be required. Earth fill shall be carefully tamped around the valve box to a distance of four (4) feet on all sides of the box, or to the undisturbed trench face if less than four (4) feet. Valves shall have the interiors cleaned of all foreign matter before installation.

All buried valves shall be installed complete with two-piece, cast iron, 5-1/4-inch shaft valve box with lid. The lid shall have the words "IRR" or "DRAIN" cast in the metal depending on the application.

3.5.1 Placement of Concrete Collars:

Valve boxes shall be set to the finished grade and contour of the street. Valve boxes shall be protected during backfilling and compaction of the road base and during the placing or replacing of road surfaces. Any valve boxes damaged or broken shall be replaced by the Developer/Contractor at its expense. Prior to paving, the valve box shall be GPS-located by the Developer / Contractor (shot at the center of the valve box) and set six (6) inches below the finished grade. After paving the asphalt shall be removed, and the valve box shall be raised to match the grade and slope of the finished road surface.

Road base around the valve box shall be re-compacted, and the concrete collar placed. Valve boxes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement. Valve boxes must be cleaned of all debris after setting of collars.

3.6 PIPE INSTALLATION

3.6.1 Cutting:

When required, cutting of pipe shall be done in a neat and workmanlike manner by a method recommended by the manufacturer. All cuts shall be cut square to the longitudinal axis of the pipe. If needed after cutting,

the pipe shall be beveled and filed to prevent gasket damage in joint assembly. All beveled ends of pipe must be removed before connecting to MJ fittings, in accordance with manufacturer's recommendations.

3.6.2 Dewatering of Trench:

Where water is encountered in the trench, it shall be removed during pipe-laying operations and until the ends of the pipe are sealed. See Section 2.3 Control of Groundwater.

3.6.3 Laying of Pipe:

The pipe and pipe coating (where applicable) shall be inspected for defects or UV light damage before installation. Any defects shall be repaired or the pipe shall be replaced, whichever is deemed necessary by the City Engineer / Public Works Representative.

All pipe shall be laid and maintained to the required lines with fittings and valves at the required locations, as shown on the Drawings.

All pipe, fittings, and valves shall be moved carefully, either when lowering from the truck, or when placing in the trench. Under no circumstances shall materials be dropped or dumped from the truck or into the trench.

The Developer/Contractor shall take the necessary precautions to ensure that foreign materials do not enter the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When laying of pipe is not in progress, the pipe shall be closed with a water tight plug.

Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C900 (latest revision), or the recommendations of the pipe manufacturer.

Deflections in PVC pipe shall be made by defecting pipe joints and may not be made by longitudinal bending of the barrel of the pipe.

3.6.4 Joint Restraints:

Concrete thrust blocks shall not be used as a restraining system for waterline mains or laterals without prior approval of the City Engineer / Public Works Representative. Reaction restraints shall be applied at all bends and tees, and at all points of reduction or at fittings where changes in pipe diameter occur in accordance with Standard Pipe Restraint Detail Drawings.

Mechanical restraints for pipes larger than twelve (12) inches in diameter must be designed by a registered professional engineer and approved by the City Engineer prior to installation.

3.6.5 Thrust Blocking:

With approval of the City Engineer / Public Works Representative thrust blocking may be applied in addition to required joint restraints at all tees, valves, plugs, caps, and at bends that deflect twenty-two and one-half ($22\text{-}1/2^\circ$) degrees or more. The fitting shall be encased in a 8 mil protective plastic wrap before the thrust block is poured. Reaction blocking shall be concrete, having a compressive strength of not less than three-thousand (3000) psi at twenty-eight (28) days. Blocking shall be placed between undisturbed soil and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as shown in the Drawings. The blocking shall be placed so that the pipe and the fittings will be accessible for repair.

3.6.6 Connections to Existing Irrigation Lines:

Information on the Drawings regarding existing pipelines is taken from "record" drawings from the City or utility company files and may or may not be accurate as to size, type of material, or location of those lines. The Developer/Contractor will be responsible to determine the proper fittings and materials required, obtain the City Engineer / Public Works Representative's approval of the planned connection, and perform the construction in a suitable fashion.

3.6.7 Pipe Embedment:

Refer to Section 2.5.3 Pipe Embedment Material Placement

3.7 PRESSURE IRRIGATION SERVICE CONNECTION

Pressure irrigation service laterals shall be constructed with materials specified and at the locations and limits shown on the Standard Drawings.

3.7.1 Extent and Locations of Laterals:

New pressure irrigation service laterals shall be installed per the location and limits shown on the utility location standard drawing. Irrigation service boxes shall be installed in the center of the park strip (where applicable) or one foot behind sidewalk where park strip does not exist or as approved by the City Engineer / Public Works Representative.

Pressure irrigation services shall not have any joints between the saddle at the main and the meter connection.

Service laterals relocated during construction of new pipelines shall extend from the pressure irrigation main to the service box if the existing service is in poor condition or of a material other than polyethylene. Relocated services shall not have any joints between the saddle and the meter.

3.7.2 Connection to Main:

A 24-inch gooseneck shall be formed with the tubing for all connection types. No connections shall be made to the main within 24” of the end of the pipe joint. On existing services the existing connection to main will be used unless damaged or leaking.

All connections of services to main lines shall be through a service saddle. All service saddles shall be of a "Full encirclement design," and shall be I.D. controlled, which design will eliminate the possibility of pipe crushing due to the over-torquing of the nuts upon installation.

All service saddles shall be manufactured of stainless steel in conformance to AWWA C800, General Section - 1, Paragraph 1.2 (ASTM B62). All service saddles shall be nylon coated ductile iron service saddle with dual stainless steel straps, Romac 202NS or equivalent.

Connection to polyethylene service line shall be made using a brass compression by MIPT adapter with Q-style (quick joint) nut, Ford style C84-44-Q or Mueller style H-15428 only.

3.7.3 Polyethylene Tubing:

Pipe for service laterals shall be a minimum of one inch (1”) diameter. Sizes larger than 1” shall comply with ASTM Specification B88. Services shall be polyethylene CTS tubing.

Pipe for the transmission of irrigation water from main to utility box shall be **purple** polyethylene CTS tube. Polyethylene CTS tube shall be manufactured in accordance with the standard specification for

Polyethylene (PEP) plastic tubing as issued by the American Standard for Testing and Materials under ASTM D 2239 and AWWA C901.

Material designation code: Polyethylene - Purple
PE 3408

Plastic Extrusion Compound: Type III, class C, Grade 34, as defined by ASTM D 2239

Standard pipe dimension ratio CTS (SDR 9) - 160-psi pressure rating.

All tubing for service lines shall be cut and installed in a neat and workmanlike manner by a method recommended by the manufacturer.

Tubing shall be Cencore HDPE 3408 or equivalent.

3.7.4 Compression Connection:

A rigid liner shall be used inside of all tubing at the compression fitting, regardless of size.

- 1) The interior surface of the coupling nut, including threads, shall have a baked on, fluorocarbon coating to reduce assembly friction and prevent the gasket from turning and twisting during tightening. The nut shall bottom on a cast or machined shoulder on the body when properly assembled. This design will provide a visual check to assure connection is properly assembled.
- 2) The sealing gasket shall be of molded synthetic rubber (ASTM D2000) with molded in place bronze spring (ASTM A134 Alloy #6) to eliminate the possible cold flow of the gasket between the pipe and fitting. A gripper band of hardened stainless steel (ANSI Type 401) shall be fitted into the gasket. When the gasket is compressed it will cause the gripper ring to distort the pipe giving the fitting a high resistance to pull out. The gripper band shall overlap itself to prevent cold flow of the gasket into the cavity under the band.
- 3) When compression fittings are used with P.E. Pipe, Stainless Steel pipe stiffeners are required to eliminate cold flow of plastic pipe.
- 4) All fittings are to be for CTS Polyethylene pipe.
- 5) The Minimum pull out load for the fitting when used with PE plastic pipe shall be as follows for each given size:

<u>SIZE</u>	<u>MINIMUM PULL OUT (FT.LBS.)</u>
1"	400
1½"	500
2"	500

MUELLER H-15428 "STRAIGHT SERVICE FITTING" OR FORD C84-XX-Q STYLE "QUICK JOINT COUPLING" COMPRESSION COUPLINGS AND FITTINGS ARE TO BE USED ON ALL P.E. PLASTIC PIPE INSTALLATIONS.

3.7.5 Ball Valve Curb Stop:

The valve must maintain a working pressure of 300 PSIG.

All fittings are to be CTS (Copper Tube Size) size, used on CTS Polyethylene pipe. No IPS polyethylene pipe or fittings are to be used.

Ball valve curb stop shall be FORD B43-444-W-Q Style or MUELLER equivalent.

3.7.6 Service Box:

Service box shall be a standard green irrigation box with cover. The size shall be the appropriate size for the service size and meter as specified and shown on the standard drawings. Service Box shall be installed over the ball valve and meter as shown on the standard drawings. A sign shall be attached or embossed to or on the cover indicating as follows: "IRRIGATION." Box shall be Brooks 1419 series utility box with lid recessed and shall be provided with Waterworks Pentagon Head locking device or equivalent.

3.7.7 PVC Pipe:

Pipe for the transmission of irrigation water from the PVC MIPT adapter to the homeowner's side of the valve shall be Schedule 80 PVC pipe threaded nipple, twelve (12) inches long. A threaded end cap will be installed on the end of the pipe on the homeowner's side. No joints will be allowed under sidewalks or other paved surfaces.

3.7.8 Service Pipe Installation:

The polyethylene service pipe shall be installed by use of a "Hole Hog" or other similar device under all existing paved surfaces. Where subsurface materials or conditions will not permit installation by this method, open trenching will be permitted with the approval of the City Engineer / Public Works Representative. Open trenching will be used in new streets not yet paved.

The Developer/Contractor shall install a brass pin, 1/2" in diameter, stamped with the letter "I" in the top back of curb at the location where the lateral crosses the curb.

3.8 PIPELINE TESTING AND FLUSHING

All newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure test. A leakage test shall be conducted concurrently with the pressure test. All new lines, and extensions there from, shall be flushed thoroughly before being placed into service. **All service line connections must be installed prior to the pressure test.**

3.8.1 Pressure Test:

If the pipe section being tested includes concrete thrust blocking, the concrete shall be allowed at least twenty-four (24) hours to set before any testing is conducted.

- 1) Test Pressure Restrictions: Test pressures shall,
 - a. Be not less than 200 psi.
 - b. Not exceed the pressure rating of the pipe.
 - c. Be of at least 2 hour duration.
 - d. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
 - e. Not exceed the rated pressure of the valves when the test boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.
- 2) Pressurization: Each valved section of pipe shall be filled slowly with water to the specified test pressure. Pressurization of the pipe shall be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage. Pressure shall be applied by means of

a pump connected to the pipe in a manner satisfactory to the City Engineer / Public Works Representative.

- 3) **Air Removal:** Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Developer/Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged.
- 4) **Examination:** All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the pressure test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent pressure testing shall be repeated as necessary for the pipeline to pass the pressure test.
- 5) **Length of Pipeline:** The maximum length of pipeline tested at one time shall be 1,000 feet.

3.8.2 Leakage Test:

A leakage test shall be conducted concurrently with the pressure test.

- 1) **Leakage defined:** Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
- 2) **Allowable leakage:** No pipe installation will be accepted if the leakage is greater than the pipeline manufacture's specifications, or that determined by the following formula, whichever is less:

$$L = \frac{SD(P)^{0.5}}{133,200}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure (gage) during the leakage test, in pounds per square inch. See Table 1.

- a. Allowable leakage at various pressures is shown in Table 1.
- b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.
- c. When hydrants are in the test section, the test shall be made against the closed hydrant.

TABLE 1
Allowable Leakage per 1000 ft of Pipeline - gph

Average Test Pressure psi (Bar)	Nominal Pipe Diameter—in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125 (9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
 **To obtain leakage in liters/hour, multiply the values in the table by 3.785.

- 3) **Examination:** All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the leakage test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent leakage testing shall be performed as necessary for the pipeline to pass the leakage test.

3.8.3 Acceptance of Testing:

Acceptance of testing shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than specified, the Developer/Contractor shall, at its own expense, locate and repair the defective material until the leakage is within the specified allowance.

All visible leaks are to be repaired regardless of the amount of leakage.

3.8.4 Flushing:

Flushing shall be accomplished through temporary flushing valves, or end of line blow-off assemblies at a minimum flushing velocity of two and one-half feet per second (2.5 fps). Flow volumes to produce this velocity are shown in the following chart:

FLOW RATE AND OPENINGS TO FLUSH PIPELINES (40 psi Residual Pressure)	
Pipe Size (inches)	Flow Required to Produce 2.5 fps velocity (gpm)
2	26
4	100
6	220
8	390
10	610
12	880
14	1,200
16	1,565
18	1,980
20	2,450
24	3,525
30	5,507
42	10,800
48	14,100

3.9 AIR RELEASE and VACUUM RELIEF VALVE

Air release and vacuum relief valves shall fulfill functions of air release (permit escape of air accumulated in line at high point of elevation while line is under pressure) and vacuum relief (allow air to enter the pipe and prevent its potential collapse due to the formation of a vacuum condition caused by rapid withdrawal of water) . Air and vacuum relief valves shall be placed at high points or uphill end points in the system. The need for air relief valves should be minimized through the engineering design of the line.

Air release and vacuum relief valves shall be single-body, standard combination valves rated for a minimum working pressure of 150 psi, unless otherwise indicated. (APCO Model 145C or approved equal as indicated on Standard Drawings). Bodies shall be of high strength cast iron. The float, seat, and all moving parts shall be constructed of Type 316 stainless steel. Seat washers and gaskets shall be of a material insuring water tightness with a minimum of maintenance. The valve exterior shall be painted with shop-applied primer suitable for contact with potable water. The connection to the main for the air release and vacuum relief valve shall be service clamp, Ford FS202 or approved equal. Tapping the main through the service clamp will be accomplished with standard tapping equipment before the system is put into service. Typical small distribution mains (4” to 12”) shall have the typical 2-inch combination air-vacuum valves per the Standard Drawings. Larger water main pipelines shall have valves which are engineered and sized to compensate for the size of pipe and the length of run.

Valves shall be installed in a 5-foot diameter precast manhole base with a standard manhole frame and lid (D&L 1180 or approved equal) per Standard Drawing. The manhole lid shall read “WATER’ or “PRESSURIZED IRRIGATION” as appropriate. Set the manhole base and lid plumb and as detailed. Center the manhole over valve. For culinary water use, the valve shall be plumbed out of the vault and behind the closest curb and gutter to vent. The air vent stand pipe shall be centered in the park strip or as directed by the City Engineer.

3.10 PRESSURE IRRIGATION DRAINS

When system drains are necessary to be installed on extensions of the pressure irrigation system they shall be constructed as a system drain to a curb inlet box or a storm drain manhole. As an alternative, the system drain may enter directly to a storm drainage pipe if approved by the City Engineer or his authorized representative. The drain shall be constructed as shown on the Standard Drawings. The materials used shall meet the requirements of Division 3, Pressure Pipe Pressure Irrigation. The connection to the box or pipe shall be by coring a hole and grouting the drainpipe in. A non-shrink grout shall be used.

When a section of pressure irrigation pipeline has to be laid such that there is a belly in it then a local drain sump will need to be constructed. The drain shall be constructed as shown on the Standard Drawings.

CHAPTER 4 - CULINARY WATER

4.1 GENERAL

This Division covers furnishing and installing pressure pipe to the lines and grades shown on the drawings and/or established in the field, and all flushing, testing, repairing, as required to ensure adequate and safe operation of the water system.

Ductile iron pipe shall be used in all areas east of 400 West unless otherwise specified by the City Engineer. PVC pipe will be used in all areas west of 400 West

4.2 DUCTILE IRON PIPE

4.2.1 Materials:

Ductile iron pipe shall conform to all requirements of ANSI/AWWA C151/A21.51. Minimum pressure class of pipes of 12-inch diameter and smaller shall be pressure Class 350. Minimum pressure Class will be 250 for pipes larger than 12-inch diameter. If thickness class pipe is used, pipes of diameters from 4 inches through 10 inches shall be minimum Class 51 and pipe from 12-inch diameter and larger shall be minimum Class 50. All pipe shall be gauged pipe.

4.2.2 Joints:

- 1) Mechanical Joints: All mechanical joint fittings with accessories shall meet all applicable requirements of ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11 (current revisions). All gasket surfaces shall be smooth and free from imperfections. Gaskets shall conform to tests in accordance with specifications and shall be less than one year old. All buried fittings having steel bolts shall be coated with food-grade grease and wrapped with polyethylene.
- 2) Push-on Joints: Joints shall be push on rubber gasket type. Lubrication shall be water soluble, non-toxic, non-objectionable in taste and odor imparted to the water, non-supporting of bacteria growth, and have no deteriorating effect on the pipe or rubber gaskets. All push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11. Gaskets shall be free from defects and not over one year old.

Lubricants shall be non-toxic and have no deteriorating effects on gasket materials. It shall not impart taste to water in a pipe. It shall conform in every way to ANSI 21.1

- 3) Flanged Joints: Flange joints on fittings shall meet the requirements of ANSI/AWWA C110/A21.10 or ANSI B16.1. Flanges on pipe shall meet the requirements of AWWA C115. Flanged joints shall be bolted firmly with machine, stud or cap bolts of proper size. Flange maybe cast integrally with the pipe or may be screwed on threaded pipe. Flanges shall be faced and drilled and of proper dimensions for size and pressure required. Bolts and nuts, unless otherwise specified, shall be made of the best quality refined iron or metal steel and have clean, well-fitting threads. Bolts will be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange and when installed shall be of length so that no more than 3/8-inch nor less than 1/8-inch extends past face of nut. All buried fittings having steel bolts shall be coated with food-grade grease and wrapped with polyethylene.

4.2.3 Coatings and Linings for Ductile Iron Pipe:

All exterior surfaces of pipe and fittings shall be coated with hot coal tar approximately 1 mil thick. All interior surfaces shall be cement mortar lined with a standard thickness according to ANSI/AWWA C104/A21.4-80.

4.2.4 Corrosion Protection and Soil Tests:

When the City Engineer / Public Works Representative determines that a potential for corrosive conditions exists such as poor drainage or reactive soils, PVC pipe shall be used rather than ductile iron.

4.2.5 Fittings:

All fittings to be used with the ductile iron pipe shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58. Pipe fittings shall be Mechanical-Joint-(MJ)-type with retainer gland (Megalug or equivalent) approved by the manufacturer for the specific pipe material unless otherwise specified by the City Engineer / Public Works Representative. All fittings shall be greased with FM NLGI 2 grease and encased in 8 mil protective plastic.

A megalug-type retainer gland system shall be used on all mechanical joints and shall meet Uni-B-13 for PVC and be UL/FM approved through twelve (12) inch diameter for both ductile iron and PVC pipe. The restraint mechanism shall consist of individually activated gripping surfaces to maximize restraint capability. Twist-off nuts, sized the same as the tee-head bolts, and shall be used to ensure proper activating of restraining devices. The gland shall be manufactured of ductile iron conforming to ASTM A-536-80. The retainer-gland shall have a pressure rating equal to that of the pipe on which it is used (through fourteen inches) with a minimum safety factor of 2:1. Gland shall be Megalug by EBAA Iron, Inc. or approved equal. The type and model of retainer and amount for each connector is shown on standard drawings.

4.2.6 Detectable Caution Tape:

All pipe shall include a three-inch (3") wide detectable caution tape installed in the pipeline trench approximately twelve inches (12") above the top of pipeline. Caution tape shall be furnished with white or black printing on a blue colored field having the words:

CAUTION: POTABLE WATER - BELOW.

4.2.7 Tracer Wire:

All pipes shall include a 12 gauge solid THHN tracer wire installed according to NESC standards. The tracer wire shall be installed and secured to the top center of the pipe. The tracer wire shall be brought up and connected to a fire hydrant flange bolt at each hydrant for pipe line location. The tracer wire shall also be installed on all service lines per the standard drawings. The tracer wire shall also be brought up along the outside of, and then through, the top of the valve box through a drilled hole (as specified on the standard drawings), unless directed otherwise by the City Engineer or his designee. All connections shall be made with waterproof grease nut connectors to help ensure continuity. A continuity test shall be conducted by the City to verify the integrity of the tracer wire installed by the Contractor. It is the responsibility of the Contractor to ensure that the continuity test is performed by the City prior to any paving operations. Failures in the continuity are the responsibility of the Contractor and shall be repaired by the Contractor and verified by the City prior to any paving operations.

4.3 PVC PIPE

4.3.1 Materials:

Pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900 standards latest revision, "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water:" PVC pipe fourteen inches (14") and larger shall be manufactured in accordance with AWWA C905 standards latest revision, "AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch." All PVC pipe four-inch (4") and larger

shall be dimension ratio (DR) 18 with a working pressure of 150 psi. The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter.

4.3.2 Joints:

- 1) Mechanical Joints: All mechanical joint fittings with accessories shall meet all applicable requirements of ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11 (current revisions). All gasket surfaces shall be smooth and free from imperfections. Gaskets shall conform to tests in accordance with specifications and shall be less than one year old. All buried fittings having steel bolts shall be coated with food-grade grease and wrapped with polyethylene.
- 2) Push-on Joints: Joints shall be push on rubber gasket type. Lubrication shall be water soluble, non-toxic, non-objectionable in taste and odor imparted to the water, non-supporting of bacteria growth, and have no deteriorating effect on the pipe or rubber gaskets. All push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11. Gaskets shall be free from defects and not over one year old.

Lubricants shall be non-toxic and have no deteriorating effects on gasket materials. It shall not impart taste to water in a pipe. It shall conform in every way to ANSI 21.1

- 3) Flanged Joints: Flange joints on fittings shall meet the requirements of ANSI/AWWA C110/A21.10 or ANSI B16.1. Flanges on pipe shall meet the requirements of AWWA C115. Flanged joints shall be bolted firmly with machine, stud or cap bolts of proper size. Flange maybe cast integrally with the pipe or may be screwed on threaded pipe. Flanges shall be faced and drilled and of proper dimensions for size and pressure required. Bolts and nuts, unless otherwise specified, shall be made of the best quality refined iron or metal steel and have clean, well-fitting threads. Bolts will be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange and when installed shall be of length so that no more than 3/8-inch nor less than 1/8-inch extends past face of nut. All buried fittings having steel bolts shall be coated with food-grade grease and wrapped with polyethylene.

4.3.3 Fittings:

All fittings to be used with the PVC pipe shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58. Pipe fittings shall be Mechanical-Joint-(MJ)-type with retainer gland (Megalug or equivalent) approved by the manufacturer for the specific pipe material unless otherwise specified by the City Engineer / Public Works Representative. All fittings shall be greased with FM NLGI 2 grease and encased in 8 mil protective plastic.

A megalug-type retainer gland system shall be used on all mechanical joints and shall meet Uni-B-13 for PVC and be UL/FM approved through twelve (12) inch diameter for both ductile iron and PVC pipe. The restraint mechanism shall consist of individually activated gripping surfaces to maximize restraint capability. Twist-off nuts, sized the same as the tee-head bolts, and shall be used to ensure proper activating of restraining devices. The gland shall be manufactured of ductile iron conforming to ASTM A-536-80. The retainer-gland shall have a pressure rating equal to that of the pipe on which it is used (through fourteen inches) with a minimum safety factor of 2:1. Gland shall be Megalug by EBAA Iron, Inc. or approved equal. The type and model of retainer and amount for each connector is shown on standard drawings.

4.3.4 Detectable Caution Tape:

All pipe shall include a three-inch (3") detectable caution tape installed in the pipeline trench approximately twelve inches (12") below the ground surface. Caution tape shall be furnished with white or black printing on a colored field having the words:

CAUTION: POTABLE WATER - BELOW.

4.3.5 Tracer Wire:

All pipes shall include a 12 gauge solid THHN tracer wire installed according to NESC standards. The tracer wire shall be installed and secured to the top center of the pipe. The tracer wire shall be brought up and connected to a fire hydrant flange bolt at each hydrant for pipe line location. The tracer wire shall also be installed on all service lines per the standard drawings. The tracer wire shall also be brought up along the outside of, and then through, the top of the valve box through a drilled hole (as specified on the standard drawings), unless directed otherwise by the City Engineer or his designee. All connections shall be made with waterproof grease nut connectors to help ensure continuity. A continuity test shall be conducted by the City to verify the integrity of the tracer wire installed by the Contractor. It is the responsibility of the Contractor to ensure that the continuity test is performed by the City prior to any paving operations. Failures in the continuity are the responsibility of the Contractor and shall be repaired by the Contractor and verified by the City prior to any paving operations.

4.4 PIPE INSTALLATION

4.4.1 Cutting:

When required, cutting of pipe shall be done in a neat and workmanlike manner by a method recommended by the manufacturer. All cuts shall be cut square to the longitudinal axis of the pipe. If needed after cutting, the pipe shall be beveled and filed to prevent gasket damage in joint assembly. All beveled ends of pipe must be removed before connecting to MJ fittings, in accordance with manufacturer's recommendations.

4.4.2 Dewatering of Trench:

Where water is encountered in the trench, it shall be removed during pipe-laying operations and until the ends of the pipe are sealed. See Section 2.3 Control of Groundwater.

4.4.3 Laying of Pipe:

The pipe and pipe coating (where applicable) shall be inspected for defects or UV light damage before installation. Any defects shall be repaired or the pipe shall be replaced, whichever is deemed necessary by the City Engineer / Public Works Representative.

All pipe shall be laid and maintained to the required lines with fittings and valves at the required locations, as shown on the Drawings.

All pipe, fittings, and valves shall be moved carefully, either when lowering from the truck, or when placing in the trench. Under no circumstances shall materials be dropped or dumped from the truck or into the trench.

The Developer/Contractor shall take the necessary precautions to ensure that foreign materials do not enter the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When laying of pipe is not in progress, the pipe shall be closed with a water tight plug.

Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C900 (latest revision), or the recommendations of the pipe manufacturer.

Deflections in PVC pipe shall be made by defecting pipe joints and may not be made by longitudinal bending of the barrel of the pipe.

4.4.4 Joint Restraints:

Concrete thrust blocks shall not be used as a restraining system for waterline mains or laterals without prior approval of the City Engineer / Public Works Representative. Reaction restraints shall be applied at all bends and tees, and at all points of reduction or at fittings where changes in pipe diameter occur in accordance with Standard Pipe Restraint Detail Drawings.

Mechanical restraints for pipes larger than twelve (12) inches in diameter must be designed by a registered professional engineer and approved by the City Engineer prior to installation.

4.4.5 Thrust Blocking:

With approval of the City Engineer / Public Works Representative thrust blocking may be applied in addition to required joint restraints at all tees, valves, plugs, caps, and at bends that deflect twenty-two and one-half (22-1/2°) degrees or more. The fitting shall be encased in a 8 mil protective plastic wrap before the thrust block is poured. Reaction blocking shall be concrete, having a compressive strength of not less than three-thousand (3000) psi at twenty-eight (28) days. Blocking shall be placed between undisturbed soil and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as shown in the Drawings. The blocking shall be placed so that the pipe and the fittings will be accessible for repair.

4.4.6 Connections to Existing Water Lines:

Information on the Drawings regarding existing pipelines is taken from "record" drawings from the City or utility company files and may or may not be accurate as to size, type of material, or location of those lines. The Developer/Contractor will be responsible to determine the proper fittings and materials required, obtain the City Engineer / Public Works Representative's approval of the planned connection, and perform the construction in a suitable fashion.

4.4.7 Pipe Embedment:

Refer to Section 2.5.3 Pipe Embedment Material Placement

4.5 WATER SERVICE LATERALS

Water service laterals shall be constructed with materials specified and at the locations shown on the Standard Drawings or at the actual location established during construction.

Pipe for water service laterals shall be a minimum of 1" in diameter. Sizes larger than 1" shall comply with ASTM Specification B88. Services shall be either Type K-soft copper tubing or polyethylene CTS tubing.

Polyethylene CTS tube shall be manufactured in accordance with the standard specification for Polyethylene (PEP) plastic tubing as issued by the American Standard for Testing and Materials under ASTM D 2239 and AWWA C901. Standard pipe dimension ratio CTS (SDR 9) - 160-psi pressure rating. Tubing shall be Cencore HDPE 3408 or equivalent.

All tubing for service lines shall be cut and installed in a neat and workmanlike manner by a method recommended by the manufacturer.

4.5.1 Extent and Locations of Laterals:

New water service laterals shall be installed at the centerline of the lot. Meter cans shall be installed in the center of the park strip (where applicable) or one foot behind sidewalk where park strip does not exist or as approved by the City Engineer / Public Works Representative.

The service lateral shall extend from the water main to the meter can and from the meter can to fifteen feet (15') beyond the back of walk. Water services shall not have any joints between the corporation stop at the main and the meter setter.

Water service laterals relocated during construction of new pipelines shall extend from the water main to the water meter if the existing service is in poor condition or of a material other than copper or polyethylene. Relocated water services shall not have any joints between the corporation stop and the meter.

4.5.2 Connection to Main:

A 24-inch gooseneck shall be formed with the tubing for all connection types. No connections shall be made to the main within 24" of the end of the pipe joint. On existing services the existing connection to main will be used unless damaged or leaking.

Connection to Ductile Iron Main

All connections of services to ductile iron main lines shall be direct tap with a corporation type stop. The corporation stop shall be a FORD FB1000-X-Q STYLE or MUELLER 300 B-25008 for one-inch (1") through two-inch (2"). All with "CC" thread for direct tap.

Connection to PVC Main

All connections of services to PVC main lines shall be through a service saddle with a corporation type stop. All service saddles shall be of a "Full encirclement design," and shall be I.D. controlled, which design will eliminate the possibility of pipe crushing due to the over-torquing of the nuts upon installation.

All service saddles shall be manufactured of stainless steel in conformance to AWWA C800, General Section - 1, Paragraph 1.2 (ASTM B62). All service saddles shall be nylon coated ductile iron service saddle with dual stainless steel straps, Romac 202NS or equivalent.

The corporation stop shall be a FORD FB1100 XX Q STYLE or MUELLER 300 B 25028 for one inch (1") through two inch (2").

4.5.3 Meter Setter, Box and Cover:

All meter setters shall be 18" dual check type.

Size	FORD 70 Series Coppersetter
1"	VBHC74-18W-11-44-NL
1 1/2"	VBHH76-21W-11-66-NL
2"	VBHH77-21W-11-77-NL

The meter box shall be 21-inch (21") diameter for a one-inch (1") service or thirty-six-inch (36") diameter for the larger service lines. Meter box to be thirty-six inches (36") in height, corrugated white HDPE, with grooves to fit over the inlet and outlet line. The meter cover to be D&L Supply L-2244 for a 21-inch (21") diameter box or L-2326 for a thirty-six-inch (36") diameter box, with recessed standard waterworks pentagon head locking device and raised cast center rim. Cover to be one inch (1") above the top back of curb.

4.5.4 Special Joints and Fittings:

Copper Tubing / Poly Tubing to Screw Pipe Joints: Joints from copper tubing or poly tubing to threaded pipe shall be made by the use of brass adapter compression fittings after receiving approval from the City Engineer / Public Works Representative.

4.5.5 Flushing, Testing and Disinfecting:

Flushing, testing and disinfecting shall be done at the time the water main is flushed, tested and disinfected. The end of the trench where the stub out past the meter is located shall be left open to allow for discharging water out of the service line for proper flushing and to insure that the line has been adequately disinfected. The line shall be flushed thoroughly following installation. Flushing, testing and disinfecting shall conform to the applicable paragraphs of this division.

On existing services the Developer/Contractor shall take precautions to prevent contamination of the pipe and connections during installation. The line shall be flushed thoroughly following installation.

4.5.6 Damage and Repair of Water Mains and Appurtenances:

The Developer/Contractor shall be responsible for any damage to water mains and water facilities caused by his operations. The Developer/Contractor may be relieved of the responsibility under the following conditions:

- 1) He has not excavated below or beyond the required excavation lines, and
- 2) He has given proper and timely notice of his work plans, and
- 3) He has used reasonable care, and cooperated, minimizing the damage.

Any damage to water gates, hydrants, valve chambers, meter boxes, and other surface appurtenances that result from the Developer/Contractor's operation shall be its sole responsibility.

The Developer/Contractor shall install a brass pin, 1/2" in diameter, stamped with the letter "W" in the top back of curb at the location where the lateral crosses the curb.

4.6 FLUSHING, DISINFECTING, AND TESTING OF WATER MAINS

4.6.1 Disinfection:

All culinary water lines shall be disinfected by chlorination. Chlorination shall provide a minimum of 25 ppm residual after 24 hours contact in the pipeline. This may be expected with an application of 50 ppm, although some conditions may require more. Chlorine in the form of a 1% slurry of high-test calcium hypochlorite (HTH, Perchloron, Pittchlor, etc. which are 70% available chlorine by weight) shall be fed into the pipeline in such a manner as to mix with the water flowing in the pipeline. (A 1% slurry - 10,000 ppm - results from mixing one pound of calcium hypochlorite with 8.40 gallons of water.)

The following table provides information as to the required quantity of slurry to be used per 100 feet of pipe to provide a chlorine concentration of 50 ppm:

Pipe Size (in.)	Vol. of 100 ft. Length (gal)	Required Amount of 1 % Chlorine Slurry (gal)
1 ½	9.18	0.07
2	16.32	0.12
2 ½	25.50	0.18
3	36.73	0.26
4	65.28	0.47
6	146.90	1.05
8	261.10	1.87
10	408.10	2.92

12	587.60	4.20
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During the process of chlorinating the pipeline, operate all valves and other pipeline appurtenances several times to provide sufficient contact with the chlorinating agent. Following chlorination, drain and thoroughly flush the water line as per the Flushing section of these specifications.

Disinfection shall conform to the requirements of AWWA C651 latest edition.

4.6.2 Bacteria Test

The Public Works Representative shall obtain two (2) water samples, 24 hours apart, upon which the City will have bacteriological tests performed.

If the line does not pass the bacteria test, the water main shall be flushed and/or rechlorinated and the water line shall be retested until the results of the bacteriological test are satisfactory.

4.6.3 Flushing:

All new water systems or extensions to existing systems shall be thoroughly flushed before being placed in service. Flushing shall be accomplished through hydrants, or end of line blow-off assemblies at a minimum flushing velocity of 2.5-feet per second. See chart below.

<p>FLOW RATE AND OPENINGS TO FLUSH PIPELINES (40- psi Residual Pressure)</p>

Pipe Size (inches)	Flow Required to Produce 2.5 fps velocity (gpm)
2	26
4	100
6	220
8	390
10	610
12	880
14	1,200
16	1,565
18	1,980
20	2,450
24	3,525
30	5,507

4.6.4 Pressure Test:

All newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure. A leakage test shall be conducted concurrently with the pressure test.

- 1) Test Pressure Restrictions: Test pressures shall:
 - a. Not be less than 150 psi or 1.5 times the static pressure at the highest point along the test section, whichever is greater.
 - b. Not exceed pipe or thrust restraint design pressures.
 - c. Be of at least 2-hour duration.
 - d. Not vary by more than plus or minus five (± 5) psi for the duration of the test.
 - e. Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.

- f. Not exceed the rated pressure of the valves when the test boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.
- 2) **Pressurization:** Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City Engineer / Public Works Representative.
- 3) **Air Removal:** Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Developer/Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged.
- 4) **Examination:** All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound materials and the test shall be repeated until it is satisfactory to the Owner.

4.6.5 Leakage Test:

A leakage test shall be conducted concurrently with the pressure test.

- 1) **Leakage Defined:** Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
- 2) **Allowable Leakage:** No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{133,200}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gage.

- a. Allowable leakage at various pressures is shown in Table 1.
- b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.
- c. When hydrants are in the test section, the test shall be made against the closed hydrant .

TABLE 1
Allowable Leakage per 1000 ft of Pipeline - gph

Average Test Pressure psi (Bar)	Nominal Pipe Diameter—in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125 (9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
**To obtain leakage in liters/hour, multiply the values in the table by 3.785.

- 3) **Examination:** All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the leakage test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent leakage testing shall be performed as necessary for the pipeline to pass the leakage test.
- 4) **Acceptance of Installation:** Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than specified, the Developer/Contractor shall, at its own expense, locate and repair the defective material until the leakage is within the specified allowance.

All visible leaks are to be repaired regardless of the amount of leakage.

4.7 RESILIENT SEATED GATE VALVE

Valves in sizes 4" through 10" shall be of the iron body, non-rising bronze stem, resilient seated type, manufactured to equal or exceed all applicable AWWA standards latest revision and all specific requirements outlined in these specifications.

All gate valves shall be WATEROUS Series 2500 or MUELLER A-2361.

4.8 BUTTERFLY VALVE

Valves in sizes 12" and larger shall be butterfly valves manufactured to equal or exceed all applicable AWWA standards latest revision and all specific requirements outlined in these specifications.

All butterfly valves shall be M&H 4500 or MUELLER LINESEAL III or approved equal.

4.9 VALVE BOXES

Valves and valve boxes shall be installed as required in these Specifications and Standard Drawings. Valves and valve boxes shall be set plumb. Valve boxes shall be centered directly over the valve. If the top of the valve nut is greater than five (5) feet below finished grade a valve nut extension shall be required. Earth fill shall be carefully tamped around the valve box to a distance of four (4) feet on all sides of the box, or to the undisturbed trench face if less than four (4) feet. Valves shall have the interiors cleaned of all foreign matter before installation.

All buried valves shall be installed complete with two-piece, cast iron, 5-1/4-inch shaft valve box with lid. The lid shall have the words "WATER" or "FIRE" cast in the metal depending on the application.

4.9.1 Placement of Concrete Collars

Valve boxes shall be set to the finished grade and contour of the street. Valve boxes shall be protected during backfilling and compaction of the road base and during the placing or replacing of road surfaces. Any valve boxes damaged or broken shall be replaced by the Developer/Contractor at its expense. Prior to paving, the valve box shall be GPS-located by the Developer / Contractor (shot at the center of the valve box) and set six (6) inches below the finished grade. After paving the asphalt shall be removed, and the valve box shall be raised to match the grade and slope of the finished road surface.

Road base around the valve box shall be re-compacted, and the concrete collar placed. Valve boxes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement. Valve boxes must be cleaned of all debris after setting of collars.

4.10 FIRE HYDRANTS

Fire hydrants shall be "traffic model" type designed to conform to AWWA Specifications. Hydrants shall be Mueller "Super Centurion 250" or Waterous "Pacer".

4.11 AIR RELEASE and VACUUM RELIEF VALVE

Air release and vacuum relief valves shall fulfill functions of air release (permit escape of air accumulated in line at high point of elevation while line is under pressure) and vacuum relief (allow air to enter the pipe and prevent its potential collapse due to the formation of a vacuum condition caused by rapid withdrawal of water) . Air and vacuum relief valves shall be placed at high points or uphill end points in the system. The need for air relief valves should be minimized through the engineering design of the line.

Air release and vacuum relief valves shall be single-body, standard combination valves rated for a minimum working pressure of 150 psi, unless otherwise indicated. (APCO Model 145C or approved equal as indicated on Standard Drawings). Bodies shall be of high strength cast iron. The float, seat, and all moving parts shall be constructed of Type 316 stainless steel. Seat washers and gaskets shall be of a material insuring water tightness with a minimum of maintenance. The valve exterior shall be painted with shop-applied primer suitable for contact with potable water. The connection to the main for the air release and vacuum relief valve shall be service clamp, Ford FS202 or approved equal. Tapping the main through the service clamp will be accomplished with standard tapping equipment before the system is put into service. Typical small distribution mains (4" to 12") shall have the typical 2-inch combination air-vacuum valves per the Standard Drawings. Larger water main pipelines shall have valves which are engineered and sized to compensate for the size of pipe and the length of run.

Valves shall be installed in a 5-foot diameter precast manhole base with a standard manhole frame and lid (D&L 1180 or approved equal) per Standard Drawing. The manhole lid shall read "WATER" or "PRESSURIZED IRRIGATION" as appropriate. Set the manhole base and lid plumb and as detailed. Center the manhole over valve. For pressurized irrigation use, the valve shall vent directly into the vault.

CHAPTER 5 - STORM DRAIN & IRRIGATION

5.1 GENERAL

This section covers the requirements for materials and installation of storm drain and other gravity flow pipes, manholes, and inlet boxes within the public right-of-way.

5.2 MINIMUM SIZES

In no case shall storm drain or irrigation mains be less than fifteen inches (15") in diameter.

Minimum manhole interior diameter is five feet (5') for all storm drain or irrigation manholes. Larger sizes may be required based on pipe size.

Minimum curb inlet box size is two feet by three feet (2' x 3'). Precast boxes with knock-outs are allowed. Larger boxes to accommodate oil/debris separation devices, orifice plates, etc. shall be required as approved by City Engineer / Public Works Representative.

5.3 PIPE

Pipe used in storm drain and irrigation pipeline construction within the public right-of-way shall be reinforced concrete pipe Class III, unless otherwise approved by the City Engineer / Public Works Representative, as required by design loading and fill heights and as follows:

5.3.1 Reinforced Concrete Pipe:

All reinforced concrete pipe shall be of the rubber gasket type, bell and spigot joint design, conforming to the requirements of the latest revision of ASTM Designation C76. Pipe class shall be a minimum of Class III or greater, required by design loading and fill heights per the manufacturer.

Bell and spigot joints, including rubber gaskets, shall conform to the requirements of the latest revision of ASTM Designation C443. The pipe joint shall be so designed as to provide for self-centering, and when assembled, to compress the gasket to form a water tight seal. The gasket shall be confined in a groove on the spigot, so that pipe movement or hydrostatic pressure cannot displace the gasket

5.3.2 Corrugated High Density Polyethylene Pipe:

Corrugated polyethylene pipe shall be high density polyethylene corrugated exterior with a smooth interior wall with water-tight joints. Eight to ten (8-10) inch diameter shall meet the requirements of AASHTO M-252 and have a smooth interior liner. Twelve to thirty six (12-36) inch diameters shall conform to AASHTO M-294 Type S. Forty-two to forty-eight (42-48) inch diameter shall conform to AASHTO MP-6 type. Materials shall conform to ASTM D-3350. All pipe joints and fittings shall be water tight and conform to AASHTO M-353 or M-294, and shall be approved by the City Engineer / Public Works Representative. **Use of HDPE pipe within the public right-of-way is only allowed upon prior approval of the City Engineer.**

The pipe and fittings shall be free of foreign inclusions and visible defects. For pipe sizes 12" diameter and greater, holes of any kind in the corrugation crests or sidewalls shall be considered unacceptable. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.

The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe. Fittings shall be molded by the manufacturer. Fittings produced by manufacturers other than the supplier of the pipe shall not be permitted.

A manufacturer's certification that the product was manufactured, tested, and supplied in accordance with this specification shall be furnished to the City Engineer / Public Works Representative upon request.

All fittings, bolts and accessories shall meet applicable specifications of the pipe being used. Use accessories and gaskets recommended by the manufacturer.

5.4 PIPE LAYING

All storm drain pipes shall be laid with uniform slope between manholes. All pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted. Pipes shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells. Specific installation requirements for RCP and Corrugated HDPE pipe are listed below:

5.4.1 Reinforced Concrete Pipe:

Rubber gaskets shall be fitted properly in place, and care shall be taken in joining the pipe sections to avoid twisting of gaskets. Joints shall be clean and dry, and a joint lubricant as recommended by the pipe supplier shall be applied uniformly to the mating joint surfaces to facilitate easy positive joint closure.

Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

5.4.2 Corrugated High Density Polyethylene Pipe:

Select material shall be compacted around the pipe to firmly bed the pipe in position. Haunching material (bed to springline) should be carefully worked under the haunches of the pipe and compacted from the pipe to the trench wall or two and one half (2-1/2) pipe diameters on each side of the pipe to ensure support. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

5.5 INSTALLATION REQUIREMENTS FOR LINE AND GRADE

All pipe shall be installed accurately to the defined line and grade and verified at every joint with grade-line pipe laser. Calibration documentation shall be provided to the City upon request.

Variance from established line and grade shall not be greater than one-sixteenth (1/16) inch per inch of pipe diameter in ten feet, and not to exceed one-half inch in ten feet, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one-sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (1/2) inch maximum.

5.6 GRAVEL FOUNDATION FOR PIPE

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, or where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

5.7 PIPE BEDDING

See Section 2.5.3 Pipe Embedment Material Placement

5.8 CLEANING AND TELEVISIONING

After the pipe lines have been laid and the trench back-filled, all pipes shall be thoroughly cleaned. Cleaning shall be done using a high-pressure jet cleaning machine, producing a minimum of 800 psi. Waste water and debris shall not be permitted to enter existing lines, but shall be removed by a vacuum truck at the lowest manhole of the extension. Such cleaning shall be done by private crews at the expense of the Developer/Contractor.

All mains shall be cleaned and then inspected using a television inspection unit capable of rotating the camera for overall pipe inspection. The televised inspection of any mains which reveal broken, misaligned or displaced pipe, or other defects shall be remedied by the contractor as directed by the City Engineer / Public Works Representative. The Developer/Contractor must provide the City with a DVD of the televising of the pipe and the Developer/Contractor shall pay all associated costs. The televised inspection shall have the slope of pipe shown on the DVD throughout the inspection. The televising equipment used must record on the DVD a continuous distance from the point of beginning. After cleaning and inspection have been completed, the pipe shall be tested as instructed in the following section.

5.9 TESTS

The Developer/Contractor will be required to conduct an air test and in the case of HDPE pipe a “GO/NO-GO” mandrel test in the presence of the City Engineer / Public Works Representative. If these tests prove to be inconclusive, any or all of the other required tests shall be conducted in the presence of the City Engineer / Public Works Representative or his representative. Tests shall be performed as follows:

5.9.1 Air Testing:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer / Public Works Representative and the Developer/Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the City Engineer / Public Works Representative, air tests of the completed pipe before it can be placed in service. Each section of pipeline between manholes shall be tested individually. Each test section shall be pressurized to 4.0 psi. For the purpose of stabilizing the air pressure in each test section, the 4.0 psi pressure shall be maintained for a two-minute period. Each test section shall then be re-pressurized to 4.0 psi for a period of four minutes. The test section shall be accepted if, after four minutes, the pressure gauge indicates 3.5 psi or greater. Failure of the Developer/Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and re-tested until the minimum air testing requirements have been met

5.9.2 GO/NO-GO” Mandrel Proof Testing (For HDPE Pipe Only):

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID). This proof test shall establish that the Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Contractor, with the City Engineer / Public Works Representative present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the City Engineer / Public Works Representative, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-

five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Contractor through one-hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Contractor not in compliance with the Project Specifications.

5.10 MANHOLES OR JUNCTION BOXES

Manholes and junction boxes shall be installed at the locations and at the depth shown on the drawings. Manholes or boxes shall be furnished complete with cast-iron rings and covers. No steps shall be installed in any manhole or box.

Unless otherwise noted manhole bases or boxes shall be precast. Concrete for manholes and boxes shall comply with the requirements of Chapter 9 – Portland Cement Concrete.

All manholes shall be precast, sectional, reinforced concrete pipe sixty-inch (60") diameter minimum, or larger, as specified. Sections shall conform to all requirements of ASTM Designation C478-88 (or latest revision) for Precast Reinforced Concrete Manhole Sections.

All joint surfaces of precast sections and the face of the manhole base shall be thoroughly cleaned prior to setting precast sections. All joints shall be set in mastic. All joints shall be water tight and free from appreciable irregularities in the interior wall surface.

5.10.1 Setting of Manhole Frames and Covers and Placement of Concrete Collars

Covers shall be set to the finished grade and contour of the street. Rings and covers shall be protected during backfilling and compaction of the road base and during the placing or replacing of road surfaces. Any rings or covers damaged or broken shall be replaced by the Developer/Contractor at its expense. Prior to paving, the manhole ring and cover shall be GPS-located by the Developer / Contractor (shot at the center of the ring) and set below the finished road base elevation. After paving the asphalt shall be removed, and the manhole ring and cover shall be raised to match the grade and slope of the finished road surface and shall use the WHIRLYGIG manhole riser/collar system or approved equal.

Road base around the manhole ring and cover shall be recompacted, and the concrete collar placed. Manholes and boxes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement. The top of all concrete lids shall be a minimum of eight inches (8") and a maximum of twelve-inches (12") below the finished road surface. Manholes and boxes must be cleaned of all debris after setting of collars.

See Standard Drawings for concrete collar details.

5.11 PIPE CONNECTIONS

Pipe connections to manholes or other structures shall be achieved by the use of a concrete collar (see Chapter 9, Portland Cement Concrete) on the exterior of the structure around the pipe creating a watertight seal between the manhole and the pipe. Non-shrink grout shall be used on interior of the structure, filling all voids and creating a watertight seal between the manhole and the pipe. Pipes shall be cut flush with interior of the structure in a workmanlike manner. Pipe shall be supported by proper trench foundation outside of the structure and shall not rely on the structure for support.

Connections to an existing storm drain / irrigation system shall be made by installation of a manhole. The City Engineer / Public Works Representative shall approve connection locations and methods.

CHAPTER 6 - SANITARY SEWER

6.1 GENERAL

This section covers the requirements for PVC plastic sewer pipe materials and installation in sanitary sewer construction.

6.2 PIPE

PVC gravity sewer pipe and fittings shall conform to ASTM D3034, for diameters from four-inch (4") to fifteen-inch (15") and ASTM F679 for eighteen-inch (18") to twenty-seven-inch (27"), with integral bell gasket joints. Rubber gaskets shall be factory installed and conform to ASTM F477. Pipe shall be made of PVC plastic having a cell classification of 12454A or 13364B (with minimum tensile modulus of 500,000 PSI) as defined in ASTM D1784 and shall have a SDR of 35 and minimum pipe stiffness of 46PSI according to ASTM test D2412.

Pipe shall be installed in compliance with ASTM D2321 and the manufacturer's requirements.

6.3 FITTINGS

Fittings shall be made of PVC plastic conforming to ASTM D1784 and a cell classification as outlined in ASTM D3034.

6.4 PIPE LAYING

Pipes shall be laid with uniform slope between manholes. All pipe installation shall proceed upgrade on a stable foundation, with joints closely and accurately fitted. Rubber gaskets shall be fitted properly in place, and care shall be taken in joining the pipe sections to avoid twisting of gaskets. Joints shall be clean and dry, and a joint lubricant as recommended by the pipe supplier shall be applied uniformly to the mating joint surfaces to facilitate easy positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-jointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

6.5 GRAVEL FOUNDATION FOR PIPE

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

6.6 INSTALLATION REQUIREMENTS FOR LINE AND GRADE

All pipe shall be installed accurately to the defined line and grade and verified at every joint with grade-line pipe laser. Calibration documentation shall be provided to the City upon request.

Variance from established line and grade shall not be greater than one sixteenth (1/16) inch per inch of pipe diameter in ten feet, and not to exceed one half inch in ten feet, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to

non-concentricity of joining surface and pipe interior surfaces, does not exceed one sixty fourth (1/64) inch per inch of pipe diameter, or one half (1/2) inch maximum.

6.7 PIPE BEDDING

See Section 2.5.3 Pipe Embedment Material Placement

6.8 CLEANING AND TELEVISIONING

After the pipe lines have been laid and the trench back-filled, all pipes shall be thoroughly cleaned. Cleaning shall be accomplished using a high-pressure jet cleaning machine, producing a minimum of 800 psi. Waste water and debris shall not be permitted to enter sewer lines in service, but shall be removed by a vacuum truck at the lowest manhole of the extension. Such cleaning shall be done by private crews at the expense of the Developer/Contractor.

All sewer pipe mains and laterals shall be cleaned and then inspected using a television inspection unit. The televised inspection of any pipes which reveal broken, misaligned or displaced pipe, or other defects shall be remedied by the contractor as directed by the City Engineer / Public Works Representative. The Developer/Contractor must provide the City with a DVD of the televising of the pipe and the Developer/Contractor shall pay all associated costs. The televised inspection shall have the slope of pipe shown on the DVD throughout the inspection. The televising equipment used must record on the DVD a continuous distance from the point of beginning. After cleaning and inspection have been completed, the pipe shall be tested as instructed in the following section.

6.9 TESTS

The Developer/Contractor will be required to conduct an air test and displacement test in the presence of the City Engineer / Public Works Representative. If these tests prove to be inconclusive, any or all of the other required tests shall be conducted in the presence of the City Engineer / Public Works Representative or his representative. Tests shall be performed as follows:

6.9.1 Infiltration Test:

The Developer / Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the City Engineer / Public Works Representative in making infiltration tests of the completed sewer before it can be placed into service. The Developer/Contractor shall furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the City Engineer / Public Works Representative. The maximum allowable infiltration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per twenty-four hours (24 hrs) for all installed sewer pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the City Engineer / Public Works Representative at the expense of the Developer/Contractor.

6.9.2 Exfiltration Test:

The Developer/Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the City Engineer / Public Works Representative in making exfiltration tests of the completed sewer before it can be placed into service. The length of line to be tested at one time shall be limited to the length between adjacent manholes. The maximum allowable exfiltration shall not exceed one-hundred-fifty (150) gallons per inch diameter per mile per 24 hours for all installed sewer pipe. The end of the sewer line, which projects into the manhole, shall be plugged. The pipe shall then be filled with water from the upper manhole, and the line maintained under a light pressure of four feet (4') of head. The inflow of water necessary to maintain this head shall be recorded as the leakage of the system. If the quantity of exfiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the City Engineer / Public Works Representative at the expense of the Developer/Contractor.

6.9.3 Air Testing:

The Developer/Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer / Public Works Representative and the Developer/Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the City Engineer / Public Works Representative, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the service laterals (and plugs) have been installed. Each test section shall be pressurized to four (4.0) psi. For the purpose of stabilizing the air pressure in each test section, the four (4.0) psi pressure shall be maintained for a two-minute period. Each test section shall then be re-pressurized to 4.0 psi for a period of four minutes. The test section shall be accepted if, after four minutes, the pressure gauge indicates 3.5 psi or greater. Failure of the Developer / Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and re-tested until the minimum air testing requirements have been met.

6.9.4 "Go/No-Go" Mandrel Proof Testing:

Not less than thirty (30) days after installation of the flexible sewer or drain pipe, the Contractor shall test the buried pipe to insure that ring-deflection of the pipe does not exceed five percent (5%) of the pipe's specified minimum inside diameter (ID). This proof test shall establish that the Contractor has installed the flexible pipe in full compliance with the Project Specifications thereby providing required pipe/soil structural strength.

The Contractor, with the City Engineer / Public Works Representative present, shall pull a "Go/No-Go" Mandrel, inspected and approved by the City Engineer / Public Works Representative, through the full length of installed flexible pipe. The Mandrel shall be fabricated from suitable metal with a minimum of nine (9) properly sized radial fins mounted upon a center pulling shaft. In any case, the Mandrel shall be provided with an odd number of rigidly mounted radial fins. The Mandrel shall be provided with a proof-sizing ring that can demonstrate that the Mandrel's minimum outside diameter (OD) is not less than ninety-five percent (95%) of the specified minimum inside diameter of the installed flexible pipe. The Mandrel shall be pulled by the Contractor through one-hundred percent (100%) of the installed flexible pipe without using mechanical equipment. Failure of the Mandrel to pass through a pipeline shall be deemed evidence of inadequate installation by the Contractor not in compliance with the Project Specifications.

6.10 MANHOLE CONNECTIONS

PVC pipe connections to manholes shall be achieved by use of manhole coupling adapters, rubber gaskets, or positive seal gasket system with 300 series nonmagnetic stainless steel bands such as PSX: Direct Drive or approved equal. PVC may not be grouted directly to concrete.

Positive seal gasket systems boot shall be constructed solely of synthetic or natural rubber, shall have a minimum tensile strength of 1600 psi and have a minimum wall thickness of 0.275 inches. The boot shall either be "cast-in-place" in the precast base or attached to the precast base by means of an internal expanding band. When the boot is attached to the precast base, a water tight seal between the boot and the precast base must be accomplished. An external band (take-up clamp) shall be supplied and used to clamp and seal the boot to the pipe. The band shall be made of 300 series nonmagnetic stainless steel. After the band has been placed, it shall be completely coated with a bituminous material approved by the City Engineer / Public Works Representative.

6.11 SEWER LATERAL CONNECTIONS

All sewer lateral connections onto new sewer mains shall be made through pre-formed wye fittings installed in the main line at the time of main line installation. The minimum spacing between sewer lateral connections using a wye is thirty feet (30'). When spacing between sewer laterals is less than thirty feet (30'), Inserta Tee connections must be used.

Connections onto existing sewer mains shall be made with Inserta Tee connections or approved equal. All connections by Inserta Tees on existing sewer mains shall be done with a sewer tapping machine and all required fittings and materials. Connections shall be made as shown on the Standard Drawing and at the location specified herein, shown on the improvement drawings or as staked in the field.

6.12 SEWER SERVICE LATERALS

New service laterals shall be constructed with materials and procedures as specified herein.

In no case shall sanitary sewer laterals be less than four inches (4") in diameter.

6.12.1 Extent of Laterals and Location of Laterals:

New sewer laterals installed to lots shall be located ten feet (10') in the downhill direction from the lot centerline and a minimum of ten feet (10') from the culinary water service. Service laterals shall extend from the sewer main to a point fifteen feet (15') beyond the street right-of-way line unless shown or staked otherwise. Laterals shall be capped with a cap suitable to withstand test pressure and prevent any leakage into or out of the lateral.

Sewer cleanouts shall be installed every one-hundred feet (100') maximum.

Lateral connections directly into a manhole shall **not** be allowed.

A two-inch by four-inch (2" x 4") lumber marker, with the top twelve inches (12") painted green, extending from the end of the sewer lateral to a minimum of twelve inches (12") above finished grade, shall be installed to clearly mark the end of each lateral line. In addition to the 2" x 4" lumber marker, the Developer/Contractor shall install a brass pin, 1/2" in diameter, stamped with the letter "S" in the top back of curb at the location where the sewer lateral crosses the curb.

When an existing sewer lateral is encountered along the line and grade of a new pipeline it shall be relocated using appropriate pipe and fittings and graded to insure adequate slope to drain properly. Minimum slope shall be one-quarter-inch (1/4") per foot.

6.12.2 Excavation and Backfill:

Trench excavation and backfill shall conform to the applicable paragraphs of Chapter 2 and the bedding requirements of Section 2.5.3 Pipe Embedment Material Placement.

6.12.3 Pipe:

Pipe used for new service laterals shall be PVC Plastic Pipe conforming to ASTM D3034 SDR 35.

6.12.4 Cover Over Sewer Lateral Lines:

There shall be a minimum of 3 feet of cover over all sewer lateral lines.

6.12.5 Testing:

The service laterals shall be tested as a part of the sewer main to which they are connected.

6.12.6 Damage and Repairs of Sewers and Appurtenances:

The Developer/Contractor shall be responsible for the protection of existing improvements, and any damage resulting from its operations shall be its sole responsibility.

Damage to the sewers, laterals, or appurtenances shall be repaired by acceptable and approved methods.

6.13 ORANGEBURG PIPE

All Orangeburg pipe (currently in service) encountered during construction shall be completely removed and replaced to current standards.

CHAPTER 7 - MANHOLES

7.1 GENERAL

This division covers the requirements for manhole materials and installation. Manholes shall be installed at the locations and at the depth shown on the drawings. Manholes shall be furnished complete with cast-iron rings and covers. No steps shall be installed in any manhole.

7.1.1 Manhole Sizing:

Minimum manhole interior diameter is four (4) feet for manholes with one inlet and one outlet pipe. Manholes with two or more inlet pipes and one outlet pipe shall be a minimum of five (5) feet in diameter.

7.2 CONCRETE BASE

Unless otherwise noted manhole bases shall be precast and shall have pipe inverts and a resilient connection between pipe and manhole for each pipe connecting to the manhole.

Where sewer lines pass through or enter manholes, the invert channels shall be smooth and semi-circular in cross section, conforming to the details shown on the Drawings. Changes of direction of flow within the manholes shall be made with a smooth curve with as long a radius as possible. The floor of the manhole outside the flow channels shall be smooth and slope toward the channel at not less than one-half inch (1/2") per foot.

Concrete for manhole bases shall comply with the requirements of Chapter 9, Portland Cement Concrete, of these Specifications.

7.3 WALL AND CONE SECTIONS

All manholes shall be precast, sectional, reinforced concrete pipe forty-eight-inch (48") diameter, or larger, as specified. Both cylindrical and taper sections shall conform to all requirements of ASTM Designation C478-88 (or latest revision) for Precast Reinforced Concrete Manhole Sections.

All joint surfaces of precast sections and the face of the manhole base shall be thoroughly cleaned and wet prior to setting precast sections. All joints, including grade rings, shall be set in mastic or equal butyl rubber gasket. The joints shall be sealed with a rubber gasket that is permanently flexible and non-shrinking. Gasket must meet or exceed all requirements of AASHTO M-198 and ASTM C 990 section 6.2.1, Butyl rubber sealants. All joints shall be water tight and free from appreciable irregularities in the interior wall surface.

7.4 DROP MANHOLES

When the difference in elevation of an incoming sewer is twenty-four inches (24") or greater a drop manhole shall be used. The drop manhole shall be constructed as shown in the Standard Drawings. The drop pipe assembly (outside of the manhole) shall be PVC pipe with appropriate fittings.

When the difference in elevation of an incoming sewer is less than twenty-four inches (24") the invert channel shall be smooth and semi-circular in cross section, conforming to the details shown on the Standard Drawings.

7.5 MANHOLE RINGS AND COVERS

All iron casting shall conform to the requirements of ASTM Designation A48 (Class 35) for grey iron castings, free from blowholes and shrinkage defects. Castings shall be free from fins and burrs and shall be shot-blasted to remove sand and other foreign matter.

Rings and covers shall be equal to the twenty-four inch (24") Standard circular, with machined bearing surfaces, gravity, solid, non-rocking type. The minimum weight of the cover shall be one hundred sixty (160) pounds. The

minimum weight of the ring shall be two hundred eighty (280 lbs.). No flat rings and covers shall be allowed unless approved by the City Engineer / Public Works Representative. The tops of the cover and ring shall be flush and there shall be 1/8-inch clearance between the cover and the ring. In addition to the foundry name and year of manufacture, the cover shall be marked "SEWER."

7.5.1 Setting of Manhole Frames and Covers and Placement of Concrete Collars

Covers shall be set to the finished grade and contour of the street. Rings and covers shall be protected during backfilling and compaction of the road base and during the placing or replacing of road surfaces. Any rings or covers damaged or broken shall be replaced by the Developer/Contractor at its expense. Prior to paving, the manhole ring and cover shall be GPS-located by the Developer / Contractor (shot at the center of the ring) and set below the finished road base elevation. After paving the asphalt shall be removed, and the manhole ring and cover shall be raised to match the grade and slope of the finished road surface and shall use the WHIRLYGIG manhole riser/collar system.

Road base around the manhole ring and cover shall be recompacted, and the concrete collar placed. Manholes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement. The top of all cone sections shall be a minimum of eight inches (8") and a maximum of twelve-inches (12") below the finished road surface. Manholes must be cleaned of all debris after setting of collar.

See Standard Drawings for Concrete collar details.

7.6 CONNECTIONS TO EXISTING SEWER MAINS

Manholes used to connect to existing sewer lines shall be plumb and centered on the existing pipe. Care shall be taken not to disturb the alignment of the existing sewer main.

A four-foot (4') manhole section (of the appropriate diameter based on the size or number of the sewer lines to be connected) shall be notched and placed over the existing sewer main. The notch in the manhole section shall be large enough such that the bottom of the manhole section is six-inches (6") below the bottom of the existing pipe. Sufficient support shall be placed below the manhole section such that the manhole section does not rest on the existing pipe. Concrete shall then be placed inside the manhole section around the existing pipe to form the manhole base to the springline of the existing pipe.

The cutting of the existing sewer pipe shall be done in the presence of the City Engineer / Public Works Representative. The cut shall be full area of the new base and shall be finished so as to leave no projections that will restrict the flow or catch solids.

Every precaution shall be taken to prevent any material from entering the sewer main. Any such materials entering the sewer shall be removed.

7.7 CONNECTIONS TO EXISTING SEWER MANHOLES

All connections to existing manholes shall be made by coring the manhole. A new trough shall form through the manhole base (via the coring process) such that the new sewer pipe flowline elevation matches the existing trough flowline elevation. The new pipe connection to the manhole shall be made via a rubber boot as previously described in these specifications.

7.8 GREASE INTERCEPTORS

All food facilities that generate grease, or have kitchen equipment that has the potential to produce grease including but not limited to restaurants, institutions, fast food establishments, and camps, are required to install a grease interceptor. Grease interceptors are required to be sized according to the latest Uniform Plumbing Code (adopted by the Springville City) at the time of plan check and approval. Minimum size requirement for a grease interceptor is

1000 gallons. The interceptor should be installed as close to the grease source as possible. Proper setbacks should be maintained from structures, property lines, etc. to comply with all codes. Location of the interceptor should be dependent upon easy pump truck access to allow for proper maintenance and should be approved by the ENGINEER. Toilets, urinals, and other similar fixtures shall not waste through the interceptor. All grease waste shall enter the interceptor through the inlet pipe only. The inlet, outlet, and baffle fittings should be designed for grease retention. To allow for proper maintenance, manholes sections to finished grade shall be provided. The manhole covers should be of gas-tight construction with a minimum opening dimension of 24 inches designed for a minimum H20 loading.

7.9 POLYMER MANHOLES - HYDROGEN SULFIDE PROTECTION

Corrosion of exposed concrete from the bacterial oxidation of hydrogen sulfide gas to sulfuric acid in the sewer system has become an issue in several areas of the City. Sulfuric acid is highly corrosive to the cement paste in concrete and causes tremendous damage to manholes when exposed in high concentrations. In areas where high concentrations of hydrogen sulfide gas have been noted and/or are expected such as where manholes receive pumped sewage, experience low sewer flows, experience low velocity sewer flows or experience other conditions that create hydrogen sulfide gas, the City may require the installation of polymer manholes that are resistant to hydrogen sulfide corrosion. The polymer manholes shall be Geneva Polymer Manhole Systems or approved equal.

CHAPTER 8 - EARTHWORK

8.1 GENERAL

This section defines the requirements for excavation and backfill for manholes, boxes and other structures, and construction requirements of earth embankments and earth fills, as required by the Standard Drawings and other sections of these specifications.

8.2 EXCAVATION FOR MANHOLES, BOXES, AND OTHER STRUCTURES

Manholes, boxes and other structures shall be placed on a stable coarse gravel foundation.

Wherever the subgrade material does not afford a sufficiently solid foundation to support structures and superimposed loads, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place. Coarse gravel or crushed stone shall be used for subsoil reinforcement if satisfactory results can be obtained thereby.

8.3 GRANULAR FOUNDATION BORROW

Granular foundation borrow shall be compacted to not less than 95% of maximum dry density as determined by ASTM D1557.

8.4 BACKFILL AROUND STRUCTURES

No backfilling around or behind structures shall be initiated until the concrete is fully cured for **seven days**. Backfill around structures shall be placed to the lines shown on the drawings, or as directed. After completion of foundation footings and walls and other construction below the elevation of the final grades, and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction is not greater than twelve inches (12”). Material for backfilling shall consist of three-inch to four-inch (3”- 4”) well-graded engineered fill meeting A-1-a, (AASHTO M 145 or ASTM D3282). Recycled concrete will not be allowed for backfill around structures.

Sieve	Percent Passing by Weight
4”	100
2”	80 -95
1”	55- 85
3/8”	40 – 70
No. 4	25 – 55
No. 10	20 – 50
No. 40	10 – 30
No. 200	2 - 10

Fill shall be placed in a manner that will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure. Each layer shall be compacted by hand or machine tampers or by other suitable equipment to a density equal to 95% of maximum dry density as measured by ASTM D1557.

8.5 CONSTRUCTION OF EMBANKMENTS AND FILLS

8.5.1 Foundation Preparation:

Foundations for earth fill shall have all unsuitable materials (such as weeds, sod, roots larger than 1/4-inch in diameter, vegetation, or other organic material) removed by clearing, stripping, and/or grubbing. Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of six inches. The moisture content of the loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches (2") in depth normal to the slope and shall be at such a moisture content that the earth fill can be compacted against them to affect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose material by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earth fill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

8.5.2 Placement:

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the City Engineer / Public Works Representative and any Regulatory Agency having authority over the project. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed twelve inches (12"). Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually-directed power tampers, shall be placed in layers whose thickness before compaction is not greater than eight inches (8"). All rock whose greatest dimension is larger than three-inch (3") shall be removed from the material receiving compaction by manually directed power tampers.

Earth fill designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

- 1) The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material.
- 2) If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill, to a depth of not less than two inches (2") before the next layer is placed.
- 3) The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of not less than two percent (2%) shall be maintained to ensure effective drainage, and except as otherwise specified for drain fill zones. If the drawings or specifications require, or the City Engineer / Public Works Representative directs, that fill be placed at a higher level in one part of the embankment than another is, the top surface of each part shall be maintained as specified above.
- 4) Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction of inlet and outlet pipes are specifically authorized in the contract.
- 5) Embankments built at different levels as described in 3 and 4 shall be constructed so that the slope of the bonding surfaces between the embankment in place and embankment to be placed is not steeper than 2-feet horizontal to 1-foot vertical (2:1). The bonding surface of the embankment in place shall be

stripped of all loose material, scarified, moistened and recompactd when the new fill is placed against it. This is needed to ensure a good bond with the new fill, to obtain the specified moisture content and specified density at the junction of the in-place and new fill.

8.5.3 Borrow:

When the embankment or fill exceeds the amount of excavation, sufficient additional material shall be obtained from borrow pits provided by the Developer/Contractor. All material proposed to be imported shall be subject to the review and approval of the City Engineer / Public Works Representative prior to starting of hauling operations.

The materials used for embankment and fill construction shall be free from sod, grass, roots larger than 1/4-inch diameter, trash, clods, rocks larger than six inches (6") in diameter, and all other material unsuitable for construction of compacted fills. Rotomilled asphalt meeting the large rock requirement may be used as borrow.

Grading of completed embankments and fills shall bring the surfaces to a smooth, uniform condition with final grades being within 0.1 foot of the design grade.

8.6 COMPACTION OF MATERIALS

The material shall be deposited in horizontal layers having a thickness of not more than twelve inches (12") prior to being compacted as hereinafter specified. The distribution of materials shall be such that the compacted material will be homogeneous and free from lenses, pockets, or other imperfections.

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range, and the moisture content shall be uniform throughout the layers. Disking, blading or other approved methods prior to compaction of the layer shall obtain uniform moisture distribution. The moisture shall be controlled at a level to permit compaction of the fill as specified, but in no case greater or less than two percent (2%) plus or minus of the optimum moisture as determined by AASHTO T-180 (Modified Proctor).

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary.

Material that is too wet when deposited on the fill shall either be removed or dried to specified moisture content prior to compaction.

If the top surface of the preceding layer, a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall be scarified and moistened by sprinkling to the required moisture content prior to placement of the next layer of fill.

When the material has been conditioned as here in before specified the backfill or embankment shall be compacted to a minimum of 95% of maximum dry density as determined by AASHTO T-180 (Modified Proctor). Densification of earth fill shall be performed by equipment designated solely for that purpose. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

8.6.1 Under Roadways:

Under roadways and extending one foot beyond the proposed curb-line the fill or embankment material shall be compacted to a minimum of 95% of maximum density specified above.

8.6.2 Under Sidewalks and Driveways:

Under sidewalks extending one foot each side of the edge of slab the fill or embankment material shall be compacted to a minimum of 95% of maximum density specified above.

8.7 REMOVAL OF DEFECTIVE FILL AND PLACEMENT OF ACCEPTABLE FILL

Fill placed that does not conform to the specifications shall be reworked to meet the requirements or removed and replaced with acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

CHAPTER 9 - PORTLAND CEMENT CONCRETE

9.1 GENERAL

The work shall consist of furnishing, forming, placing, finishing, and curing Portland Cement concrete, as required.

9.2 MATERIALS

9.2.1 Portland Cement:

Portland cement shall be Type II and shall comply with the Standard Specification for Portland Cement, ASTM C150.

If air-entraining cement is to be used, the Developer/Contractor shall furnish the manufacturers written statement giving the source, amount and brand name of the air-entraining addition.

Cement shall be stored in such a manner as to be protected from weather, dampness or other destructive agents. Cement that is partially hydrated or otherwise damaged will be rejected.

9.2.2 Aggregate:

Aggregates shall conform to Tentative Specifications for Concrete Aggregates, ASTM C33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when: (1) the specified alternate conditions of acceptance can be proved prior to the use of the aggregates on the job and within a period of time such that no work under the contract will be delayed by the requirements of such proof; or, (2) the specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

The potential reactivity of aggregates with the alkalis in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C33, Appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used, except under one of the following conditions:

- 1) Applicable test results of mortar bar tests, made according to ASTM Method C227, are available which indicate an expansion of less than 0.10 per cent at six months in mortar bars made with cement containing not less than 0.8 per cent alkalis expressed as sodium oxide; or
- 2) Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with "low alkali" cement, containing less than 0.60 per cent alkalis expressed as sodium oxide.

Aggregate of each class and size shall be stored and handled by methods that prevent segregation of particle sizes or contamination by intermixing with other materials.

9.2.3 Water:

Water shall be cleaned and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances and shall meet the requirements of ACI Standard Code (ACI 318 latest edition), paragraph 3.4.

9.2.4 Air-Entraining Agent:

Air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to ASTM Designation C150 and C260, except that the relative durability factor in the freezing and thawing test shall be not less than 95.

9.2.5 Water-Reducing and Set-Retarding Admixtures:

Water-reducing and set-retarding admixtures shall conform to the requirements of ASTM Specification C494, except that resistance to freezing and thawing shall be determined in all cases, and the minimum relative durability factor shall be 95.

Admixtures shall be Type A, Water-Reducing or Type D, Water-Reducing and Retarding, as defined in ASTM Specification C494.

When added, in the manner and amount recommended by the manufacturer, to the concrete used on the job, with no change in the cement content or proportions of the aggregates, admixtures shall have the following effects:

Type A or Type D: The water content at the required slump shall be at least 5 percent less with the admixture than without. The air content shall remain within the range specified, but shall not exceed 8 per-cent in any case.

Type D: The time of initial setting, determined as prescribed in ASTM C494, shall be from 1 to 3 hours longer with the admixture than without.

9.2.6 Curing compound:

Curing compound for concrete shall meet the requirements of ASTM Specification C309.

Unless otherwise specified, the compound shall be Type 2.

All curing compound shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner to prevent damage to the containers and to protect water-emulsion types from freezing.

9.3 CLASS OF CONCRETE

Concrete used within the City Right-of-Way shall have the following properties:

- Minimum 28 day compressive strength of 5000 psi
- Minimum cement content of 7.5 bags
- Maximum water-cement ratio of 0.44

9.4 COMPOSITION OF CONCRETE

9.4.1 Aggregate:

Aggregates maximum size shall be not larger than one-fifth (1/5) of the narrowest dimension between forms within which the concrete is to be cast, nor larger than three-fourths (3/4) of the minimum clear spacing

between reinforcing bars or between reinforcing bars and forms. For un-reinforced concrete slabs, the maximum size of aggregates shall not be larger than one-fourth (1/4) the slab thickness.

9.4.2 Water:

Water shall be added to the mix to produce concrete with the minimum practicable slump. The slump of mechanically vibrated concrete shall not exceed four-inch (4"). No concrete shall be placed with a slump in excess of five-inch (5").

9.4.3 Air-Content:

Air-Content for air-entrained concrete shall comply with the following:

Course Aggregate Size (in.)	Air Content (percent)
1 1/2 to 2 1/2	5 ± 1
3/4 or 1	6 ± 1
3/8 or 1/2	7 ± 1

The air-entraining agent shall be added as liquid to the mixing water by means of mechanical equipment capable of accurate measurement and control.

9.4.4 Admixtures:

Water Reducing and/or Set Retarding admixtures shall not be used except with previous approval from the City Engineer / Public Works Representative and shall in such a case, conform to the standards of materials set forth in the specification.

9.5 DESIGN OF THE CONCRETE MIX

The proportions of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exclude free water during consolidation.

Prior to placement of concrete, the Developer/Contractor shall furnish the City Engineer / Public Works Representative, for approval, a statement of the materials and mix proportions (including admixtures, if any) it intends to use. The statement shall include evidence satisfactory to the City Engineer / Public Works Representative that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After the job mix has been reviewed for conformance to specification by the City Engineer / Public Works Representative, neither the source, character, grading of the aggregates, the type and brand of cement, nor admixture shall be changed without prior notice to the City Engineer / Public Works Representative. If such changes are necessary, no concrete containing such new or altered materials shall be placed until the City Engineer / Public Works Representative has approved a revised job mix.

9.6 OBSERVATION AND TESTING

The City Engineer / Public Works Representative shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the City Engineer / Public Works Representative to observe the materials, equipment and processes and to obtain samples of the concrete. All tests and observations will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

9.6.1 Concrete Testing Requirements:

- 1) Review and/or test materials in conformance with specifications. Concrete material shall conform to Section 9.2. Flowable Fill shall conform to Chapter 16.
- 2) Conduct strength tests of concrete used in conformance with the following procedures:
 - a. Secure composite samples in conformance with ASTM C 172. Obtain samples from different batches of concrete on a random basis. When testing concrete from a concrete pump, take the sample from the hose after all the priming grout has been wasted.
 - b. Take four specimens per sample in conformance with ASTM C31. Report deviations from requirements.
 - c. Test specimens per sample in conformance with ASTM C39. Make at least one strength test for each 50 CY, or fraction thereof, of each mix design of concrete placed in any one day. When total quantity of concrete with a given mix design is less than 50 CY, strength tests may be waived by Engineer if, in his judgment, adequate evidence of satisfactory strength is provided.
- 3) Perform slump tests with each strength test in conformance with ASTM C143. Reject concrete failing slump test.
- 4) Determine normal weight concrete air content with each strength test in conformance with ASTM C231.
 - a. If an air test fails, immediately terminate concrete discharge and retest the same load.
 - b. The concrete will be rejected if the second air test does not meet the specification.
 - c. If the second air test meets the specification, a third test will be performed to establish concrete acceptance or rejection.
- 5) Determine air content and unit weight of lightweight concrete test with each strength test in conformance with ASTM C173 and C567.
- 6) Determine temperature of concrete for each strength test.
- 7) Identify on testing reports, location of placement of tested concrete.

9.6.2 Evaluation of Test Results:

Concrete strength: As long as averages of all sets of three consecutive strength test results equal or exceed specified strength (f_c) and no individual strength test result falls below specified strength (f_c) by more than 500 psi, concrete strength is considered satisfactory.

9.6.3 Acceptance:

- 1) The strength will be determined by the average of the test lot cylinders taken on a specific pour. The test lot will consist of four (4) cylinders, one broken at 7 days and three broken at 28 days. The last three will be used for determining the average strength.
- 2) Concrete with compressive strength below the required specified strength shall be evaluated by the Engineer for capabilities necessary to the integrity of the structure. The City Engineer / Public Works Representative may accept this concrete, or require that it be replaced with acceptable material. The City Engineer / Public Works Representative shall make the final decision.

9.7 HANDLING AND MEASUREMENT OF MATERIALS

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Except as otherwise provided in Division 8, cement and aggregates shall be measured as follows:

- 1) Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.
- 2) Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.
- 3) Water shall be measured by weight, to accuracy within one per cent of the total quantity of water required for the batch.
- 4) Admixtures shall be measured within a limit of accuracy of 3 percent (3%).

9.8 MIXERS AND MIXING

Concrete shall be uniform and thoroughly mixed when delivered to the work. Variations in slump of more than one inch (1") within a batch will be considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other means. For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than one and one-half (1-1/2) minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 or more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site will be permitted if approved by City Engineer / Public Works Representative. The batching and mixing equipment shall conform to the requirements of ASTM Specification C685 and shall be demonstrated prior to placement of concrete, by tests with the job mix, to produce concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with Sections 6, 7, 8, 13, and 14 of ASTM Specification C685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

9.9 FORMS

Forms shall be of steel or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a non-staining form oil before being set into place.

Metal ties or anchors within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete.

All edges that will be exposed to view when the structure is completed shall be chamfered by placing molding in the forms, unless finishing with molding tools.

9.10 PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

Unless otherwise specified, when concrete is to be placed over drain fill, the contact surface of the drain fill shall be covered with a layer of asphalt-impregnated building paper or polyvinyl sheeting prior to placement of the concrete. Forms for weepholes shall extend through this layer into the drain fill.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

9.11 CONVEYING

Concrete shall be delivered to the site and discharged into the forms within 90 minutes after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The City Engineer / Public Works Representative may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

Concrete shall not be dropped more than five feet (5') vertically unless suitable equipment is used to prevent segregation.

9.12 PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved. No concrete shall be placed except in the presence of the City Engineer / Public Works Representative. The Developer/Contractor shall give 48-hour notice to the City Engineer / Public Works Representative each time it intends to place concrete. Such notice will give the City Engineer / Public Works Representative adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcements and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Unless otherwise specified, slab concrete shall be placed to design thickness in one continuous layer. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes or "elephant trunks" shall be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layers being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tramping or vibration as necessary to insure smooth surfaces and dense concrete. Each layer shall be consolidated to insure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the Developer/Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

9.13 CONSTRUCTION JOINTS

If construction joints are needed they shall be placed in locations approved by the City Engineer / Public Works Representative.

Where a featheredge would be produced at a construction joint, as in the top surface of a sloping wall, an inset form shall be used so that the resulting edge thickness on either side of the joint is not less than six inches (6").

In walls and columns, as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardening concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the City Engineer / Public Works Representative. The surfaces shall be kept moist for at least one (1) hour prior to placement of the new concrete.

9.14 EXPANSION AND CONTRACTION JOINTS

Maximum Joint Spacing

	Expansion Joints	Contraction Joint
Sidewalk	50 LF	5 LF
Curb and Gutter	At Construction (Cold) Joints	10 LF
Cross Gutter	At Construction (Cold) Joints	10 LF

Contraction joints shall be a minimum of T/4 where T is the thickness of the concrete.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

Open joints, when specified, shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of open joints shall be finished with an edging tool prior to removal of the joint strips.

9.15 WATERSTOP

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

9.16 REMOVAL OF FORMS

Forms shall not be removed without the approval of the City Engineer / Public Works Representative. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

9.17 FINISHING FORMED SURFACES

Immediately after the removal of the forms:

- 1) All fins and irregular projections shall be removed from exposed surfaces.
- 2) On all surfaces, the holes produced by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted and filled with a dry-pack mortar consisting of one part Portland cement, three parts sand that will pass a No. 16 sieve, and water just sufficient to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

9.18 FINISHING UNFORMED SURFACES

All exposed surfaces on the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft will not be permitted.

The addition of dry cement or water to the surface of the screeded concrete to expedite finishing will not be allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

9.19 CURING AND PROTECTION

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Sprinkling, flooding or fog spraying shall maintain moisture or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms (except plywood) left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

As soon as the concrete has hardened sufficiently to prevent damage, the finished surface shall be protected for curing in one of the following ways:

- 1) Ponding of water on the surface or continuous sprinkling.
- 2) Application of absorptive mats such as three-inches (3") of cured hay, clean straw or fabric kept continuously wet.
- 3) Application of two-inches (2") of moist earth or sand uniformly distributed on the surface and kept saturated by spraying with water.
- 4) Application of light colored waterproof plastic materials, conforming to "Specifications for Waterproof Sheet Materials for Curing Concrete" ASTM C171, placed and maintained in contact with the surface of the concrete.
- 5) Application of a curing compound, conforming to "Specifications for Liquid Membrane - Forming Compounds for Curing Concrete" ASTM C309. The compound shall be light in color and shall be applied in accordance with the manufacturer's recommendations immediately after any water sheen, which may develop after finishing, has disappeared from the concrete surface.

Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be re-sprayed at the rate of application specified above.

9.20 REMOVAL OR REPAIR

When concrete is honey combed, damaged or otherwise defective, the Developer/Contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective concrete. Prior to starting repair work the Developer/Contractor shall obtain the City Engineer / Public Works Representative's approval of its plan for affecting the repair. The Developer/Contractor shall perform all repair work in the presence of the City Engineer / Public Works Representative.

9.21 CONCRETING IN COLD WEATHER

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40° F unless facilities are provided to prevent the concrete from freezing. (Below 25° F heating blankets alone will not be allowed and must be supplemented with an additional heat source.) The use of accelerators or antifreeze compounds will not be allowed. The contractor shall be responsible to insure the protection of the concrete regarding these requirements.

9.22 CONCRETING IN HOT WEATHER

The Developer/Contractor shall apply effective means to maintain the temperature of the concrete below 90° F during mixing, conveying and placing. The contractor shall be responsible to insure the protection of the concrete regarding these requirements.

CHAPTER 10 - CONCRETE REINFORCEMENT

10.1 GENERAL

This division furnishing and placing reinforcing steel, epoxy-coated reinforcing steel, and fiber reinforcement.

Steel reinforcement shall be free from rust, oil, grease, paint or other deleterious matter. Use deformed billet-steel bars as specified. All reinforcing bars shall be Grade 40 or Grade 60 as required. Wire Fabric shall conform to ASTM A185-70.

Before supply of steel, the Developer/Contractor shall provide all order lists and bending diagrams for approval of the City Engineer / Public Works Representative. The approval of such lists and diagrams shall in no way relieve the Developer/Contractor of responsibility for the correctness of reinforcing supplied and all expenses incidental to revision of furnished reinforcing steel shall be carried by the Developer/Contractor.

All steel to conform to ACI Standard Code (ACI 318 latest edition), Section 3.5. Gages, spacing and arrangement of wires in welded steel wire fabric shall be as defined in ACI Standard Code (ACI 315 latest edition) for the specified style designations.

Steel reinforcement stored at the site of the work shall be stored above the ground surface on platforms, skids or other supports and shall be protected from mechanical injury and corrosion.

10.2 FABRICATION AND PLACING STEEL REINFORCEMENT

10.2.1 Fabrication:

Reinforcement shall be cold bent to the shapes shown in accordance with ACI Standard Code (ACI 318 latest edition), Section 7.1.

10.2.2 Clearances:

All bars shall be of the size specified and shall be placed in the positions shown on the Drawings in such a manner as to be firmly held during the placing of the concrete. Where not otherwise indicated, minimum clearance and cover as required by the ACI Standard Code (ACI 318 latest edition), Section 7.7 shall be maintained.

Reinforcement Clearances	Minimum Cover Inches
Cast In Place Concrete (Non Prestressed)	
Concrete cast against and permanently exposed to earth	3
Concrete exposed to earth or weather:	
No. 6 through No. 18 Bar	2
No. 5 Bar, W31 or D31 wire, and smaller	1 1/2
Concrete not exposed to weather or in contact with ground:	
- Slabs, Walls, and Joists:	
No. 14 and no. 18 Bar	1 1/2
No. 11 Bar and smaller	3/4
- Beams, Columns:	
Primary reinforcements, ties, stirrups, spirals	1 1/2
- Shells, Folded Plate Members:	
No. 6 Bar and larger	3/4
No. 5 Bar, W31 or D31 wire, and smaller	1/2

Reinforcement Clearances	Minimum Cover Inches
Precast Concrete (Manufactured Under Plant Controlled Conditions)	
Concrete exposed to earth or weather:	
- Wall Panels:	
No. 14 and No. 18 Bars	1 1/2
No. 11 Bar and smaller	3/4
-Other Members:	
No. 14 and No. 18 Bars	2
No. 6 through No. 11 Bars	1 1/2
No. 5 Bar, W31 or D31 wire, and smaller	1 1/4
Concrete not exposed to weather or in contact with ground:	
- Slabs, Walls, Joists:	
No. 14 and No. 18 Bars	1 1/4
No. 11 Bar and smaller	5/8
- Beams, Columns:	
Primary reinforcement	1 1/2
Ties, stirrups, spirals	3/8
- Shells, folded plate members:	
No. 6 Bar and larger	5/8
No. 5 Bar, W31 or D31, and smaller	3/8

10.2.3 Support:

Bars shall be tied at all intersections except where the spacing is less than twelve inches (12") where alternate intersections shall be tied. Distance from supports shall be by means of ties, hangers, or other approved supports. Metal chairs of approved design shall be used to hold reinforcement from contact with the forms. Metal chairs that are in contact with the exterior surface of the concrete shall be galvanized. Layers of bars or when placing concrete directly on a prepared subgrade reinforcing shall be separated by precast mortar blocks or by other equally suitable devices. The use of stones, pieces of broken brick, metal pipe, or wooden blocks shall not be permitted. Reinforcement in any member shall be placed and then inspected and approved by the City Engineer / Public Works Representative before the placement of concrete begins. Concrete placed in violation of this provision may be rejected in which case removal will be required.

If the fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

10.2.4 Splicing:

All splices shall be staggered so that splices in adjacent bars shall be not less than four feet (4') apart, and shall conform to ACI Standard Code (ACI 318 latest edition), Section 12.15.

10.3 EPOXY COATING

10.3.1 Prequalify all Coatings:

Ensure that epoxy coating applicator has Concrete Reinforcing Steel Institute (CRSI) fusion bonded epoxy coating applicator plant certification. Furnish a copy of the Prequalification Test Report to the City Engineer / Public Works Representative. Provide an 8-ounce sample of the coating material from each batch.

10.3.2 Coat Bars as Specified:

The following requirements shall be followed:

- 1) Maintain the coating thickness between 8 and 12 mils.
- 2) Coat bars after bending, unless the fabricator can show that satisfactory results can be obtained by coating before bending
- 3) Reject any bent bars with visible cracks or damage in the coating.

10.3.3 Handling:

Do not damage the bars or the coating during handling and storage.

- 1) Use systems with padded contact areas when handling coated bars.
- 2) Pad all bundling bands.
- 3) Lift all bundles with strong back, multiple supports, or a platform bridge.
- 4) Do not drop or drag bars.
- 5) Repair damaged bars or coating at no additional cost to the Owner.
- 6) Use patching material per manufacturer's recommendation to repair damaged coating.
- 7) Have the coated bars inspected for damage to the coating after the bars are in place and immediately before concrete placement.
- 8) Repair all visible defects using the specified patching or repair material.

10.4 FIELD CUTTING EPOXY-COATED BARS

10.4.1 Cutting:

Saw or shear epoxy-coated bars that are specified to be cut in the field. Do not flame cut.

10.4.2 Repairing:

Repair the sawed or sheared end using the specified patching or repair material.

10.5 FIBER REINFORCEMENT

Upon request by the City Engineer, cast-in-place concrete shall contain polypropylene fiber reinforcing with a fiber length of 0.75 inches minimum and mixed at a rate of 1.5 pounds per cubic yard of concrete. The fibers shall be introduced into the concrete mix at the time the concrete is batched in accordance with the manufacturer's recommendations. The required physical characteristics of the reinforcing fiber are as follows:

- | | |
|---------------------|-----------------------|
| a) Specific Gravity | 0.91 |
| b) Tensile Strength | 80-110 ksi |
| c) Fiber Length | 0.75 inches (minimum) |

The Developer/Contractor will submit documentation to the City Engineer and obtain approval of the fiber material prior to use on the job.

CHAPTER 11 - RESTORATION OF SURFACE IMPROVEMENTS

11.1 GENERAL

The Developer/Contractor shall be responsible for the protection and the restoration or replacement of any improvements existing on public or private property at the start of work or placed there during the progress of the work. Existing improvements shall include but not be limited to permanent surfacing, striping, curbs, gutters, sidewalks, driveways, planted areas, sprinkling systems, ditches, culverts, fences, walls, etc. All improvements shall be reconstructed to equal or better, in all respects, than the existing improvements removed.

Developer/Contractor shall document existing improvements and conditions (video, photo, etc.) prior to commencement of any construction activities. Where there are disputes regarding restoration of existing improvements, the City will side with the private property owner if no documentation to the contrary can be provided by the Developer/Contractor.

11.2 FIELD VERIFICATION OF IMPROVEMENTS

The Developer/Contractor shall carefully examine the site of the work and to acquaint itself with all conditions relating to the protection and restoration of existing improvements. The City Engineer / Public Works Representative does not guarantee that all improvements are shown on the Drawings, and it shall be the Developer/Contractor's responsibility to protect and restore all existing improvements whether or not each is provided for specifically on the Drawings.

11.3 REMOVAL OF PAVEMENT, SIDEWALKS, CURBS, ETC.

The pavement, sidewalk, curb and gutter, driveway, etc. shall be cut vertically along the limits of the improvements to be removed, or nearest full joint, in such a manner as to not cause damage to adjoining pavement, sidewalk, curb and gutter, driveway, etc. The portion to be removed shall be broken up in a manner that will not cause damage to the pavement or concrete outside the limits of the improvements to be removed; however, any pavement damaged by operations outside the limits of the work area shall be replaced at the Developer/Contractor's expense.

11.4 MATERIALS

Materials used for repair or replacement of surface improvements shall be equal to or better than the material removed. All materials shall meet or exceed Springville City Standards and Specifications.

11.5 RESTORING BITUMINOUS OR CONCRETE STREET SURFACES

Where trenches are in or cross bituminous or concrete surfaced roads, traffic lanes, driveways, parking areas, etc., the bituminous or concrete surface shall be restored as quickly as there is sufficient quantity to make it practical (weather permitting), and maintained as follows:

11.5.1 Before Excavation:

All existing asphalt or concrete surfaces shall be saw cut or roto-milled to a square edge before excavation.

11.5.2 Temporary Graded Surface:

Until resurfacing can be done in paved areas a temporary untreated base course surface shall be placed deep enough to provide a minimum of eight inches (8") below the bottom of the bituminous surface and shall be brought flush with the paved surface.

The untreated base shall be placed in the trench at the time it is backfilled. Excess material shall be removed

from the premises immediately. The Developer/Contractor will maintain the temporary untreated base course surface until the asphalt is placed.

11.5.3 Preparation for Paving:

The area over trenches to be resurfaced shall be graded to a smooth, uniform surface and compacted to not less than 95% (maximum dry density). Mud or other soft or spongy material shall be removed and the void filled with untreated base course and rolled and tamped thoroughly in layers not exceeding six inches in thickness. The edges of trenches, which are broken down during the making of subgrade, shall be removed and trimmed neatly before resurfacing.

Before any permanent resurfacing is placed, the Developer/Contractor shall trim the existing paving to clean straight lines as nearly parallel to the centerline of the trench as practicable. Said straight lines shall be established in thirty foot minimum lengths and no deviations from such lines shall be made except as specifically permitted by the City Engineer / Public Works Representative.

Existing paving shall be saw-cut back a minimum of twelve inches (12") beyond the limits of any excavation or cave-in along the trench, creating a T-patch. The existing base material shall be removed in the twelve inch (12") cut back area and new road base material placed and compacted so that the edges of the new trench paving will rest on a minimum of eight inches (8" depth) of newly placed and compacted road base material (refer to the trench detail in the Standard Drawings). **NOTE** - the depth of base material removed will need to be sufficient to allow for a minimum of four inches (4") of pavement (or the existing pavement thickness plus one inch whichever is greater), to be placed on a minimum of eight inches (8") of compacted road base.

The existing pavement from the edge of the newly created T-patch to the edge of asphalt / lip of gutter must be a minimum of 30" wide and be undisturbed in order to remain in place. If this width is less than 30", or has been disturbed, then the Developer/Contractor shall be responsible to remove and replace the exist asphalt.

A minimum of thirty (30) inches of existing undisturbed pavement is required between the edge of the newly created T-patch and any structure, concrete, or edge of existing pavement surface. If less than thirty (30) inches remains, the pavement shall be removed and permanent surfacing placed to the concrete or structure. If more than 50% of the permanent surfacing of a traveled lane is impacted by the excavation, the entire lane width will be required to be saw cut/milled, removed, and replaced to City standards. Trenching or excavation is not permissible within eighteen (18) inches of any concrete or structure, unless permitted by the City Engineer. Any surface or underlying pavement outside the trench which is undermined or damaged by the trenching operation shall be removed to a neat, straight line, and replaced. In areas where native, clean sands are present the City Engineer may require that trenching exceeding five (5) feet in depth be required to remove and replace surfacing for a minimum of two (2) times the depth unless direct contact shoring is provided to fully support the trench walls for full depth of the excavation.

11.5.4 Bituminous Surface:

The bituminous surface over trenches shall be restored by standard paving practices to a minimum thickness of four inches (4") or match existing asphalt thickness plus one inch, whichever is greater. Gradation of aggregate shall conform to the 1/2-inch gradation limits as defined in these Specifications, unless otherwise approved by the City Engineer. Asphalt specifications to meet Section 12.8.

Pavement restoration shall include priming of pavement edges with Type MC-70 bituminous material and placing rolled plant hot mix bituminous material to the level of the adjacent pavement surfaces.

11.5.5 Special Requirements for Longitudinal Trench Repair:

Trenching running parallel to the street (longitudinal) generally will have special mill and overlay repair requirements. This will need to be coordinated with the City and constructed as specified in the

“Excavation Permit” and as approved by the City Engineer.

11.6 UTILITY POTHoles-KEYHOLE METHOD

This specification covers the requirements for keyhole coring, vacuum excavation, backfilling, and reinstatement of the keyhole core in asphalt or concrete pavements to allow for underground utility repairs and underground exploratory potholing. **Keyhole coring** shall be defined as follows: *The operation of coring a circular hole through the roadway pavement using diamond tipped core drilling equipment.*

11.6.1 Pothole Excavation:

The vertical alignment of the keyhole coring shall be perpendicular to the horizon, and the cutting shall extend to the full depth of the existing pavement section.

Unless otherwise approved by the Engineer, keyhole cores shall be no less than 6 –inches and no greater than 18- inches in diameter. Adjacent cores shall not be closer than 3 feet from each other (edge to edge), shall not contain a joint or any pavement cracks greater than 1/8-inch wide, and shall not be performed in pavements where the section is less than 3-inches thick. Coring shall be performed with a keyhole coring saw with high strength steel diamond tipped core drill bits.

The Contractor shall place a temporary mark on the keyhole core prior to cutting to insure that the removed section is replaced in the same orientation as originally found in the pavement.

Soils within potholes shall be removed by air/vacuum extraction methods to expose utilities. The zone of soil removal shall remain essentially within a vertical plane extending below the edges of the removed pavement.

The Contractor shall remove all excess materials excavated from the site.

11.6.2 Pothole Backfill:

The Contractor shall use ½-sack CLSM as backfill in accordance with Chapter 16 – Flowable Fill (CLSM).

11.6.3 Bonding Agent:

The bonding agent is material required to bond asphalt pavement cores to the asphalt concrete pavement from which it was originally removed. Bonding material shall be a single component cementitious, rapid hardening, high strength, waterproof bonding agent conforming to the physical properties shown in Table-1 below.

TABLE-1

Bond Material Properties		
Property	ASTM Test Method	Requirements
Bond Strength, psi (70 degrees F., 30 minute cure)	C882	200 min.
Compressive Strength, psi (70 degrees F, 60 min cure)	C109	1500 min.

- 1) Bonding material shall be impervious to water penetration at the joint after curing.
- 2) Bonding material shall, within 30 minutes at minimum ambient temperature of 70 degrees F., allow an 18" diameter core to support a traffic load equivalent to at least three (3) times the AASHTO H-25 standard wheel load.
- 3) The bonding material is required to securely bond the asphalt concrete core to asphalt concrete pavement and to fill all voids between the core and pavement and within the core.

- 4) Specifications and test results for the bonding material shall be submitted to the City for review and approval before use.

11.6.4 Pavement Restoration:

The surface cut by keyhole coring restored to its original condition with the reinstated core flush with and in the original orientation as the existing surface, matching existing pavement surface appearance.

The bonding agent meeting the requirements of 11.6.3 shall be used for pavement core reinstatement. Excess bonding material shall be removed from the restored surface. A patched appearance shall be avoided in surface restoration wherever possible.

Unless otherwise approved by the Engineer, the Contractor shall reinstate the bonded keyhole core within 24 hours of cutting the pavement. Openings allowed to be left open greater than 24 hours shall be covered with an approved steel road plate capable of supporting traffic loads. The steel plate must be rounded with a fitted collar that, when inserted into the hole, will prevent the steel plate from tipping, tilting, bouncing or spinning out of the hole under traffic conditions. An asphalt mix shall be used to ramp pavement up to the steel plate along all edges.

Surface Tolerances: The reinstated core shall be flush and level with the adjacent pavement. Gaps attributable to the positioning of the core shall be less than 1/16-inch between the bottom of a minimum 3-foot long straightedge and the surface of the pavement in any direction on the surface of the keyhole core, except across the pavement crown or drainage gutters.

11.6.5 Deficiencies:

Where the pavement core is found to be fractured or defective upon removal, or becomes damaged after removal and prior to reinstating, the defective or damaged core shall not be used to reinstate the pavement. Pavement repair shall be performed in accordance with Section 11.5.

A pavement core is considered unacceptable when one of the following conditions exist:

- 1) The core contains any vertical cracks wider than 1/8-inch extending full depth or partial depth through the core; or
- 2) Any deteriorated piece of the core is larger than 10 percent of the overall area of the core.
- 3) Two or more successive layers of asphalt concrete in the core become horizontally delaminated and cannot be rebounded to each other with the bonding compound.

All unacceptable pavement cores shall be removed from the job site.

If another equivalent core of sound condition and matching existing pavement of the same diameter, depth and composition as the defective core is available, it may be reinstated in substitution of the defective core.

11.7 GRAVEL SURFACE

Where trenches are excavated through gravel-surfaced areas such as roads and shoulders, parking areas, unpaved driveways, etc., the gravel surface shall be restored and maintained as follows:

11.7.1 Layer Thickness:

Place a minimum of six inches of compacted material.

11.7.2 Placement:

The material shall be placed in the trench at the time it is backfilled. The surface shall be maintained by

blading, sprinkling, rolling, adding material, etc., to maintain a safe, uniform surface. Excess material shall be removed from the premises immediately.

11.7.3 Gradation:

Material for use on gravel surfaces shall be road base obtained from sound, tough, durable gravel or rock meeting the following requirements for gradation:

Passing 1-inch sieve	100%
Passing 1/2-inch sieve	79-91%
Passing No. 4 sieve	49-61%
Passing No. 16 sieve	27-35%
Passing No. 200 sieve	7-11%

11.8 MISCELLANEOUS IMPROVEMENTS

It shall be the Developer/Contractor's responsibility to restore to their original condition all irrigation canals, levees, culverts, gates, fences, drainage ditches, and all such improvements, which are cut or disturbed during construction. Topsoil in farming areas or along road edges shall be stored separate from subsoil during pipe trench excavation. Topsoil shall be replaced during backfill operations as nearly as possible to its original condition, thereby assuring suitable soil for reseeding.

11.9 RESTORATION OF SURFACES

Unless otherwise directed, all street surfacing, curbs, gutters, sidewalks, driveways, or other hard surface that must be removed in the performance of the work shall be restored in kind by the Developer/Contractor in accordance with the Specifications contained herein. Deviation of more than one-fourth inch (1/4") between old and new work or within new construction shall be corrected. Such measurement shall be made from a ten-foot (10') minimum length straight edge. Adjoining surfaces between old and new must be flush.

11.10 CLEANUP

At the completion of each area of work all equipment, barricades, and similar items shall be removed from the area. All excess material will be removed. Adjacent borrow pits and road shoulders used for storage of excavating materials will be smoothed and returned to their original condition.

11.11 PAVEMENT MARKINGS

The Developer/Contractor shall be responsible for restoration of pavement markings on all City and/or County roadways. Restoration of pavement markings shall conform to the applicable local and state specifications.

On roadways under UDOT jurisdiction temporary pavement markings shall be provided for any removed or obliterated markings. The temporary markings shall conform to UDOT standards and specifications. Permanent pavement markings will be replaced by UDOT.

11.12 LANDSCAPE RESTORATION

Areas of new construction that cover or disturb existing landscaped areas with fills and cuts or areas disturbed by construction of retaining walls shall have the landscape restored. Areas that have lawn or flower beds shall be restored including sprinkling systems that might be damaged or relocated because of construction. Lawn covered or removed shall be replaced by sod.

The topsoil shall be fertile, sandy loam topsoil, obtained from well-drained areas. It shall be without admixture of subsoil or slag and shall be free of stones, lumps, sticks, plants or their roots, toxic substances or other extraneous

matter that may be harmful to plant growth and would interfere with future maintenance. Topsoil pH range shall be 5.3 to 6.0.

The Contractor shall take a video of the construction area and perimeter thereof prior to commencing any construction activities to document existing conditions of all areas adjacent to the construction site. A copy of this video shall be made available to the City at the pre-construction meeting and will be referred to ensure the restoration of disturbed areas is equal to or better than prior to the construction.

CHAPTER 12 - ROADWAY CONSTRUCTION

12.1 GENERAL

This Division covers roadway construction, including work consisting of pulverizing existing asphalt, earthwork and roadway excavation. It also includes imported granular borrow, subgrade preparation, untreated base course, asphalt surface and raising manholes and valve boxes to grade.

12.2 MILLING / PULVERIZING

The limits of the area to be milled / pulverized will be as shown on the improvement drawings. The existing asphalt edges where the milling / pulverizing terminates shall be saw cut following or prior to being milled / pulverized.

Millings / Rap may only be used as granular borrow with approval of City Engineer.

When used as granular borrow, the Developer/Contractor shall pulverize the existing asphalt and road base to a depth of 6 to 8 inches. The Developer/Contractor has the option of methods he feels will result in the least work and best product in breaking up the existing asphalt, provided that the maximum size for a single piece of asphalt does not exceed 3 inches. Placing, grading and compacting of this material shall comply with the requirements of borrow.

12.3 EARTHWORK

The earthwork needed for roadway construction shall meet the requirements of Chapter 8, Earthwork.

12.4 ROADWAY EXCAVATION

The roadway shall be excavated to the lines and grades shown on the improvements drawings or to the minimum standard depths shown and/or described in these Standards and Drawings. All materials not meeting gradations and specifications described herein shall be removed from the road section.

12.5 SUBGRADE PREPARATION

This work shall consist of the shaping and compacting of the subgrade in accordance with these specifications and in conformity with the lines, grades, and typical cross sections shown on the Drawings or as established by the City Engineer / Public Works Representative.

Following roadway excavation the existing subgrade shall be proof rolled by running moderate-weight rubber tire-mounted construction equipment uniformly over the surface at least twice. During the rolling operation moisture content of the subgrade layer shall be maintained at not less than 97% or more than 105% of the optimum moisture content. Rolling shall be continued until the entire roadbed is compacted to the specified density to a minimum depth of 8 inches.

It is the Developer/Contractor's responsibility to stabilize the existing subgrade material by whatever means are necessary to create a stable foundation upon which the roadway may be constructed. These means and methods must be approved by the City Engineer / Public Works Representative prior to placement.

12.6 GRANULAR BORROW

Granular borrow (foundation or roadway) material shall consist of three-inch to four-inch (3"- 4") well-graded engineered fill meeting A-1-a, (AASHTO M 145 or ASTM D3282). Recycled concrete will not be allowed in the public right-of-way.

Sieve	Percent Passing by Weight
4"	100
2"	75 -90
1"	50- 80
3/8"	40 – 70
No. 4	25 – 55
No. 10	20 – 50
No. 40	10 – 30
No. 200	2 - 10

The granular borrow material shall be compacted to not less than 95% maximum dry density as determined by AASHTO T-180 (Modified Proctor) or as determined by ASTM D1557 (Modified Proctor). Surfaces shall be true to the established grade with thickness being not less than 1-inch from the required layer thickness and with the surface elevation varying not more than 1-inch in ten feet from the true profile and cross section.

Submittals or proctor test, gradation and sieve analysis shall be required every 500 tons of material imported.

12.7 UNTREATED BASE COURSE

Base for all streets shall meet current APWA Untreated Base Course Class A specifications (APWA 32 11 23) and meet A-1-a soil classification. Recycled concrete will not be allowed in the public right-of-way.

The material shall be deposited and spread in a uniform layer, without segregation of size, with such depth that when compacted the layer will have the required thickness as stated below.

Each layer shall be compacted for the full width and depth. Alternate blading and rolling will be required to provide a smooth, even and uniformly compacted course true to cross section and grade. Places inaccessible to rolling shall be compacted with mechanically operated hand tampers.

The base course shall be compacted to not less than 95% maximum dry density as determined by AASHTO T-180. Surfaces shall be true to the established grade with thickness being not less than 1/4-inch from the required layer thickness and with the surface elevation varying not more than 3/8-inch in ten feet from the true profile and cross section.

12.8 ASPHALT PAVEMENT

Over the dry, dust-free compacted base course the Developer/Contractor shall place and compact asphalt pavement. The asphalt pavement shall meet current APWA Asphalt Concrete standards (APWA 32 12 05).

The paving asphalt material for local roadways shall be PG 58-28 or PG 64-22. For larger roadways (collectors / arterials) shall be PG 64-22 only. Gradation of aggregate shall conform to the DM-1/2-inch gradation limits as defined in these Specifications, unless otherwise approved by the City Engineer.

The asphalt mixtures shall be spread with self-propelled mechanical spreading and conditioning equipment capable of distributing at least a 12-foot width. The mixture shall be spread and struck off in such a manner that the finished surface shall result in a uniform smooth surface. The longitudinal joints in succeeding courses shall be offset at least 6 inches transversely to avoid a vertical joint through more than one course. The maximum compacted thickness of a single course of asphalt is 4".

All cold transverse joints shall be paper-patched or saw-cut to a clean vertical edge before paving resumes.

The temperature of the asphalt mix shall be between 270° F and 325° F when placing.

After the mixture has been spread, the surface shall be rolled in longitudinal direction commencing at the outside edge or lower side and proceeding to the higher side. Each pass of the roller shall overlap the preceding pass at least one-half the width of the roller. Rolling shall continue until 95% of the laboratory density as determined in accordance with ASTM Designation D1559 for the asphalt mixture being used has been obtained. Density tests shall be done following the procedures of ASTM D2950. Complete compaction before temperature drops to 180° F.

Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller.

The surface of the pavement, after compaction, shall be uniform and true to the established grade. When tested with a ten-foot straight edge placed on the surface of the pavement, at any point, the surface shall not deviate more than one-eighth of an inch from the lower edge of the straight edge. All high and low spots shall be remedied immediately by removing the wearing course material over the affected areas and replacing it with fresh, hot wearing course and surface finish material and immediately compacting it to conform with the surrounding area.

It is the responsibility of the Developer/Contractor to control traffic. Insofar as possible, all traffic shall be kept off the completed surface for a minimum period of 24 hours.

No asphalt surface course shall be placed when the temperature of the roadbed is 45° F or below, during rainy weather, when the base is wet, or during other unfavorable weather conditions as determined by the City Engineer / Public Works Representative. The air temperature shall be 45° F and rising when measured in the shade.

A 2% minimum cross-slope and 4% maximum cross-slope is required. Any slopes higher or lower than the required range must be approved by the City Engineer or designee.

12.9 ADJUSTING MANHOLES AND BOXES TO FINAL GRADE & INSTALLING CONCRETE COLLAR

Covers shall be set to the finished grade and contour of the street. Rings and covers shall be protected during backfilling and compaction of the road base and during the placing or replacing of road surfaces. Any rings or covers damaged or broken shall be replaced by the Developer/Contractor at its expense. Prior to paving, the manhole ring and cover shall be GPS-located by the Developer / Contractor (shot at the center of the ring) and set below the finished road base elevation. After paving the asphalt shall be removed, and the manhole ring and cover shall be raised to match the grade and slope of the finished road surface and shall use the WHIRLyGIG manhole riser/collar system.

Road base around the manhole ring and cover shall be recompact, and the concrete collar placed. Manholes and boxes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement. The top of all concrete lids or cone sections shall be a minimum of eight inches (8") and a maximum of twelve-inches (12") below the finished road surface. Manholes and boxes must be cleaned of all debris after setting of collars.

12.10 ADJUSTING VALVE BOXES TO FINAL GRADE & INSTALLING CONCRETE COLLAR

Valve boxes shall be set to the finished grade and contour of the street. Valve boxes shall be protected during backfilling and compaction of the road base and during the placing or replacing of road surfaces. Any valve boxes damaged or broken shall be replaced by the Developer/Contractor at its expense. Prior to paving, the valve box shall be GPS-located by the Developer / Contractor (shot at the center of the valve box) and set six (6) inches below the finished grade. After paving the asphalt shall be removed, and the valve box shall be raised to match the grade and slope of the finished road surface.

Road base around the valve box shall be re-compact, and the concrete collar placed. Valve boxes placed in asphalt surfacing shall be constructed such that the cast iron ring is one-quarter inch (1/4") lower than the pavement. Valve boxes must be cleaned of all debris after setting of collars.

CHAPTER 13 - CONCRETE PLACEMENT

13.1 GENERAL

This section covers installation of curb and gutter and all concrete flatwork. All improvements shall be constructed to the dimensions and thickness shown on the Standard Drawings.

13.2 CONCRETE

See Chapter 9, Portland Cement Concrete.

13.3 GRADE

After construction, gutters shall be checked by flowing water. The City Engineer / Public Works Representative shall be present during the flow test. Any high spots or depressions (which exceed 0.02 feet) shall be repaired by removing concrete and replacing to the correct grade. Puddling shall not flow from flow line past lip of gutter. (Minimum flow line grade shall be 0.5 percent.)

13.4 FORMS

All forms shall be steel, except at curves with a radius smaller than 200 feet. They shall be of a size to match the sections shown on the Drawings. Forms shall be held firmly in place with stakes or other approved means and shall be true to line and grade.

All forms shall be clean and coated with a light oil to prevent the concrete from adhering to them. Clamps, spreaders and braces shall be used where required to insure rigidity in the forms.

Forms shall not vary from vertical grade by more than 0.02 feet and from horizontal alignment by more than 0.05 feet. All forms shall have smooth even lines in both the horizontal and vertical plane.

Forms for curved sections shall be so constructed and placed that the finish surface of walls and edge of sidewalks, curbs and gutters will not deviate from the arc of the curve.

13.5 SUBGRADE PREPARATION

The Developer/Contractor shall grade to the line and grade approved by the City. The sub-grade shall be properly shaped to conform with the cross section shown on the Standard Drawings, graded and compacted. Compaction shall meet the requirements of Division 7 Earthwork.

All excess material excavated by the Developer/Contractor shall be removed from the site. Removal of the excavated material shall be done before or immediately after the concrete is placed. The Developer/Contractor shall maintain adequate barricades and other devices to protect the public until excavated material is removed.

Placement of concrete on unsuitable materials shall not be permitted. The subgrade surface shall have a road base foundation as shown on the Standard Drawings. Immediately prior to the placing of concrete, the subgrade shall be compacted to at least 95% of the maximum dry density as determined by AASHTO T-180 (Modified Proctor).

13.6 CONSTRUCTION OF CURB, GUTTER AND SIDEWALK

Concrete for curb and gutter or sidewalks may be placed using stationary forms or the slip method of forming.

13.6.1 Matching Existing Monolithic Curb, Gutter and Sidewalk

When matching an existing condition of combination curb, gutter and sidewalk the following construction methods shall be used: Concrete curb, gutter and sidewalk shall be constructed by first constructing the curb and gutter and then constructing the sidewalk behind it. Stationary forms may be used to place combination curb, gutter and sidewalk. The slip form method may be used if it can be demonstrated that the tolerances specified herein can be met.

13.6.2 Curb and Gutter Joints

Curb and gutter shall have contraction joints placed every 10 feet by use of 1/8-inch steel template of the exact cross section of the curb and gutter. Remove the templates as the concrete takes initial set. Cut the joint 1-1/2 inches deep when using the slip form method to place the concrete. Use 1/2-inch thick, pre-molded, expansion joint filler at all cold joints unless otherwise specified by the City Engineer / Public Works Representative.

13.6.3 Sidewalk Joints

Sidewalks shall have contraction joints at 5-foot intervals. The joints shall be approximately 3/16 inch wide and approximately one-half of the total slab thickness in depth.

Expansion joints shall be 1/2-inch thick, shall be placed every 50 feet minimum, and at all cold joints. Material for expansion joints shall be as specified in AASHTO M-153 and AASHTO M-213, and shall be installed with its top approximately 1/4-inch below the concrete surface.

13.6.4 Finishing of Sidewalks

After the concrete placed for a sidewalk has been brought to the established grade and screeded, it shall be float finished, edged and then given a light broom finish. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or hasten hardening. Surface edges of all slabs shall be rounded to a radius of 1/2 inch.

13.6.5 Finishing of Curb and Gutter

After concrete has been placed in curb and gutter forms, it shall be consolidated so as to insure a thorough mixture, eliminate air pockets, and create uniform, smooth sides. As the concrete takes its initial set the forms shall be removed and all exposed surfaces shall be float finished, edged and broomed lightly. The curb and gutter shall be constructed to the dimensions shown in the Standard Drawings.

The top and face of the curb and also the top of the apron on combination curb and gutter must be finished true to line and grade and without any noticeable irregularities of surface. No portion of the surface or face of the curb and gutter shall depart more than 1/4 inch from a straight edge ten feet in length, placed on the curb parallel to the street center line nor shall any part of the exposed surface present a wavy appearance.

13.7 CONCRETE DRIVE APPROACH

The concrete to be used for the drive approach shall be Class AA(AE) and shall meet the requirements of Chapter 9, Portland Cement Concrete.

The approach shall be of the minimum thickness and constructed to the dimensions shown on the Standard Drawings. The concrete shall be finished as described above for sidewalks.

The approach shall have a compacted untreated base course under them as shown on the standard drawings.

13.8 ADA (AMERICANS WITH DISABILITIES ACT) STANDARDS IN PUBLIC RIGHTS-OF-WAY

All construction shall conform to the current Federal American With Disabilities Act (ADA) guidelines for public rights-of-way, and in accordance to the City's Standard Drawings.

CHAPTER 14 - UTAH DEPARTMENT OF TRANSPORTATION RIGHTS-OF-WAY

14.1 GENERAL

The Developer/Contractor shall be responsible to obtain all necessary permits and meet any bond requirements imposed by the Utah Department of Transportation for all work to be performed within UDOT rights-of-way.

A copy of the approved permit(s) shall be submitted to the City prior to commencing any work within the UDOT right-of-way within Springville City limits.

CHAPTER 15 - CASINGS

15.1 GENERAL

This division defines the requirements for casings under canals, railroad tracks, highways and interstates. All construction operations shall be subject to the approval of the canal company, Railroad Company, or the Utah Department of Transportation whose facilities are being crossed.

The Developer/Contractor shall be responsible to make application to and obtain all necessary permits and meet any bond requirements imposed by the entity whose facility is to be crossed. A copy of the approved permit(s) shall be submitted to the City prior to commencing any work within the right-of-way within Springville City limits.

The Developer/Contractor shall provide all insurance and the services of all watchmen and flagmen required by the entity whose facility is to be crossed. The Developer/Contractor will pay entity whose facilities are to be crossed for their inspection services.

CHAPTER 16 - FLOWABLE FILL (CLSM)

16.1 GENERAL

Meet the requirements of APWA SECTION 31 05 15 CEMENT TREATED FILL.