

TITLE III

GENERAL PUBLIC WORKS

CONSTRUCTION STANDARDS AND SPECIFICATIONS

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Chapter 3.01

GENERAL PROVISIONS

Sections:

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3.01.005 SCOPE OF ORDINANCE. This title defines the general requirements for improvements to be built by a subdivider or contractor working within the public way.

The required improvements shall include all street improvements in front of all lots along all dedicated streets to a connection with existing improvements of the same kind or to the boundary or the subdivision nearest existing improvements. Design must provide for future extension to adjacent development and be compatible with the contour of the ground for proper drainage. All water lines, sewer lines, and any other buried conduit shall be installed to the boundary lines of the subdivision.

3.01.010 CONSTRUCTION DRAWINGS. Complete and detailed construction plans and drawings of improvements shall be submitted to the Zoning Administrator for the review by the City Engineer and Public Works Dept. prior to receiving final plat approval and prior to commencing construction. No construction shall be started until plans have been checked and approved by the City Engineer.

3.01.015 STANDARDS FOR CONSTRUCTION DRAWINGS. The following instructions are for the purpose of standardizing the preparation of drawings to obtain uniformity in appearance, clarity, size, and style. These plans and designs shall meet the standards defined in the specifications and drawings hereinafter outlined. The minimum information required on drawings for improvements is as follows:

All drawings and/or prints shall be clear and legible and conform to good engineering and drafting room practice. Size of drawings shall be 24" X 36" with ½-inch border on top, bottom and right sides, left side 1½ inches.

A. In general, the following shall be included on drawings:

1. North arrow (plan), Vicinity Map, Drawing Index;
2. Scale and elevations referenced to an approved datum;
3. Stationing and elevations for profiles;
4. Title block, to include:
 - a. Name of City
 - b. Project title (subdivision, etc.)
 - c. Specific type and location of work.
 - d. Space for approval signature of City Engineer and date
 - e. Name of engineer or firm preparing drawings with license number, P.E. stamp and signature.

B. Curb and gutter, drains and drainage structures, sidewalks and street surfacing drawings shall show:

1. Scale: 1" = 20' or 50' horizontal; 1" = 2', 5', or 10' vertical;
2. Both plan view and centerline profile must be shown. On subdivisions along steep cross slopes, profiles for each side of the street may be required to be shown;
3. Stationing and top of curb elevations with curve data with slope through curve must be shown at the beginning and end of all curves and at all intersection curb return points;
4. Flow direction and type of cross drainage structures at intersections with adequate flow line elevations;
5. Bench Mark (B.M.) location and elevation (use approved datum) shall be noted;
6. Typical cross-section for all street sizes and variations;
7. Street survey monument locations shall be required by the City Engineer;
8. Plan and Profiles shall indicate design and/or existing grades a minimum of two-hundred (200) feet beyond the limits of the proposed project.

C. Sanitary and Storm Sewer drawings shall show:

1. Scale: 1" = 20' or 1" = 50' horizontal; 1" = 5', or 1" = 10' vertical (may be shown on street drawings);
2. Location, size and slope of mains;
3. Location of sewer laterals into lots;
4. Manhole size, location and flow line elevation;
5. Type of pipe;
6. B.M. location and elevation (use approved datum) shall be noted.

D. Culinary water drawings shall show:

1. Scale: 1" = 20' or 1" = 50' horizontal (may be shown on street drawings);
2. Size and location of water mains, valves and hydrants and minimum cover;
3. Location of service laterals and water meters;
4. Type of pipe.

E. Each set of plans shall be accompanied by a separate sheet of details for special structures which are to be constructed and are not covered by the City Standards. All structures shall be designed in accordance with the minimum Tremonton City Standards.

F. Separate drawings of elements of the Tremonton City Standards shall not be required to be redrawn and submitted with the construction drawings unless specific deviations from the standards are requested for approval; however, the construction drawings shall refer to the specific items of the Standards that are to be incorporated into the work.

G. Once the City Engineer approves the construction drawings, a minimum of three (3) sets shall be submitted with one set retained by the City Public Works Department, one by the City Engineer, and one set returned to the Subdivider, Developer, Contractor or Project Manager. This approved set shall be kept available at the construction site. All sets of approved construction drawings shall be marked as approved by the City. Prior to final acceptance by the City, the subdivider, developer, contractor or project engineer shall submit to the City Public Works Department a set of reproducible mylar or vellum "as constructed" drawings for permanent city file record.

3.01.020 PRECONSTRUCTION CONFERENCE. A preconstruction conference shall be held before any excavation or other work is begun in the subdivision or Project. The meeting will include: (a) City Engineer; (b) Developer or Project Manager; (c) Public Works Director; (d) Subdivision or Project Engineer; (e) all Contractors and Subcontractors involved with installing the subdivision or project improvements; (f.) representatives of local utility companies as may be required by Tremonton City. Items pertaining to the construction and inspection of the subdivision or Project improvements will be discussed.

3.01.025 INSPECTIONS. All construction work involving the installation of improvements in subdivision or project shall be subject to inspection and approved by the City prior to covering the improvement. It shall be the responsibility of the person responsible for construction to ensure that inspections take place where and when required. Certain types of construction shall have continuous inspection, while others may have only periodic inspections.

A. Continuous inspection may be required on the following types of work:

1. Laying of street surfacing;
2. Placing of concrete for curb and gutter, sidewalks, and other structures;
3. Laying of sewer pipe, drainage pipe, water pipe, valves, hydrants and testing.

B. Periodic inspections shall be required on the following:

1. Street grading and gravel base;
2. Excavations for curb and gutter and sidewalks;
3. Excavations for structures;
4. Trenches for laying pipe;
5. Forms for curb and gutter, sidewalks and structures.

On construction requiring continuous inspection, no work shall be done except in the presence or by permission of the Public Works Director.

3.01.030 REQUESTS FOR INSPECTION. Requests for inspections shall be made to the City by the person(s) responsible for the construction. Requests for inspection on work requiring continuous inspection shall be made two (2) working days prior to the commencing of the work. Notice shall also be given one (1) day in advance of the starting of work requiring periodic inspection, unless specific approval is given otherwise by the Public Works Director or his duly authorized representative.

3.01.035 CONSTRUCTION COMPLETION INSPECTION. An inspection shall be made by the City Engineer and the Public Works Director after all construction work is completed within the subdivision or project. Any faulty or defective work shall be corrected by the person(s) responsible for the work within a period of thirty (30) days of the date of the City Engineer's Inspection Report defining the faulty or defective work.

3.01.040 CONSTRUCTION TESTING. All in-place density testing shall be performed and paid for by the Subdivider. The cost of obtaining necessary soil "proctors," asphalt extractions, gradations, "Marshall" asphalt densities, and concrete test cylinders shall be provided by and paid for directly by the Subdivider, Developer, Contractor, or Project Manager.

3.01.045 APPROVAL BY CITY ENGINEER. All references within these specifications to the "City Engineer" shall be construed to refer to "the City Engineer or his duly authorized representative."

3.01.050 DRAWINGS. All references within these specifications to "the Drawings" shall mean the City-approved construction drawings or the General Public Works Standards and Specifications, as is applicable.

3.01.055 GUARANTEE OF WORK. The subdivider shall warrant and guarantee (and post bond or other security in the amount of ten (10) percent of the original development improvement bond) that the improvements provided for in, and every part thereof, will remain in good condition for a period of twenty-four (24) months after the date of the Construction Completion Inspection Report by the City Engineer or his representative, and agrees to make all repairs to and maintain the improvements and every part thereof in good condition during that time with no cost to the City.

It is further agreed and understood that the determination for necessity of repairs and maintenance of the work rests with the City Engineer. His decision upon the matter shall be final and binding upon the developer, and the guarantee hereby stipulated shall extend to and include, but shall not be limited to, the entire street base and all pipes, joints, valves, backfill and compaction, as well as the working surface, curbs, gutters, sidewalks, and other accessories that are or may be affected by the construction operations; and whenever, in the judgment of the City Engineer, said work shall be in need of repairs, maintenance, or rebuilding, he shall cause a written notice to be served upon the developer, and thereupon the developer shall undertake and complete such repairs, maintenance, or rebuilding. If the developer fails to do so within thirty (30) days from the date of the service of such notice, the City Engineer shall have such repairs made, and the cost of such repairs shall be paid by the developer, together with twenty-five (25) percent in addition thereto, as and for stipulated damages for such failure on the part of the developer to make the repairs.

Chapter 3.02

PERMIT REQUIREMENTS FOR WORK IN THE PUBLIC WAY

Sections:

- 3.02.005 Purpose of Intent.
- 3.02.010 Permits and Licensing.
- 3.02.015 General Conditions.
- 3.02.020 Excavation Operations.
- 3.02.025 Environmental Control.
- 3.02.030 Guarantees.
- 3.02.035 Enforcement.
- 3.02.040 Development Safety.

3.02.005 PURPOSE OF INTENT. The purpose of this section is to describe Tremonton City's Department of Public Works policies for issuing permits and to control any excavation and construction operations in the public way in Tremonton City. All contractors and utility companies proposing to construct, repair, or replace any facility within the public way, shall contact the Tremonton City Department of Public Works and complete all permit requirements including paying the permit fee amount set by resolution of the City Council prior to commencing proposed work as outlined in this chapter.

Work by utility companies and contractors in constructing facilities in new subdivision streets shall not be required to obtain a "Public Way Permit," but will still be subject to City inspection and compliance with subdivision requirements.

3.02.010 PERMITS AND LICENSING.

A. Permittee must be licensed with the State of Utah. Tremonton City requires that contractors desiring to perform work in the City's public way shall be properly licensed in the State of Utah.

Exceptions: A license shall not be required by the City when permittee is a Public Utility Company.

B. Determining when "Permit Waivers" can be granted. Working within the public way without a permit violates this ordinance unless the permit is waived by the Public Works Department. Waivers can be granted by the Public Works Department when any of the following conditions occur:

1. When routine maintenance work which is being done by City, State, and utility personnel does not involve excavations in the City's public way, i.e., crack sealing, street resurfacing and repair, snow plowing, sanding, sweeping, garbage collection, storm drain cleaning, leaves pickup, above grade work, etc.
2. When a permittee allows other contractors or utility companies to perform work in the permitted trench limits.
3. When utilities must be relocated or adjusted in conjunction with a City Public Works Department-sponsored project provided the utility work is being accomplished within one (1) week of the time the City or its contractor is scheduled to begin construction at that location and provided the work is coordinated and approved by the City's Public Works Department.

C. Issuing No Fee Permits. The Public Works Department reserves the right to issue "No Fee Permits" for work in the public way when the following conditions are met:

1. When abutting property owners are repairing or replacing in kind any existing public facilities such as drive approaches, curb, gutter or sidewalk, construction of new facilities, or any combination thereof.

2. When utility companies are doing excavation work and such work is required in conjunction with a City Public Works Department project and the work is required to be accomplished prior to the execution of the Public Works Department contract.

3. When the City Public Works Department is repairing or maintaining public way facilities such as curbs, gutters, cross drains, storm drains, traffic facilities, driveway, sidewalk, etc., and such work requires excavation.

4. When frames and lids in paved surfaces are raised or lowered providing the work does not disturb the underlying road base material.

D. Revoking "Permit Waivers" and "No Fee Permits". "Permit Waivers" and "No Fee Permits" will be revoked by the Public Works Department if the work is defective or requires action or supplemental inspection by the Public Works Department. In the revocation proceedings, the Public Works Department and City Manager shall serve written notice which defines the problems encountered and the time (at least one (1) day) the permittee has to correct the problem. If the work is not satisfactorily completed within the time specified, the "Permit Waiver" or the "No Fee Permit" shall be revoked. The permittee will be required to secure a Fee Permit before proceeding to complete the work.

E. Completion of work by City. Liability for costs. If the work is unduly delayed by the permittee, or if the public interest so demands, the Public Works Department shall do the work only after forty-eight (48) hour written notice (unless the public's safety requires a lesser time) has been given to the permittee and the permittee fails to respond to the Public Works Department's request. The actual cost of such work incurred by the City including a overhead charge in the amount set by resolution of the City Council shall be paid by the permittee.

F. Extending permit construction time limits. Subject to the Public Works Department's approval, permits which expire may be extended by paying a permit extension fee in the amount set by resolution of the City Council. The length of the extension determined by the permittee shall be subject to the approval of the Public Works Department.

3.02.015 GENERAL CONDITIONS.

A. Utility drawing requirements. Whenever the work involves the extension, placement or the relocation of a utility facility, three (3) copies of the drawings shall be provided for the Public Works Department which details the location and type of the proposed facility. Work involving maintenance of existing facilities or placement of laterals does not require a drawing.

B. Permit. When the work is in progress, the permittee shall have at the work site a copy of the permit and his/her contractor's license number.

C. Emergency Work. Maintenance of pipelines or facilities in the public way may proceed without a permit when emergency circumstances demand the work be done immediately provided a permit could not reasonably and practicably have been obtained beforehand.

In the event that emergency work is commenced on or within any public way of the City, the Public Works Department shall be notified within one-half hour when the work commences or as soon as possible from the time the work is commenced. If emergency work is commenced during off business hours, the Public Works Department shall be notified within one (1) hour of the start of work on the first regular business day on which City offices are open after such work commences, and, at the discretion of the Public Works Department, a permit may be issued which shall be retroactive to the date when the work was begun. Before commencing and while conducting emergency work, all necessary safety precautions for the protection of the public and the direction and control of traffic shall be taken. None of the provisions of these regulations are waived for emergency situations except for the prior permit requirement.

D. Private access. Temporary, all weather roadways, driveways, walks, and right-of-ways for vehicles and pedestrians shall be constructed and continuously maintained where required.

E. Street excavation in winter. Excavation of City streets during the winter months (herein defined as November 15 to April 1) will be allowed only if the work is a new service connection, required maintenance or emergency, or otherwise approved by the Public Works Department. Permanent patching of City streets excavated in the winter may be delayed until April 1, provided the permittee provides/maintains a temporary untreated base course surface until such time as the permanent surfacing is accomplished. This provision applies regardless of whether the permittee or City crews are performing the permanent resurfacing.

F. Existing utilities. The contractor shall use extreme caution to avoid a conflict, contact, or damage to existing utilities such as power lines, sewer lines, storm drains, street lights, telephone lines, fiber lines, television lines, gas lines, poles or other appurtenances during the course of construction of the project. Any such conflict, contact or damage shall be immediately communicated to the Public Works Department and Utility provider.

G. Preconstruction photographs or videotapes of existing public way improvements. The permittee may secure photographs of the condition of the existing public way improvements such as curbing, sidewalk, landscaping, asphalt surfaces, etc. In the event that public way improvements are damaged and no photographs or videotapes are taken, the Public Works Department will assume the correction of the damage is the responsibility of the permittee.

3.02.020 EXCAVATION OPERATIONS.

A. Blue stakes. Before commencing excavation operations, the permittee shall call "Blue Stakes" at 1-800-662-4111 and the Tremonton City Public Works Department. Forty eight (48) hours notice is required.

B. Traffic control devices. Traffic control devices such as barricades and cones must be in place before excavation begins.

C. 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 shall use rubber cleats or paving pads when operating on or crossing said surfaces.

D. Open trench limits. Open trenches will be limited to two hundred (200) feet at a time.

E. State Highway Construction Requirements. Compliance with state highway construction permit issuance, inspection, and operations is required.

3.02.025 ENVIRONMENTAL CONTROL.

A. Dust and debris. The permittee or contractor shall keep dust and debris controlled at the work site at all times. If necessary, wet down dusty areas with water and provide containers for debris. The Public Works Director reserves the right to shut down the work or issue a fine if dust is not controlled.

B. Noise. The permittee or contractor shall keep neighborhood free of noise nuisance in accordance with the Noise regulation of Title I chapter 1.11.

C. Cleanup. The permittee or contractor shall remove all equipment, material, barricades and similar items from the right-of-way. Areas used for storage of excavated material will be smoothed and returned to their original contour. Vacuum sweeping or hand sweeping shall be required when the Public Works Department determines cleaning equipment is ineffective.

3.02.030 GUARANTEES.

A. Street Maintenance. After completion of the work, the permittee shall exercise reasonable care in inspecting for and immediately repairing and making good any injury or damage to the public and private facilities resulting from defective work done under the permit. The obligation of the permittee to inspect and repair work done under the permit shall continue for a period of two (2) years following completion of said work, or in the event of repairs thereto, two (2) years from the date of said repairs.

Before commencing the work, the permittee shall identify any damaged public facilities in the vicinity of his work. Upon notice from the Public Works Department, permittee shall immediately repair any injury or damage to the public and private facilities as a result of the work done under the permit. In the event such repairs are not made by the permittee within forty-eight (48) hours after written notice unless the public's safety requires a lesser time, the Public Works Department is hereby authorized to make such repairs and charge all costs including the amount set by resolution of the City Council for overhead charge to the permittee. By acceptance of the permit, the permittee agrees to comply with the above.

B. City's Protective Liability Insurance. The permittee indemnifies and holds the City harmless from and against any and all liability, damages, claims, demands, costs, and expenses of whatsoever nature, including court costs and counsel fees, arising from or growing out of any injury to or death of any person or persons, whomsoever, or for loss of or damage to any property whatsoever, (including loss or damage to the tools, plant, or equipment of the permittee) resulting directly or indirectly from the carrying on of the work herein specified, and to that end will purchase on the City's behalf, City's Protective Liability Insurance with \$1,000,000.00 combine single limit.

3.02.035 ENFORCEMENT. Violators of these regulations of working within the Public Way shall be subject to the provisions of Title I Section 1.01.80 of the Tremonton City Ordinance.

3.02.040 DEVELOPMENT SAFETY. It shall be the responsibility of the developer and/or his/her development representative to maintain and enforce all federal, state, and local safety codes involved with the development.

Chapter 3.03 EARTHWORK

Sections:

- 3.03.005 General.
- 3.03.010 Excavation for structures.
- 3.03.015 Backfill around structures.
- 3.03.020 Construction of embankments and fills.
- 3.03.025 Compacting Earth Materials.
- 3.03.030 Road Sub-grade preparation.

3.03.005 GENERAL. This Chapter defines the requirements for excavation and backfill for structures, construction requirements for embankments and fills, and sub-grade preparation for pavements and other surface improvements.

3.03.010 EXCAVATION FOR STRUCTURES. All structures shall be founded on undisturbed original subsoil. All unauthorized excavation below the specified structure subgrade shall be replaced with concrete monolithic with that of the slab above or with coarse gravel compacted to 95% of maximum dry density as measured by AASHTO T-99 in lifts not to exceed ten (10) inches.

Subgrade soil for all concrete structures, regardless of type or location, shall be firm, dense, thoroughly compacted and consolidated; shall be free from mud and muck and shall be compacted to 95% of AASHTO T-99. Coarse gravel or crushed stone may be used for subsoil's reinforcement if satisfactory results can be obtained thereby. Such material shall be applied in thin layers not to exceed four (4) inches, each layer being embedded in the subsoil by thorough tamping. All excess soil shall be removed to compensate for the displacement of the gravel or crushed stone, and the finished elevation of any subsoil reinforced in this manner shall not be above the subgrade elevation.

3.03.015 BACKFILL AROUND STRUCTURES. Backfill around structures shall be placed to the lines shown on the approved 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 excavation shall be cleaned of all trash and debris. Material for backfilling shall consist of excavated material or borrow of sand, gravel, or other suitable material, and shall be placed in layers not exceeding ten (10) inches in uncompacted thickness. 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 AASHTO T-99.

3.03.020 CONSTRUCTION OF EMBANKMENTS AND FILLS. Unsuitable materials that occur in the foundations for embankments and fills shall be removed by clearing, stripping, and/or grubbing. Where suitable materials occur, after stripping, the foundation shall be scarified to a depth of not less than six inches, and the loosened material shall be moistened and compacted as hereinafter specified for each layer. All materials in embankments and fills shall be placed, moistened, and compacted as provided in the following paragraphs.

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

The materials used for embankment and fill construction shall be free from sod, grass, trash, rocks larger than four inches in diameter, and all other material unsuitable for construction of compacted fills.

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. In no case shall embankment slopes be steeper than 1-1/2:1.

3.03.025 COMPACTING EARTH MATERIALS. The material shall be deposited in horizontal layers having a thickness of not more than ten (10) inches after being compacted as hereinafter specified; provided that, when mechanical equipment is used for placing and compacting the material on a sloping foundation, the layers may be placed parallel to the foundations. The distribution of materials shall be such that the compacted material will be homogeneous and free from lenses, pockets, or other imperfections.

Prior to and during compaction operations the material shall have the optimum moisture content required for the purpose of compaction, and the moisture content shall be uniform throughout the layers, insofar as practicable. Moistening of the material shall be performed at the site of excavation, but such moistening shall be supplemented as required by sprinkling at the site of construction. If the moisture content is more than optimum for compaction, the compaction operations shall be delayed until such time as the material has dried to the optimum moisture content. When the material has been conditioned as hereinbefore specified, the backfill or embankment shall be compacted as follows:

A. Under Roadways and extending six (6) inches beyond the proposed curb line the fill or embankment material shall be compacted to a density equal to not less than 95% of maximum dry density as measured by AASHTO T-180.

B. Under Sidewalk and Drive Approaches the fill or embankment material (to at least one foot each side of the edge of the slab) shall be compacted to a density equal to not less than 95% of maximum dry density as measured by AASHTO T-180.

C. Other Fills and Embankments not listed above shall be compacted to a density equal to not less than 85% of maximum dry density as measured by AASHTO T-180.

3.03.030 ROAD SUB-GRADE PREPARATION. In both cut and fill areas the paving sub-grade shall be scarified to a depth of eight (8) inches and compacted to the equivalent of ninety-five (95) percent of maximum dry density as measured by AASHTO T-180. No rocks larger than four (4) inches in diameter, organic material, soft clay, spongy material, or other deleterious material will be permitted in this scarified sub-grade layer. Rough sub-grades shall be shaped and graded to within a tolerance of 0.10 foot of design grade, and drainage shall be maintained at all times.

During the rolling operation moisture content of the subgrade layer shall be maintained at not less than 97% or more than 105% of optimum moisture content. Rolling shall be continued until the entire roadbed is compacted to the specified density to a minimum depth of eight (8) inches.

Chapter 3.04
STREET CONSTRUCTION

Sections:

- 3.04.005 General.
- 3.04.010 Base Course.
- 3.04.015 Surface Paving.
- 3.04.020 Bituminous Surface Course.
- 3.04.025 Construction methods and equipment.
- 3.04.030 Spreading and compaction.
- 3.04.035 Weather Limitations.
- 3.04.040 Bituminous Seal Coat material.
- 3.04.045 Seal coat protection.
- 3.04.050 Application of bituminous seal coat.
- 3.04.055 Spreading and compacting of Seal Coat cover material.
- 3.04.060 Weather and Seasonal limitations.
- 3.04.065 Bituminous Plant mix seal coat.

3.04.005 GENERAL. This chapter covers the requirements for bituminous surface paving on roads. All streets shall be surfaced in accordance with the following specifications, unless otherwise specified by the City Engineer.

3.04.010 BASE COURSE. Base course for all streets shall consist of select material, either natural or crushed, and shall be graded to either one of the following:

1 Inch Gradation

<u>Sieve Size</u>	<u>Ideal Gradation</u> (Percent Passing)	<u>Ideal Gradation</u> (Tolerance)
1 inch	100	0
½-inch	85	± 6
No. 4 sieve	55	± 6
No. 16 sieve	31	± 4
No. 200 sieve	9	± 2

¾ Inch Gradation

¾ Inch	100	0
⅜ Inch	85	± 7
No. 4	61	± 6
No. 16	33	± 5
No. 200	9	± 2

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 above.

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.

3.04.015 SURFACE PAVING. This section covers the requirements for bituminous surface paving on roads. All streets shall be surfaced in accordance with the following, unless otherwise specified by the City Engineer. Classification of streets shall be the responsibility of the City Engineer.

A. Local Streets.

a. Minor Streets.

1. Eight (8) inch minimum compacted thickness granular borrow.
2. Eight (8) inch minimum crushed gravel base course over prepared sub-grade;
3. Three (3) inch minimum compacted thickness plant mix asphalt surfacing on streets.

b. Standard Residential Streets.

1. Eight (8) inch minimum compacted thickness granular borrow.
2. Eight (8) inch minimum crushed gravel base course over prepared sub-grade;
3. Three (3) inch minimum compacted thickness plant mix asphalt surfacing on streets.

c. Low Impact Residential Road

1. Eight (8) inch minimum compacted thickness granular borrow.
2. Eight (8) inch minimum untreated gravel base course over prepared sub-grade;
3. Three (3) inch minimum compacted thickness plant mix asphalt surfacing on streets.

B. Collector Streets.

1. Twelve (12) inch minimum compacted thickness granular borrow.
2. Eight (8) inch minimum crushed gravel base course over prepared sub-grade;
3. Three (3) inch minimum compacted thickness plant mix asphalt surfacing on streets.

C. Arterial Streets.

a. Minor Arterial Street.

1. Fifteen (15) inch minimum compacted thickness granular borrow.
2. Ten (10) inch minimum crushed gravel base course over prepared sub-grade;
3. Three and one-half (3½) inch minimum compacted thickness plant mix asphalt surfacing on streets.

b. Major Arterial Streets.

1. Eighteen (18) inch minimum compacted thickness granular borrow.
1. Twelve (12) inch minimum crushed gravel base course over prepared sub-grade;
2. Four (4) inch minimum compacted thickness plant mix asphalt surfacing on streets.

Note: The subdivider may submit a pavement design for review on any street.

The gravel base course shall be compacted to not less than 95% maximum dry density as determined by AASHTO T-99. During rolling operation, moisture content of the base course layer shall be maintained at not less than 97% or more than 105% of optimum moisture content. Surfaces shall be true to the established grade with the 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.

3.04.020 BITUMINOUS SURFACE COURSE. Over the dry, dust-free compacted course the Contractor shall place and compact a bituminous surface course. The surface course shall consist of a mixture of mineral aggregate and binder. Gradation of aggregate shall conform to the following:

<u>Sieve Size</u>	<u>Ideal Gradation</u> (Percent Passing)	<u>Ideal Gradation</u> Tolerance
3/4 inch	100	0
3/8 inch	80	± 11
No. 4	50	± 8
No. 16	24	± 7
No. 50	15	± 6
No. 200	6	± 2

The Contractor shall establish a mix gradation, and the amount of bituminous material shall be subject to the approval of the City Engineer and shall meet the requirements of the gradation selected. Regardless of the bituminous content, there shall not be more than three (3) percent voids in the aggregate.

The bituminous material for the surface course shall be AC-10 asphalt cement conforming to the requirements of AASHTO —226.

The bituminous surface course shall be mixed at a mixing plant and spread and compacted on the prepared base in conformance with the lines and dimensions shown on the plans and in accordance with these Specifications.

All traffic shall be kept off the completed surface for a minimum of twenty-four (24) hours.

3.04.025 CONSTRUCTION METHODS AND EQUIPMENT. The methods employed in performing the work, all equipment, tools and machinery, and other appliances used in handling the materials and executing the work shall be the responsibility of the Contractor. The Contractor shall make such changes in the methods employed and in the equipment used as are necessary whenever the bituminous material being produced does not meet the specifications herein established.

3.04.030 SPREADING AND COMPACTION. The bituminous mixtures shall be spread with self propelled, mechanical spreading and conditioning equipment capable of distributing at least a twelve (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 six (6) inches transversely to avoid a vertical joint through more than one course. Compacted surface course lifts shall be limited to a maximum of three (3) inches. Prior to placement of bituminous material, all exposed vertical facings on curb and existing pavement shall receive a complete asphalt tack coat at a rate 0.08 gal/per square yard. Care shall be exercised to prevent over spraying on finish concrete surfaces.

The temperature of the bituminous mix shall be between 250° F. and 325° F. when being placed.

After the mixture has been spread, the surface shall be rolled in a 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 ninety-five (95) percent of the laboratory density, as determined in accordance with ASTM Designation D-1559 (Marshall Test), for the bituminous mixture being used has been obtained.

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 crown and grade. When tested with a ten (10) foot straight-edge placed parallel to the centerline of the pavement, the surface of the pavement at any point shall not deviate from the lower edge of the straight-edge by more than one-eighth (1/8) of an inch. 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 surrounding area.

3.04.035 WEATHER LIMITATIONS: No bituminous surface course shall be placed when the temperature of the air or roadbed is 50° F or below, during rainy weather, when the base is wet, or during other unfavorable weather conditions as determined by the City Engineer. No bituminous plant mix seal coat shall be placed when the temperature of the air or roadbed is less than 70° F, during rainy weather, when the pavement surface is wet, or during other unfavorable weather conditions as determined by the City Engineer, see section 3.04.060. The air temperature shall be measured in the shade. No bituminous surface course shall be placed after October 15th without written approval from Tremonton City Public Works Director.

3.04.040 BITUMINOUS SEAL COAT: Following installation of surface course, all completed asphalt areas shall receive a bituminous seal coat preferably a minimum of twelve (12) months after bituminous paving as directed by the City Engineer. Bituminous material shall be an approved emulsified asphalt used for seal coating. Cover material shall consist of clean, hard, rough, durable, and sound fragments of broken stone, crushed gravel, or crushed slag conforming to the following requirements:

- a. The dry mineral aggregate shall be uniformly graded to the gradation limits specified below, when tested in accordance with AASHTO Designation T-27.

<u>Percentage Passing Sieves</u>	
<u>Sieve Size</u>	<u>% Passing</u>
½-inch	100
3/8-inch	85-100
No. 4	5-20
No. 8	0-5
No. 200	0-1

Acceptance of cover material with respect to gradation shall be based on the average gradation of five (5) samples taken from a test lot of 5,000 tons. The samples shall be obtained from the stockpile prior to use. A test lot shall be obtained when the average gradation of the five (5) samples is within the specified gradation band and when the number of individual samples in each test lot outside the gradation band does not exceed two (2) and when they are not outside the band by more than two (2) percentage points on any one sieve.

The total amount of material passing the No. 200 sieve shall be determined by washing with water in accordance with AASHTO Designation T-11.

- b. That portion of the aggregate retained on the No. 4 sieve shall be clean and free of clay coatings and shall have not less than eighty (80) percent by weight of particles with at least one clean mechanically fractured face when tested in accordance with Department Test Procedure 8-929.
- c. The aggregate shall have a percentage of wear not exceeding thirty (30) when tested in accordance with AASHTO Designation T-96.
- d. The crushed mineral aggregate shall have a weighted percent of loss not exceeding ten (10) percent by weight when subjected to five (5) cycles of sodium sulfate and tested in accordance with AASHTO T-104.
- e. The aggregate shall be of such nature that when the particles are thoroughly coated with the bituminous material specified for the project not less than Ninety (90) percent of the coating shall be retained when

tested in accordance with Department Test Procedure 8-945.

f. The maximum dry unit weight of material shall not exceed one hundred (100) pounds per cubic foot when measured according to the loose weight determination as described in AASHTO Designation T-19 and the moisture content shall be determined according to ASTM D-2216.

3.04.045 SEAL COAT PROTECTION. Seal coat operations shall not be started until the surface to be sealed has been thoroughly compacted. In no event shall seal coat be placed on newly constructed bituminous surfaces within seven (7) days after such surfaces are laid and preferably a minimum of twelve (12) months after placing asphalt pavement as directed by the City Engineer. Prior to placing the seal coat, the existing surface shall be cleaned of all dirt, sand, dust, or other objectionable material.

3.04.050 APPLICATION OF BITUMINOUS SEAL COAT MATERIAL. The material shall be sprayed over the prepared surface by means of a pressure distributor. The material shall be applied in such a manner that an inspection of the spread can be made and any defects corrected before the cover material is applied. The rate of application shall be determined by the City Engineer. Application of bituminous material shall not be more than 1,000 feet in advance of the placing of cover material.

The contractor shall be responsible to cover all existing manholes and valve boxes with felt paper prior to the installation of the seal coat to protect these facilities from being covered with the bituminous seal coat materials.

Joints between applications shall be made by starting and stopping the distributor on building paper. Valve action shall be instantaneous, both in starting and cut off. The distributor shall attain the proper application speed at the time the spray bar is opened.

The contractor shall be responsible to furnish and place the required asphalt emulsion at a uniform rate and application coverage of 0.43 gallons per square yard or as directed by the City's project representative. The emulsion shall be CRS-2 with a LMCRS2A rubber additive as approved by the City Engineer. The material shall be sprayed over the prepared surface by means of a pressure distributor. The material shall be applied in such a manner that an inspection of the spread can be made and any defects corrected before the cover materials is applied. The application of bituminous emulsion material shall not be more than 1,000 feet in advance of the placing of cover material.

The temperature range of the bituminous material at the time of application shall be such that the viscosity will be between fifty (50) and one hundred (100) centistokes as determined in accordance with ASTM Designation D-2170. The exact temperature range shall be designated by the City Engineer.

3.04.055 SPREADING AND COMPACTING OF SEAL COAT COVER MATERIAL. Prior to the placing of the cover material, the contractor shall perform a test of the spreading equipment at a location approved by the City. The test shall determine the exact rate of application of the emulsion and cover material and to calibrate the contractors equipment.

The cover material shall be spread immediately after applying the bituminous material by means of an approved spreader which can be adjusted to uniformly spread the required amount of aggregate. Provisions shall be made so that the larger particles will be deposited first. The rate of cover material application, in pounds per square yard, shall be determined by the City Engineer. Immediately after spreading, the cover material shall be hand broomed, if necessary, to distribute the aggregate uniformly over the surface. After the cover material has been satisfactorily spread, the surface shall be rolled by pneumatic-tired rollers in a longitudinal direction. Rolling performed with pneumatic-tire rollers shall adequately seat the cover material and shall consist of at least two complete coverage's. Rolling shall be complete the same day the bituminous material and cover material are applied.

On completion of final rolling, traffic shall be permitted to travel over the seal coat. Between seven (7) – thirty (30) days following application of the seal coat, the Contractor shall return to the site and broom clean any excess chips

from the roadway and curb and gutter.

3.04.060 SEAL COAT WEATHER AND SEASONAL LIMITATIONS. Seal coat shall be applied only between June 1 and September 15 and when the air temperature in the shade and the roadbed temperature are above 70° F. Seal coat shall not be applied during rain, fog, or other adverse weather conditions. Seal coat placed after September 15 shall be placed only upon written authorization from the City Engineer, and then only when the air temperature in the shade and the roadbed temperature are above 70° F.

3.04.065 BITUMINOUS PLANT MIX SEAL COAT. Where determined by the City Engineer that the bituminous surface course is unacceptable due to material or construction defects, the Contractor shall place and compact a bituminous plant mix seal coat over the bituminous surface course. The seal coat shall consist of a mixture of mineral aggregate and bituminous binder. Gradation of the aggregate shall conform to the following:

<u>Sieve Size</u>	<u>% Passing</u>	
	<u>Type A</u>	<u>Type B</u>
½-inch	100	100
3/8-inch	95-100	95-100
No. 4	30-50	30-50
No. 8	10-25	22-37
No. 16		15-28
No. 50		8-16
No. 200		5-10

The Contractor shall establish a mix gradation, and the amount of bituminous material shall be subject to the approval of the City Engineer and shall meet the requirements of the gradation selected. Regardless of the bituminous content, there shall not be more than three percent (3%) voids in the mix.

The bituminous material shall be AC-10 asphalt cement conforming to the requirements of AASHTO—226.

A tack coat shall be applied to all existing pavement prior to pouring the plant mix seal coat. The bituminous material shall be Grade CS-1 Emulsion applied at the rate of 0.08 gallons per square yard.

The bituminous plant mix seal coat shall be mixed at a mixing plant and spread and compacted on the prepared pavement in accordance with the lines and dimensions shown on the plans and in accordance with these specifications.

Chapter 3.05

CONCRETE

Sections:

- 3.05.005 Scope.
- 3.05.010 Materials.
- 3.05.015 Concrete Mix.
- 3.05.020 Forms.
- 3.05.025 Joints.
- 3.05.030 Reinforcement and embedded materials.
- 3.05.035 Preparations.
- 3.05.040 Concrete Mixing.
- 3.05.045 Depositing.
- 3.05.050 Placing Concrete in Cold Weather.
- 3.05.055 Finishing.
- 3.05.060 Curing and Protection.
- 3.05.065 Concrete Testing.

3.05.005 SCOPE. This section of the specifications defines materials to be used in all concrete work and requirements for mixing, placing, finishing, and curing.

3.05.010 MATERIALS. Materials used in concrete and reinforcing of concrete shall meet the following requirements:

A. Cement. Portland cement shall be Type II or as approved by the City Engineer and shall comply with the Standard Specification for Portland Cement, ASTM C-150.

B. Aggregates. Concrete aggregates shall conform to Tentative Specifications for Concrete Aggregates, ASTM C-33.

C. Water. Water used in mixing concrete shall be clean and free from oil, acid, salt, injurious amounts of alkali, organic matter or other deleterious substances.

D. Entraining Agent. An air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to ASTM Designation C-175 and C-260.

E. Admixtures. No admixture (except calcium chloride) will be permitted to be used in concrete unless such use is specifically authorized by the City Engineer. Calcium chloride shall conform to ASTM Standard Specification D-98.

F. Reinforced Steel. All bar material used for reinforcement of concrete shall be intermediate grade steel conforming to the requirements of ASTM Designation A-615 and shall be deformed in accordance with ASTM Designation A-305.

G. Welded Wire Fabric. Welded wire fabric for concrete reinforcement shall conform to the requirements of ASTM A-185.

3.05.015 CONCRETE MIX. For the purpose of practical identification, concrete has been divided into three classes: Class A, B, and C. Basic requirements and use for each class are as defined below:

<u>Class</u>	<u>Minimum Cement (sacks/c.y.)</u>	<u>Minimum 28-day Comp. Strength (psi)</u>	<u>Primary Use</u>
A	6-1/2	4000	Reinforced structural concrete.
B	6	3500	Sidewalks, curbs & gutters, cross, gutters, pavements, and unreinforced footings and foundations
C	5	2500	Thrust blocks, anchors, mass concrete

All concrete shall also comply with the following requirements:

A. Aggregates. The maximum size of the aggregate shall be not larger than one-fifth of the narrowest dimension between forms within which the concrete is to be cast, nor larger than three-fourths of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms. For unreinforced concrete slabs, the maximum size of aggregates shall not be larger than one-fourth the slab thickness.

B. Water. Sufficient 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 inches. No concrete shall be placed with a slump in excess of five inches.

C. Air-Entraining. Air content for air-entrained concrete shall comply with the following:

<u>Course Aggregate Size (in.)</u>	<u>Air Content (%)</u>
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.

D. Calcium Chloride. Calcium chloride may be added as an accelerator with prior approval of the City Engineer during cold weather, with maximum amount being two pounds per sack of cement.

3.05.020 FORMS. Forms shall be substantially built and adequately braced so as to withstand the liquid weight of concrete. All linings, studding, walling and bracing shall be such as to prevent bulging, spreading, or loss of true alignment while pouring and displacement of concrete while setting.

Metal forms shall be used for curb and gutter work unless otherwise specified by the City Engineer. All edge forms for sidewalk pavements, curbs, and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade. Prior to concrete placement, all forms shall be lightly coated with oil to prevent concrete adhesion to form materials.

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 appreciably from the arc of the curve.

Exposed vertical and horizontal edges of the concrete in structures shall be chamfered by the placing of moldings in the forms at those locations shown on the Drawings.

3.05.025 JOINTS. Joints shall be provided for sidewalks and curb and gutter as follows:

A. Sidewalks. Shall have scribed joints at intervals of four (4) feet which joints shall be approximately 3/16" wide and be approximately one-fourth (1/4) of the total slab thickness. In addition, one-half (1/2) inch expansion joints shall be provided at thirty-two (32) foot intervals and at locations where sidewalks adjoin curbs or existing sidewalks. Slabs shall be ruled at four (4) foot intervals.

B. Curb and Gutter. Shall be cut into lengths of ten (10) feet by the use of one-eighth (1/8) inch steel division plates of the exact cross section of the curb and gutter or shall be scribed when installed by a lay down machine. Also, one-half (1/2) inch expansion joints shall be provided at curb and gutter radii, where the curb and gutter abuts a solid object and at intervals not to exceed fifty (50) feet, unless otherwise specified by the City Engineer. Material for one-half (1/2) inch expansion joints shall be as defined in AASHTO -33, and shall be installed with its top approximately one-fourth (1/4) inch below the concrete surface.

3.05.030 REINFORCEMENT AND EMBEDDED ITEMS. Reinforcing steel shall be clean and free from rust, scale, paint, grease, or other foreign matter which might impair the bond. It shall be accurately bent and shall be tied to prevent displacement when concrete is poured. Reinforcing steel shall be held in place by only metal or concrete ties, braces and supports. No steel shall extend from or be visible on any finished surface and shall have a minimum of one and one-half (1-1/2) inch concrete cover.

The Contractor shall use concrete chairs for holding the steel away from the sub grade, and spreader or other type bars for securing the steel in place. The spreader bars shall be not less than three-eighths (3/8) inch in diameter.

3.05.035 PREPARATIONS. Before batching and placing concrete, all equipment for mixing and transporting the concrete shall be cleaned, all debris and ice shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and masonry filler units that will be in contact with concrete shall be well drenched (except in freezing weather), and the reinforcements shall be thoroughly cleaned of ice or other coatings. Water shall be removed from spaces to receive concrete.

When placing concrete on earth surfaces, the surfaces shall be free from frost, ice, mud, and water. When the sub grade surface is dry soil or pervious material, it shall be sprayed with water immediately before placing of concrete or shall be covered with waterproof sheathing paper or a plastic membrane. No concrete shall be placed until the surfaces have been inspected and approved by the City Engineer or City Inspector.

3.05.040 CONCRETE MIXING. All concrete shall be ready-mixed and delivered in accordance with ASTM C-94. The concrete shall be mixed until there is a uniform distribution of the materials. Sufficient water shall be used in mixing concrete to produce a mixture which will flatten and quake when deposited in place, but not enough to cause it to flow. Sufficient water shall be used in concrete in which reinforcement is to be embedded, to produce a mixture which will flow sluggishly when worked and which, at the same time, can be conveyed from the mixer to the forms without separation of the coarse aggregate from the mortar. In no case shall the quantity of water used be sufficient to cause the collection of a surplus in the forms or exceed the maximum allowable slump as specified in 3.05.015 (b).

3.05.045 DEPOSITING. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. The concrete placing shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the corners of forms and reinforcing bars. No concrete that has partially hardened or been contaminated by foreign material shall be deposited in the work, nor shall retempered concrete be used. No concrete shall be dropped more than three (3) feet. Concrete delivered to the job site having a temperature which exceeds 90° F shall not be placed. Concrete cooling methods during hot weather will be approved by the City

Engineer.

All concrete in structures shall be vibrator compacted during the operation of placing, and shall be thoroughly worked around reinforcement and embedded fixtures and into the corners of the forms.

3.05.050 PLACING CONCRETE IN COLD WEATHER. No concrete shall be poured where the air temperature is lower than 40°F, at a location where the concrete cannot be covered or protected from the surrounding air. When concrete is poured below a temperature of 35°F the ingredients of the concrete shall be heated so that the temperature of the mixture shall not be less than 50°F or more than 100°F. Before mixing, the heated aggregates shall not exceed 125°F and the temperature of the heated water shall not exceed 175°F. Cement shall not be added until the temperature of the mixed aggregates and water is greater than 100°F. When there is likelihood of freezing during the curing period, the concrete shall be protected by means of an insulating covering and/or heating to prevent freezing of the concrete for a period of not less than seven (7) days after placing. Concrete shall not be placed on frozen soil.

Equipment for protecting concrete from freezing shall be available at the job site prior to placing concrete. Particular care shall be exercised to protect edges and exposed corners from freezing. In the event heating is employed, care shall be taken to insure that no part of the concrete becomes dried out or is heated to temperatures above 90°F. The housing, covering, or other protection used shall remain in place and intact at least twenty-four (24) hours after the artificial heating is discontinued. Combustion heaters shall not be used during the first twenty-four (24) hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

3.05.055 FINISHING. All concrete finish work shall be carefully performed and shall produce a top quality visual appearance as is common to the industry. After the concrete for slabs has been brought to the established grade and screened it shall be worked with a magnesium float 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 one half (½) inch.

After concrete has been poured in curb and gutter forms it shall be puddled and spaded so as to insure a thorough mixture, eliminate air pockets, and create uniform and smooth sides. Before the concrete has thoroughly set, and while the concrete is still green the forms shall be removed and the front and top sides shall be finished with a flat or steel trowel to make a uniform finished surface. Wherever corners are to be rounded, special steel trowels shall be used while the concrete is workable and the corners constructed to the dimensions specified.

The top and face of the curb and also the top of the apron on combined curb and gutter must be finished true to line and grade and without any irregularities of surface noticeable to the eye. The gutter shall not hold water to a depth of more than one-fourth (¼) inch, nor shall any portion of the surface or face of the curb or gutter depart more than one-fourth (¼) inch from a straight edge ten (10) feet in length, placed on the curb parallel to the center line of the street nor shall any part of the exposed surface present a wavy appearance.

3.05.060 CURING AND PROTECTION. 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:

- A. Ponding of water on the surface or continuous sprinkling.
- B. Application of absorptive mats such as three (3) inches of cured hay, clean straw, or fabric kept continuously wet.
- C. Application of two (2) inches of moist earth or sand uniformly distributed on the surface and kept saturated by spraying with water.
- D. Application of light colored waterproof plastic materials, conforming to "Specifications for Waterproof Sheet Materials for Curing Concrete" ASTM C-171, placed and maintained in contact with the surface of

the concrete.

E. Application of a curing compound, conforming to "Specifications for Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C-309. 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.

The freshly finished surface shall be protected from hot sun and drying winds until it can be sprinkled or covered as above specified. The concrete surface must not be damaged or pitted by rain. The Contractor shall provide and use, when necessary, sufficient tarpaulins to completely cover all sections that have been placed within the preceding twelve (12) hours. The Contractor shall erect and maintain suitable barriers to protect the finished surface. Any section damaged from traffic or other causes occurring prior to its official acceptance shall be repaired or replaced by the Contractor at his own expense in a manner satisfactory to the City Engineer.

Defective concrete conditions or surfaces shall be removed, replaced or repaired as directed to meet the approval of the City Engineer.

3.05.065 CONCRETE TESTING. In the event that the concrete placed or delivered to the job site appears to have questionable quality, the City Engineer may order the taking of concrete test cylinders to check required compressive strengths. In-place concrete may be cored for testing. Cost of all required laboratory testing shall be the responsibility of the Subdivider/Developer, Contractor or ready-mix supplier. All concrete delivered to the job site shall be accompanied by a ticket specifying bag mix, air content, etc. Said tickets shall be given to the City Inspector who may field check slump and air entrainment compliance.

Chapter 3.06

EXCAVATION AND BACKFILL FOR PIPELINES

Sections:

3.06.005 General.

3.06.010 Control of groundwater.

3.06.015 Excavation for pipelines.

3.06.020 Gravel foundation for pipe.

3.06.025 Blasting.

3.06.030 Sheet piling, Bracing, and Shoring of Excavations.

3.06.035 Backfilling.

3.06.040 Compaction of backfilling.

3.06.005 GENERAL. The work covered by this specification consists of furnishing all labor, tools, materials, equipment, and in performing all operations in connection with the excavation, trenching, and backfilling for underground pipelines and appurtenances.

3.06.010 CONTROL OF GROUNDWATER. Trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations in an adequate and acceptable manner. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater elevation 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. The discharge from trench dewatering shall be conducted to natural drainage channels, gutters, or drains. Surface water shall be prevented from entering trenches.

3.06.015 EXCAVATION FOR PIPELINES. Excavation for pipelines shall follow lines parallel to and equidistant from the location of the pipe centerline. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

A. Except in ledge rock, cobble rock, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation four (4) inches above the bottom of the pipe after placement in its final position. All additional excavation necessary for preparation of the trench bottom shall be made manually. Excavation shall not be carried below the grade shown on the Drawings. Any unauthorized excavation made below grade for any reason shall be backfilled in accordance with these Specifications.

B. Excavation for trenches in ledge rock, cobble rock, stones, mud, or other material unsatisfactory for pipe foundation shall extend to a depth of at least four (4) inches below the bottom of the pipe. A bedding of special material shall be placed and thoroughly compacted with pneumatic tampers in four (4) inch lifts to provide a smooth, stable foundation. Special foundation material shall consist of suitable earth materials free from roots, sod, or organic matter. Trench bottoms shall be hand-shaped as specified in paragraph (a) above. Where unstable earth or muck is encountered in the excavation at the grade of the pipe, a minimum of twelve (12) inches below grade will be removed and backfilled with crushed rock or gravel to provide a stable sub grade.

C. The maximum width of trench, measured at the top of the pipe, shall be as narrow as possible but not wider than twelve (12) inches on each side of sewer pipe or drainage pipe and fifteen (15) inches on each side of water pipe.

D. Excavation for pipelines under existing curb and gutter, concrete slabs or sidewalks, shall be open cut. In no case shall tunneling be allowed. At the option of the City Engineer, jacking under permanent facilities may be allowed based on his direction. Backfill of open cut areas shall be restored as specified in Section 3.06.035.

3.06.020 GRAVEL FOUNDATION FOR PIPE. Wherever the sub grade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, where water must be drained to maintain a dry trench bottom for pipe installation, and at other locations as previously defined, the sub grade shall be excavated to the specified depth and replaced with crushed rock or gravel. Gravel for pipe foundation shall be clean crushed rock or gravel conforming to the following gradation:

For all piping materials other than PVC.

<u>Screen</u>	<u>% Passing</u>
1-1/2"	100
No. 4	5

For all PVC piping.

<u>Screen</u>	<u>% Passing</u>
1"	100
No. 4	5

The gravel material shall be deposited over the entire trench width in six-inch maximum layers; each layer shall be compacted by tamping, rolling, vibrating, spading, slicing, rodding, or by a combination of two or more of these methods. In addition, the material shall be graded to produce a uniform and continuous support for the installed pipe.

3.06.025 BLASTING. Blasting will not be allowed except by special permission of the City Engineer. When the use of blasting is necessary, the Contractor shall use utmost care not to endanger life or property. The Contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property, and he/she shall be fully responsible for all damage attributable to blasting operations. Signals warning persons of danger shall be given before any blast. Suitable weighted plank coverings of timber mats shall be provided to confine all materials lifted by blasting within the limits of the excavation or trench.

Excessive blasting or overshooting will not be permitted, and any material outside the authorized cross section which may be shattered or loosened by blasting shall be removed at the Contractor's expense. The City Engineer shall have authority to order any method of blasting discontinued which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

3.06.030 SHEETING, BRACING, AND SHORING OF EXCAVATIONS. Excavation shall be sheeted, braced, and shored as required to support the walls of the excavations to eliminate sliding and settling and as may be otherwise required to protect the workmen and existing utilities, structures, and improvements. All such sheeting, bracing, and shoring and side slopes shall comply with the requirements of the Utah State Industrial Commission and OSHA.

All damage resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Contractor, and the Contractor shall accomplish all necessary repairs or reconstruction resulting from such damage.

3.06.035 BACKFILLING. Backfill shall be carefully placed around and over pipes and shall not be permitted to fall directly on a pipe from such a height or in such a manner as to cause damage. In these specifications the process of preparing the trench bottom to receive the pipe and the backfilling on each side of the pipe to a level over the top of the pipe is defined as bedding. Bedding requirements are as defined on the Tremonton City Standard Drawings

and in the Specifications for each pipe type.

Trench backfilling above the level of the pipe bedding shall be accomplished with imported materials and shall be free from rocks larger than eight (8) inches in diameter.

3.06.040 COMPACTION OF BACKFILL. Compacted backfill shall be placed by means of pneumatic tire rollers, or other mechanical tampers of a size and type approved by the City Engineer.

The backfill in all utility trenches shall be either compacted or consolidated according to the requirements of the materials being placed. Under pavements or other surface improvements the in-place density shall be a minimum of ninety (90) percent of laboratory standard maximum dry density, as determined by AASHTO T-99. In shoulders and other areas the in-place density shall be a minimum of eighty-five (85) percent of laboratory standard maximum dry density, as determined by the same laboratory method.

Where compaction methods are used, the material shall be placed at a moisture content such that after compaction the required relative densities will be produced; also, the material shall be placed in lifts which, prior to compaction, shall not exceed twelve (12) inches.

Prior to compaction each layer shall be evenly spread and moistened as approved by the City Engineer.

Approval of equipment, thickness of layers, moisture content, and compactive effort shall not be deemed to relieve the Contractor of the responsibility for attaining the specified minimum relative densities. The Contractor, in planning his work, shall allow sufficient time for the Contractor to make tests for relative densities for the approval of the City Engineer.

Chapter 3.07

STORM SEWER PIPING.

Sections:

- 3.07.005 General.
- 3.07.010 Pipe materials.
- 3.07.015 Pipe Laying.
- 3.07.020 Gravel foundation for pipe.
- 3.07.025 Installation Requirements for Line and Grade.
- 3.07.030 Pipe Bedding.
- 3.07.035 Backfill of CHDPE Pipe.
- 3.07.040 Tests.

3.07.005 GENERAL. This section covers the requirements for pipe materials and installation of concrete and corrugated metal pipe.

3.07.010 PIPE MATERIALS.

A. Reinforced Concrete Pipe. All reinforced concrete pipe used in the construction shall be of the rubber gasket type, bell and spigot joint design, conforming to the requirements of the latest revision of ASTM Designation C-76. Pipe class shall be as shown on the approved drawings. If pipe class is not shown, Class III pipe shall be used. The minimum joint length of all pipe provided shall be 7-1/2 feet, or as approved by the City Engineer.

B. Non-Reinforced Concrete Pipe. All non-reinforced concrete pipe shall be of the rubber gasket type bell and spigot joint design conforming to the latest revision of ASTM designation C-14, Class 3.

C. Bell and Spigot Joints. Bell and spigot joints, including rubber gaskets, shall conform to the requirements of the latest revision of ASTM Designation C-443. The pipe joint shall be so designed as to provide for self-centering, and when assembled, to compress the gasket to form a watertight seal. The gasket shall be confined in a groove on the spigot, so that pipe movement or hydrostatic pressure cannot displace the gasket.

D. Corrugated High Density Polyethylene Pipe (CHDPEP). CHDPEP shall conform to AASHTO -252 (3"-10"), AASHTO -294 (12"-48"), ASTM F-405, ASTM F-667, and shall be Type S (Smooth Interior). All CHDPEP used in the construction shall be of the rubber gasket type, bell and spigot joint design, conforming to the requirements of the latest revision of ASTM D-3212 and ASTM F-477 (Elastomeric Gaskets). Minimum Cover shall be twenty-four (24) inches unless otherwise determined by City Engineer. Maximum Cover to be determined by City Engineer.

3.07.015 PIPE LAYING. 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 units 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 rejoined 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.

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

Gravel for concrete pipe foundation shall be clean crushed rock or gravel with one hundred (100%) passing a one and one half (1½) inch screen and five percent (5%) passing a No. 4 sieve.

3.07.025 INSTALLATION REQUIREMENTS FOR LINE AND GRADE. All concrete and CHDPE pipe shall be installed accurately to the defined line and grade with the following limits:

Variance from established line and grade shall not be greater than one-sixteenth (1/16) inch per inch of pipe diameter in ten (10) feet, and not to exceed one-half (½) inch in ten (10) 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 (½) inch maximum.

3.07.030 PIPE BEDDING. All pipe sewers and drains shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the mid-point of the pipe shall be deposited and compacted in layers not to exceed ten (10) inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than two-inch diameter; with all materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve (12) inches above the top of the pipe.

Modified bedding material shall be graded as follows: one hundred percent (100%) passing a one and one half (1½) inch screen and five percent (5%) passing a No. 4 sieve.

3.07.035 BACK FILL OF CORRUGATED HIGH DENSITY POLYETHYLENE PIPE (CHDPEP). Backfill of CHDPEP shall be done in accordance to the Manufactures specifications.

3.07.040 TESTS. The Contractor will be required to conduct a displacement test in the presence of the City Engineer or his representative. Test shall be performed as follows:

- A. Displacement Test. In conducting the displacement test a light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned, or displaced pipe or other defects, the defects designated by the City Engineer shall be remedied at the Contractor's expense. If a curved pipeline is approved and installed, or if displacement or breakage is suspected and is not readily visible, the City Engineer may require television inspection of the curved pipeline or the suspect section of the pipe.

Chapter 3.08

DUCTILE IRON PRESSURE PIPE

Sections:

- 3.08.005 General.
- 3.08.010 Materials.
- 3.08.015 Joints.
- 3.08.020 Fittings.
- 3.08.025 Laying Pipe.
- 3.08.030 Gravel foundation for pipe.
- 3.08.035 Pipe Bedding.
- 3.08.040 Polyethylene Wrapping.
- 3.08.045 Pipe Sizes.
- 3.08.050 Cleaning and Flushing.

3.08.005 GENERAL. This section covers the requirements for ductile iron pressure pipe materials and installation.

3.08.010 MATERIALS. Ductile iron pipe shall conform to all requirements of AWWA C 151 and ANSI A-21.51, "Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water or Other Liquids." Minimum thickness shall be Class 51 for eight (8) inch diameter and smaller. Pipes in excess of eight (8) inch diameter shall be thickness Class 50.

3.08.015 JOINTS.

A. Mechanical Joints. All mechanical joints shall meet requirements of ANSI A-21.6 and ANSI 21.11. All gasket surfaces shall be smooth and free from imperfections. All mechanical joint gaskets shall be armor guard type gaskets and shall conform to tests in accordance with construction specifications and shall be less than one (1) year old.

D. Compression Joints. Compression joints shall be mechanical joint sleeve Smith Blair 441 or Flange adaptor Smith Blair Type 900 or approved equal. Bolts shall meet all requirements of the above specifications, honoring all characteristics, tolerances, and tests. All bolts shall be of the proper size and length to match the size of pipe fitting as per drawings.

B. Push-on Joints. Push-on joints will be used for main line six (6) inch and eight (8) inch ductile iron pipe. All push-on joints shall meet the requirements of ANSI 21.11. Gaskets shall be free from defects and not over one (1) year old. All push-on joints shall have a minimum of three (3) brass wedges per joint for ten (10) inch diameter and smaller. Pipe sizes in excess of ten (10) inch diameter shall have four (4) brass wedges per joint.

Lubricants shall be non-toxic and have no deteriorating effects on gasket materials. Lubricants shall not impart taste, odor or flavor to water in a pipe. It shall conform in every way to ANSI 21.11.

C. Flanged Joints. Flanged joints shall be bolted firmly with machine, stud, or cap bolts of proper size. Flanges may be cast integrally with the pipe or may be screwed on threaded pipe. Flanges shall be faced and drilled and of proper dimensions and class for size and pressure required. All flanges shall meet requirements of ANSI A 21.10, "American Standard for Cast Iron Fittings."

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 three-eighths (3/8) inch or less than one-eighth (1/8) inch extends past face of nut.

Gaskets shall be 1/16-inch thick, made of best quality sheet gasket material or equal. A gasket for each flanged joint of proper size, ring type or full face shall be installed.

3.08.020 FITTINGS.

A. Mechanical Joint Fittings. Mechanical joint fittings shall conform to ANSI A 21.10, "American Standard for Cast Iron Fittings."

B. Push-on Fittings. Push-on fittings shall conform to ANSI A 21.10 with bells, sockets, and plain ends per ANSI A 21.11.

C. Flanged Fittings. Flanged fittings shall conform to ANSI A 21.10, "American Standard for Cast Iron Fittings."

All flanges shall be faced and drilled. Where cap screws or stud bolts are needed, flanges shall be tapped to support cap screws or stud bolts.

3.08.025 LAYING PIPE. Pipe shall be laid as specified in AWWA Standard for "Installation of Water Mains" C-600, except as modified herein and in Special Conditions.

Tees, elbows, crosses, and reducers shall be used for changes in direction and outlets, as shown on the Drawings. Anchors and thrust bolts shall be placed at valves, elbows, tees, etc., as shown on the Drawings and as directed by the City Engineer.

All ductile iron pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. 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 rejoined as for new pipe. In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to the flow line. As work progresses, the interior of the pipe shall be cleared of dirt and superfluous materials of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after jointing has been completed. Trenches shall be kept free from water until pipe jointing has set, and pipe shall not be laid when condition of the trench or weather is unsuitable for such work. At all times when work is not in progress, all open ends of the pipe and fittings shall be securely closed to the satisfaction of the City Engineer so that no water, earth, or other substance will enter the pipe or fittings.

3.08.030 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. Gravel for ductile iron pipe foundations shall be clean crushed rock or gravel with one hundred (100) percent passing a one and one half (1½) inch screen and five (5) percent passing a No. 4 sieve.

3.08.035 PIPE BEDDING. All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded. A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed ten (10) inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses. Bedding materials shall be loose earth, free from lumps; sand materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve (12) inches above the top of the pipe.

Modified bedding material shall be graded as follows: one hundred (100) percent passing a one (1) inch screen and five (5) percent passing a No. 4 sieve.

3.08.040 POLYETHYLENE WRAPPING. Ductile iron pipe materials placed may be required to be wrapped, at the direction of the City Engineer, with a polyethylene plastic wrap the entire length of the pipeline materials, including all fittings and valves, in accordance with the manufacturer's specifications. This shall be completed in order to provide the necessary cathodic protection. All testing and costs to determine need for cathodic protection shall be the responsibility of the Subdivider, Developer, Contractor or Project Manager.

Polyethylene encasement wrap shall consist of one or more wraps of sheet polyethylene plastic to produce a minimum thickness of eight (8) mils over all surfaces. The wrap shall be sufficiently loose so that it will contact all surfaces without tension after backfilling. The wrap shall extend one foot over adjacent surfaces. The overlap at edges of the plastic shall be a minimum of one (1) foot, and the laps shall be secured in place. Ends of the wrap shall be secured by circumferential bands on one (1) inch wide polyethylene plastic tape applied under light tension. Where polyethylene wrap is specified, all compression couplings, mechanical joints, flanged joints, and valves exposed to soil shall be wrapped with eight (8) mil thick polyethylene film adhesive tape equal to Polyken No. 900 or Scotchrap No. 50. The tape shall be installed to adhere securely to both the pipe and polyethylene. Enough film shall be used to overlap the adjoining pipe a minimum of one (1) foot.

Valves shall be wrapped by bringing the wrap on the adjacent pipe over the bells or flanges of the valve and sealing with the adhesive tape. The valve bodies are then wrapped with a flat sheet of the film passed under the valve bottom and brought up around the body to the stem and fastened in place with the adhesive tape.

All fittings that require concrete blocking shall be completely wrapped prior to pouring the concrete backing block.

Polyethylene wrap shall be protected from the sun and weathering prior to use. Care shall be exercised during backfilling of the protected areas to prevent puncturing the film. The bottom of the trench shall be shaped to give substantially uniform circumferential support of the lower third of each pipe.

3.08.045 PIPE SIZES. An eight (8) inch diameter pipe is the minimum permitted diameter. If the size of any piping is not clearly evident in the Drawings, the Contractor shall request instructions from the City Engineer as to the proper sizing. Any changes resulting from the Contractor's failure to request clarification shall be at his expense.

3.08.050 CLEANING AND FLUSHING. The Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping, or other method that will not harm the lining or pipe.

Water required for flushing shall be furnished by the Contractor. All temporary connections for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor. All open ends of pipes shall be bulkheaded or plugged when workmen are not on the job or in the immediate area to prevent rocks or other foreign matter from entering the pipe.

Chapter 3.09

DUCTILE IRON PIPE FITTINGS

Sections:

3.09.005 Scope.

3.09.010 Ductile Iron Fittings.

3.09.015 Coatings for Ductile Iron Pipe and Fittings.

3.09.020 Handling Ductile Iron Fittings.

3.09.025 Installation.

3.09.005 SCOPE. This section applies to the furnishing and installation of cast iron pipe fittings.

3.09.010 DUCTILE IRON FITTINGS. Fittings shall be of the short body design and shall meet AWWA C-153. and shall have mechanical rubber gasket type joints. Fittings inside structures or where otherwise noted on the Drawings shall be ASA Class 125 flanged design with full face rubber gaskets.

3.09.015 COATINGS FOR DUCTILE IRON PIPE AND FITTINGS. All exterior surfaces of pipe and fittings shall be coated with hot coal tar as specified in the Proposed American Standard Specifications for Coal Tar Dip Coatings for Ductile Iron Pipe and Fittings.

3.09.020 HANDLING DUCTILE IRON FITTINGS. Fittings shall be handled in such a manner as to insure installation in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating.

All damaged pipe coating shall be repaired prior to laying the pipe or placing the backfill. Repair shall be accomplished by removing all damaged coating, wire-brushing to exposed metal, and applying two coats of coal tar coating of a type and quality equal to that used originally in coating the pipe.

3.09.025 INSTALLATION. All Ductile iron fitting materials placed may be wrapped, at the direction of the City Engineer, with a plastic liner the entire length of the pipeline materials, including all fittings and valves, in accordance with Section 3.08.040 of these specifications. This shall be completed in order to provide the necessary cathodic protection.

Chapter 3.10

PVC PLASTIC SEWER PIPE

Sections:

- 3.10.005 General.
- 3.10.010 Pipe.
- 3.10.015 Joints.
- 3.10.020 Fittings.
- 3.10.025 Pipe Laying.
- 3.10.030 Gravel Foundation for Pipe.
- 3.10.035 Installation Requirements.
- 3.10.040 Pipe Embedment.
- 3.10.045 Tests.
- 3.10.050 Sewer Lateral Connections.

3.10.005 GENERAL. This section covers the requirements for PVC plastic sewer and storm drain pipe to be used in mains and laterals.

3.10.010 PIPE. PVC plastic sewer pipe shall be made of compound conforming to ASTM D-1784 with a cell classification of 13364-B with a minimum tensile modular of 500,000 psi. PVC sewer pipe must meet all the dimensional, chemical, and physical requirements outlined in ASTM D-3034, shall have a SDR of thirty-five (35). Pipe shall carry the IAPMO UPC or approved Seal of Approval or as otherwise specified by the City. SDR and laying length may be modified as conditions dictate when approved by the City Engineer.

PVC sewer pipe shall be installed according to the requirements of ASTM D-2321 and the manufacturer's requirements.

3.10.015 JOINTS. Joints for PVC plastic sewer pipe shall be of the rubber gasket bell and spigot type, and the rubber gaskets shall conform to ASTM D-1869.

3.10.020 FITTINGS. Fittings shall be made of PVC plastic conforming to ASTM D-1784, have a cell classification as outlined in ASTM D-3034, and carry the IAPMO UPC Seal of Approval.

3.10.025 PIPE LAYING. All pipe installation shall proceed upgrade on a stable foundation with joints closely and accurately fitted. Installation requirements of the manufacturer shall be rigidly adhered to.

Rubber gaskets shall be fitted properly in place and care shall be taken in joining the pipe units 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 jointing 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 rejoined 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 to the specific requirements of the pipe manufacturer.

3.10.030 GRAVEL FOUNDATION FOR PIPE. Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, it shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place. Gravel foundation material for pipe shall be placed only when, and to the depth, requested by the Engineer or specified on the Drawings.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with one hundred (100) percent passing a one (1) inch screen and maximum of five (5) percent passing a No. 4 sieve.

3.10.035 INSTALLATION REQUIREMENTS FOR LINE AND GRADE. All sewer pipe shall be installed accurately to the defined line and grade with the following limits:

Variance from established line and grade shall not be greater than one thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch, 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.

3.10.040 PIPE EMBEDMENT. All pipe shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded in suitable embedment material.

The bottom of the trench shall be of stable materials. In general, coarse-grained soils, free of rocks and stones, such as graded crushed rock, gravel, sand, and other granular materials, are considered stable materials. A stable material shall be placed and compacted under the pipe haunches and up to the springline in uniform layers not exceeding ten (10) inches in depth. When bedding is required, the same material should be used for both bedding and haunching. Stable material, free of rocks and stones, shall be used to backfill the trench from the springline of the pipe to a point at least twelve (12) inches above the top of the pipe. Each ten (10) inch layer of bedding, haunching and initial backfill shall be placed, then carefully and uniformly compacted to 95% of AASHTO T-180 density. Extra-fine sand, clay, silt, or large soil lumps shall not be allowed as bedding, haunching, or initial backfill material. The remaining backfill over the top of the initial backfill shall be placed in accordance with Chapter 3.06. No bedding material shall be used unless accepted by the City Engineer. Samples of the materials shall be submitted by the Contractor a sufficient time in advance of intended use to enable its inspection and testing.

3.10.045 TESTS. The contractor will be required to conduct an air test and a recorded video inspection, to be presented with the inspection log to the City's Public Works Department after the acceptance of the inspection, in the presence of the City Engineer or his 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 or his representative. Tests shall be performed as follows:

A. Video Inspection Test. In conducting this test the contractor or developer shall have all newly installed sewer mains video inspected and shall provide a written log of the actual footage to every service lateral and each manhole location. The video inspection shall be witnessed by the City Engineer or his representative. If the video shows broken, misaligned, displaced pipe, or other defects, the defects designated by the City Engineer or his representative shall be repaired by the contractor or developer at their expense. The repairs shall then be reinspected with the video inspection. After acceptance of the inspection, the videos and their logs shall be turned over to the Public Works Department of the City.

B. Infiltration Test. The Contractor shall furnish labor, equipment, and materials, including pumps, and shall assist the City Inspector in making infiltration tests of the completed sewer before it can be placed into service. The 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. The maximum allowable infiltration shall be determined by the city Engineer or his representative. 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 at the expense of the Contractor.

C. Air Testing. The Contractor or his representative (a qualified firm or individual agreed upon by the City and the Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the City Inspector, 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 four (4) inch service laterals (and plugs) have been installed. 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 repressurized 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 Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and retested until the minimum air testing requirements have been met.

3.10.050 SEWER LATERAL CONNECTIONS.

All sewer lateral service lines shall be marked in the curb with the placement of a #20 Steel nail in the concrete. All new or replaced sewer laterals shall have a sewer lateral clean-out, purchased from the City, and shall be placed at the property line and buried six (6) inches below finish grade, as shown on the City Standard Drawings. All sewer lateral connections into new sewer mains shall be through pre-formed wyes. All connections into existing sewer mains shall be done with a sewer tapping machine or hole saw and using a Romac Style CB Saddles or a PVC Insert-A-Tee, for the appropriate size for sewer lateral and for the sewer main, and as shown on the City Standard Drawings. All replaced sewer laterals shall be constructed to the newest City Standards and when the termination of the replace sewer lateral is within three (3) feet of the sewer main a connections into existing sewer mains shall be done and using a Romac Style CB Saddles or a PVC Insert-A-Tee, unless the replaced sewer lateral was connected through a pre-formed wye fitting in the existing sewer main. This to be done by property owner, developer or subdivider at their expense.

Chapter 3.11

PVC PLASTIC PRESSURE PIPE

Sections:

- 3.11.005 Scope
- 3.11.010 Joints.
- 3.11.015 Fittings.
- 3.11.020 Service Connections.
- 3.11.025 Pipe Laying.
- 3.11.030 Gravel Foundation for Pipe.
- 3.11.035 Pipe Bedding.
- 3.11.040 Installation of Locator Tape and Copper Wire.
- 3.11.045 Pipe Sizes.
- 3.11.050 Cleaning and Flushing.

3.11.005 SCOPE. This specification applies to the furnishing and installation of PVC AWWA C-900, class 200 plastic pressure pipe. Pipe shall be AWWA-C900-81, with material compound being 1245A, per ASTM D1784. Class 200 pipe shall meet DR-14.

3.11.010 JOINTS. The Elastomeric Seal (gasket) shall conform to ASTM F477. The gasketed joint assembly shall conform to ASTM D3139, and the installation of the C900 pipe shall conform with Uni-Bell-3, AWWA M23 installation guide.

3.11.015 FITTINGS. Fittings shall be short body cast iron or ductile iron, iron pipe size for PVC application, and in accordance with AWWA C-110. They shall be capable of withstanding, without bursting, hydrostatic tests of three times the rated water working pressure. The fittings shall be furnished with mechanical, bell and spigot, or flange joints and shall conform to the dimensions and weights given in AWWA C-110 and AWWA C-111.

3.11.020 SERVICE CONNECTIONS. Service connection to PVC plastic pressure pipe shall be by a Romac Style 202-N service saddle with two (2) Stainless Steel Straps.

3.11.025 PIPE LAYING. All PVC plastic pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. 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 rejointed 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.

Service lines and laterals must be assembled so that no strain is placed on the pipe during or after backfill operations. After laying of the pipe is completed, it shall be center loaded with backfill and bedding to prevent arching and whipping under pressure. Center loading should be done carefully so that joints will be completely exposed for examination.

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

3.11.030 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.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with one hundred (100) percent passing a one-inch screen and five (5) percent passing a No. 4 sieve.

3.11.035 PIPE BEDDING. All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed ten (10) inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compacted masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than one (1) inch diameter; with all materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve (12) inches above the top of the pipe.

Modified bedding material shall be graded as follows: one hundred (100) percent passing a one (1) inch screen and five (5) percent passing a No. 4 sieve.

3.11.040 INSTALLATION OF LOCATOR TAPE AND COPPER WIRE. PVC pipelines shall be furnished with metallic locating tape laid along the centerline of the pipe trench at a depth of twenty-four (24) inches below finish grade. The CONTRACTOR shall furnish manufacturer's literature, completely describing the tape proposed to be installed. No tape shall be installed prior to approval of the Engineer. The CONTRACTOR shall also install #14 plastic coated, solid copper wire in the trench with the pipeline. The ends of the wire shall be terminated inside valve boxes with four (4) feet of coiled wire.

3.11.045 PIPE SIZES. An eight (8) inch diameter pipe is the minimum permitted diameter. If the size of any piping is not clearly evident in the Drawings, the Contractor shall request instructions from the City Engineer as to the proper sizing. Any changes resulting from the Contractor's failure to request clarification shall be at this expense.

3.11.050 CLEANING AND FLUSHING. The Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping, or other method that will not harm the lining or pipe.

Water required for flushing shall be furnished by the Contractor. All temporary connections for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor.

All open ends of pipes shall be bulkheaded or plugged when workmen are not on the job or in the immediate area to prevent rocks or other foreign matter from entering the pipe.

Chapter 3.12

SUBSURFACE DRAIN PIPE

Sections:

3.12.005 General.

3.12.010 Material.

3.12.015 Pipe Laying.

3.12.005 GENERAL. Buried drain pipe with open joints or perforated pipe shall be provided for the drains in the locations shown on the Drawings. The Contractor shall furnish and lay the drain pipe.

3.12.010 MATERIAL. Drain pipe may be perforated PVC pipe (ASTM D-1784), perforated or non-perforated concrete sewer pipe. Corrugated polyethylene piping per ASTM F-405-77a may also be used if installed with direct burial laser grade control equipment.

Non-perforated pipe shall be extra-strength non-reinforced concrete pipe. The pipe may be furnished with either bell-and-spigot or tongue-and-groove joints. Laying lengths of the pipe shall not exceed four (4) feet. To insure open joints between lengths of pipe, spacer lugs approximately one-eighth (1/8) inch high located on the one-third (1/3) or one-fourth (1/4) points around the perimeter shall be provided at each joint between lengths of drain pipe. The lugs may be cast on one end of the pipe during manufacture and similar to the details shown on the Drawings, or may be gasket-type lugs of plastic, metal, or other suitable material cemented to the pipe by the Contractor and approved by the City Engineer.

Perforated pipe shall be PVC, extra-strength non-reinforced concrete pipe (ASTM-C 14) or reinforced concrete pipe (ASTM-C-76). All of which shall have one-fourth (1/4) inch diameter perforations or as approved by the City Engineer. Concrete pipe may be furnished with bell-and-spigot or tongue-and-groove joints. Laying lengths of pipe shall not exceed five (5) feet.

3.12.015 PIPE LAYING. Gravel backfill shall be placed under and over the pipe to the minimum depth as shown on the Drawings. The pipe shall be laid carefully on the gravel in a workmanlike manner and to the lines and grades shown on the Drawings or established by the City Engineer. The joints for unperforated pipe shall be covered with asphalt-saturated felt strips placed to extend over the upper half of the circumference of the pipe and to not less than four and one half (4½) inches in each direction from the joint.

The maximum allowable departure from grade shall not exceed ten (10) percent of the inside diameter of the drain pipe, and in no case shall the departure exceed 0.1 foot. Where departures occur, the rate of return to established grade shall not exceed two (2) percent of the pipe diameter per joint of pipe. The maximum allowable departure from alignment shall not exceed twenty (20) percent of the inside diameter of the drain pipe, with a rate of return to the established line not to exceed five (5) percent per joint of pipe.

The finished bed for all pipe shall be made smooth, including removal of material under the bell, so that the full length of pipe will be evenly and uniformly supported. The pipe shall be laid and completed with adjacent ends closely abutted and with the bell ends upgrade. Where necessary, as determined by the City Engineer, mechanical means shall be used to hold the pipe in place. Any pipe which is broken, cracked, or otherwise unsuitable, as determined by the City Engineer, shall be removed and replaced at the Contractor's expense. The water level in the trench area where the pipe is being laid shall be held to a minimum. During placement of the pipe, the water level in the trench shall not exceed fifty (50) percent of the diameter of the pipe above the invert of the pipe. Water may be removed by permitting the water in the trench to flow down the previously installed drain pipe, provided that a screen cover is kept continuously in place over the exposed end of the pipe at all times, except when additional pipe is actually being placed. The screen used for this purpose shall be approved by the City Engineer and shall have maximum mesh openings of one-eighth (1/8) inch. The pipe shall not be covered with backfill until it has been inspected and approved by the City Engineer. Unless otherwise approved by the City Engineer, the pipe shall not be covered with backfill except in the presence of a duly authorized City Inspector. After approval, the trench shall be

backfilled as prescribed in Chapter 3.06.

The Contractor shall keep the pipe drain and manholes free from deposits of mud, sand, gravel, or other foreign matter and in good working condition until the construction is complete and accepted. Upon completion of the drain, if a clear and unobstructed view of the whole bore of the pipe cannot be obtained between manholes by use of a light or sun reflector, a device approved by the City Engineer, having a diameter one (1) inch less than the drain tile to be tested, shall be pulled through the drain between manholes. Any obstruction found in the drain shall be removed by the Contractor without cost to the City. Any methods used by the Contractor to remove deposits of mud, sand, gravel, or other foreign matter from the drains, such as use of water or air pressure, shall be subject to the approval of the Engineer.

Chapter 3.13

MANHOLES

Sections:

3.13.005 General.

3.13.010 Concrete Bases.

3.13.015 Wall and Cone Sections.

3.13.020 Iron Castings.

3.13.025 Manhole Steps.

3.13.005 GENERAL. This chapter covers the requirements for manhole materials and installation.

3.13.010 CONCRETE BASES. Manhole bases may be either precast or cast-in-place unless otherwise specified. Precast manhole bases shall have pipe inverts, a neoprene boot with strap for each pipe connecting to the manhole, and a minimum of six (6) inches of compacted gravel base under the manhole. Cast in place pipe connections may also be utilized as outlined on the drawings.

Where sewer lines 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 flows within the manholes shall be made with a smooth curve with as long a radius as possible. The floor of the manhole outside the channels shall be smooth and slope toward the channel at not less than one-half (1/2) inch per foot.

The connecting boots shall be made of neoprene compound meeting ASTM C-443 Specifications. The boot shall have a wall thickness of three-eighths (3/8) inch. 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 watertight seal between the boot and the precast base must be accomplished.

An external band shall be supplied and used to clamp and seal the boot to the pipe. The band shall be made of 300 series non-magnetic corrosion-resistant steel. After the band has been placed, it shall be completely coated with a bituminous material approved by the Engineer.

All manholes with three (3) or more pipes entering the base or pipes larger than thirty (30) inches in diameter shall be sixty (60) inch inside diameter; all others shall be forty-eight (48) inch inside diameter.

Concrete for manhole bases shall comply with the requirements of Chapter 3.05 of these Specifications.

3.13.015 WALL AND CONE SECTIONS. All manholes shall be precast, sectional, reinforced concrete pipe of either forty-eight (48) or sixty (60) inch I.D., as specified. Both cylindrical and taper sections shall conform to all requirements of ASTM Designation C-76 for Reinforced Concrete Culvert Pipe with the following exceptions:

- A. The throat section of the manhole shall be adjustable, by use of pipe sections, up to eighteen (18) inches in height.
- B. The taper section shall be a maximum of three (3) feet in height, shall be of eccentric conical design, and shall taper uniformly to thirty (30) inches inside diameter.
- C. The pipe used in the base section shall be furnished in section lengths of one (1), two (2), three (3), and four (4) feet as required.
- D. Reinforcing steel shall consist of a circular cage with a minimum cross sectional area of 0.25 square inch of steel per foot for cylindrical sections and 0.20 square inch per foot for cone 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. Joints shall be set in mortar consisting of one (1) part cement and one and one half (1½) parts sand with sufficient water added to bring the mixture to workable consistency.

Bituminous jointing material may be used in lieu of cement mortar and shall be installed in accordance with manufacturer's recommendations. All joints shall be watertight and free from appreciable irregularities in the interior wall surface.

3.13.020 IRON CASTINGS. All iron castings shall conform to the requirements of ASTM Designation A-48 (Class 30) for grey iron castings.

Rings and covers shall be thirty (30) inch diameter as supplied by "D&L Supply" Model A-1180 (vented) for Sewers unless the lids will be buried then a Model A-1181 (solid) for sewers or a Model A-1165 for drains or an approved equal. Each cover shall contain one (1) pick hole. The cover shall be marked "SEWER" or "STORM DRAIN," as appropriate.

3.13.025 MANHOLE STEPS. All sanitary sewer and storm drain manholes over six (6) feet in depth shall be provided with manhole steps as shown on the drawings. All steps shall be securely grouted into the wall section and shall be water tight. Steps shall be uniformly spaced at one (1) foot maximum and shall be polypropylene covered steel steps, Model PSI-PF as manufactured by "M. A. Industries" or an approved equal.

Chapter 3.14

VALVES, HYDRANTS AND MISCELLANEOUS ITEMS

Sections:

- 3.14.005 General.
- 3.14.010 Gate Valves.
- 3.14.015 Valve Boxes.
- 3.14.020 Fire Hydrants.
- 3.14.025 Couplings.
- 3.14.030 Water Service Connections.
- 3.14.035 Water Meter Boxes and Lids.

3.14.005 GENERAL. This chapter covers valves, hydrants, and meter boxes, together with other miscellaneous items to be installed.

3.14.010 GATE VALVES. Gate valves shall conform to AWWA Specification C-509 . Valves shall be of cast iron body, Resilient Wedge Valve, non-rising stem design with O-ring seals. Unless otherwise shown or specified, valves shall be of mechanical joint connection design for buried service and flanged connection design for installation in structures. Buried valves shall have two (2) inch operating nuts, and valves in structures shall have handwheels unless otherwise specified.

3.14.015 VALVE BOXES. All buried valves shall be installed complete with two-piece, cast iron, screw type, five and one-fourth (5¼) inch shaft valve box with locking lid. Valve boxes installed between the curb and gutter and sidewalk shall be placed in a concrete pad as indicated on the standard Drawings, and valve boxes placed in the street shall be surrounded by a concrete ring.

3.14.020 FIRE HYDRANTS. Fire hydrants shall be "traffic model" type designed to conform to AWWA Specification C-502 of the proper bury depth and shall be Mueller Centurion or Clow Medallion.

Hydrant valves shall be a minimum of six (6) inch size. Hydrants shall be supplied complete with two (2) two and one half (2½) inch hose nozzles and one (1) four and one half (4½) inch pumper nozzle. All nozzles shall be provided with National Standard threading. A one-half (½) cubic yard gravel sump shall be provided at each hydrant. All hydrants shall be supplied complete with a flanged by mechanical joint end auxiliary gate valve and box. Each hydrant shall also be supplied with O-ring seals, a National Standard pentagon operating nut which is designed for clockwise rotation closing, and a six (6)inch ANSI 150-pound flanged inlet.

3.14.025 COUPLINGS. Couplings shall be equal to the product of Smith-Blair or Dresser with cast iron couplings being used on all cast iron and asbestos cement pipe and steel couplings on steel pipe. Couplings shall be of the straight, transition, or reducing style as required by the specific installation. Buried steel couplings shall be protected from corrosion with an approved coating.

3.14.030 WATER SERVICE CONNECTIONS. All water service lines shall be marked in the curb with the placement of #20 steel nail in the concrete. Pipe for water services shall be 160 P.S.I. "type K" copper water tubing or shall be 200 psi Polyethylene (PE) Copper Tubing Size (CTS) Poly, with Stainless Steel Inserts used on all connections. (3/4" for single family dwellings).

Connections of services to main lines shall be through a corporation-type stop Mueller (Ball Corp B-25028) or Ford (FB1100). All connections shall be made using Compression type fittings.

Connections to main lines shall be made as specified for the various types of mainline materials, and shall require a corporation stop as specified above.

The following table gives the maximum size for direct tapping into Cast Iron or Ductile Iron when permitted:

<u>Pipe Size</u>	<u>Max. Tap Size</u>
4"	1"
6"	1-1/4"
8"	1-1/2"
10"	1'1/2"
12"	2"
14"	2"
16"	2-1/2"
18"	2-1/2"

All taps larger than those shown above must be accomplished with a tapping sleeve or equivalent.

All connections made to existing water lines shall be done using a "wet-tap" method.

Meters shall be connected through coppersetters Mueller (B-2423-2 with Bypass for one (1) 1/2" - 2" and B-2434-6A 3/4" - 1") or Ford (VBHH 70 Series with Bypass for one (1) 1/2" - 2" and VBH 3/4" - 1") all Meter setters shall be eighteen (18) inches and by equipped with a Dual Check Valve, all meter setter shall be staked and secured, with a metal stake, inside of the meter box to prevent movement of meter setter and inverted-key angle valve on the inlet riser, drilled for wire sealing. All materials used shall be coordinated with the Tremonton City Water Department.

All service lines shall be assembled as outline in the following paragraph. Service Connections and Lines shall consist of a Romac-202-N service saddle or direct tap into main when applicable, a Corporation Stop - Mueller (Ball Corp B-25028) or Ford (FB1100), a service line of 160 psi K Type Copper Tubing or 200 psi CTS PE Tubing, a Curb Stop Mueller (Ball Curb Valve B-20283) or Ford (Ball Valve Curb Stop B-11), a Brass Close Nipple, a Brass Union, a 18" Copper Meter Setter with Dual Check Valve Mueller (B-2423-2 with Bypass for one (1) 1/2" - 2" and B-2434-6A 3/4" - 1") or Ford (VBHH 70 Series with Bypass for one (1) 1/2" - 2" and VBH 3/4" - 1"), with a Mueller (H-15451-CTS x FMIP or H-15428 CTS x MIP) or Ford (C14 - FMIP x QJCTS or C84 - MIP x QJCTS) fittings on the setter.

3.14.035 WATER METER BOXES AND LIDS. Meter boxes and lids shall be as specified in the following paragraph and shall be installed in accordance with the Drawings at the time the subdivision is developed and are the responsibility of the subdivider.

Meter boxes shall be round eighteen (18) inch inside diameter boxes of either concrete or corrugated metal or hope pipe. The lids for meter boxes shall be cast iron with a locking lid operated by a pentagon head, and shall have twelve (12) inch minimum opening diameter.

Meter Box shall not be located in the Sidewalk or Drive-Ways and shall be the responsibility of the Subdivision Developer, Building Contractor or Homeowner to see that the Meter Box is properly located and moved if necessary, at their expense, to insure that Meter Box is not in said Sidewalk or Drive-Way.

Chapter 3.15 TESTING AND DISINFECTION OF WATER LINES

Sections:

- 3.15.005 General.
- 3.15.010 Testing.
- 3.15.015 Flushing.
- 3.15.020 Disinfection.

3.15.005 GENERAL. All culinary water lines shall be tested, flushed, and disinfected to the American Water Works Association (AWWA) ANSI/AWWA Standard C651-99 as outlined in this section.

3.15.010 TESTING. Tests shall be made upon completion of system installation or any valves portion thereof. All tests shall be made at the expense of the Contractor and in the presence of the City Engineer or his representative.

Lines shall be slowly filled with water, no more than 1 fps velocity, venting off all air. If required, taps shall be provided at line high points to bleed off the air, and after testing these shall be plugged. The line shall be pressurized to an amount equal to one hundred fifty (150) percent of the normal static pressure of the system. This pressure shall remain steady for a period of two hours for water line approval.

3.15.015 FLUSHING. After both pressure testing and chlorination, all pipelines shall be flushed. Flushing shall be accomplished through hydrants or, if a hydrant does not exist at the end of the line, the Contractor shall install a tap sufficient in size to provide for a 2.5 foot per second flushing velocity in the line. The following is the flow quantity required to provide a 2.5-foot per second flushing velocity:

<u>Pipe Size</u> <u>(in.)</u>	<u>Flow</u> <u>(gpm)</u>
2	26
4	100
6	220
8	390
10	610
12	880

3.15.020 DISINFECTION. After flushing, all culinary water lines shall be disinfected by chlorination. Chlorination shall provide a minimum of twenty-five (25) ppm residual after twenty-four (24) hours contact in the pipeline. This may be expected with an application of fifty (50) ppm, although some conditions may require more. Chlorine in the form of a one (1) percent slurry of high-test calcium hypochlorite (HTH, Perchloron, Pittchlor, etc. which are seventy (70) percent available chlorine by weight) shall be fed into the pipeline, in the presence of the City Engineer or his representative, in such a manner as to mix with the water flowing in the pipeline. (A one (1) percent slurry -- 10,000 ppm -- result from mixing one pound of calcium hypochlorite with 8.40 gallons of water.) Or one of the other acceptable disinfection methods listed in the ANSI/AWWA C651-99 Standard.

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

Pipe Size (in.)	Vol. of 100 ft. Length (gal.)	Req'd Amt. 1% Chlorine Solution/100 ft. of Pipe (gal.)
1-1/2	9.18	0.07
2	16.32	0.12
2-1/2	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

During the process of chlorinating the pipeline, all valves and other pipeline appurtenances shall be operated several times to provide sufficient contact with the chlorinating agent. Following chlorination, the water line shall be drained and thoroughly flushed and, if necessary, rechlorinated until a satisfactory bacteriological test is obtained and the appropriate bacteriological results are reported and turned into the City Engineer or his representative

Chapter 3.16

CONSTRUCTION AND PLACEMENT OF THRUST BLOCKS

Sections:

3.16.005 Scope.

3.16.010 Placement.

3.16.015 Concrete Mix Design.

3.16.005 SCOPE. This chapter of the Specifications defines the placement and the construction of thrust blocks where required. It also gives the mix design required for the Portland Cement Concrete required in the construction of the thrust blocks.

3.16.010 PLACEMENT. Thrust blocks are required at points where the pipe changes direction, such as: at all tees, elbows, wyes, caps, valves, hydrants, reducers, etc. Thrust blocks should be constructed so that the bearing surface is in direct line with the major force created by the pipe or fitting. The earth-bearing surface should be undisturbed. See Standard Drawings for typical thrust block details. Thrust blocks shall be designed by a registered professional engineer and approved by the City Engineer.

3.16.015 CONCRETE MIX DESIGN. The concrete mixture shall have a minimum twenty-eight (28) day compressive strength of 2,500 pounds per square inch and shall comply with the requirements of Class C concrete outlined in chapter 3.05.

Chapter 3.17
RESTORATION OF SURFACE IMPROVEMENTS

Sections:

- 3.17.005 General
- 3.17.010 Gravel Surface.
- 3.17.015 Bituminous Surface.
- 3.17.020 Concrete Surfaces.
- 3.17.025 Pavement Patching.

3.17.005 GENERAL. The 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. All restoration of improvements shall comply with the requirements of Chapter 3.02, "Permit Requirements for Work in the Public Way."

Existing improvements shall include but are not limited to permanent surfacing, curbs, gutters, sidewalks, planted areas, ditches, driveways, culverts, fences, and walls. All improvements shall be reconstructed to equal or better conditions in all respects than the existing improvements removed.

3.17.010 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:

A. The gravel shall be placed deep enough to provide a minimum of eight (8) inches of material.

B. The gravel shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding gravel, etc., to maintain a safe, uniform surface satisfactory to the City Engineer. Excess material shall be removed from the premises immediately.

C. Material for use on gravel surfaces shall be obtained from sound, tough, durable gravel or rock meeting the following requirements for grading:

	<u>Ideal</u>	<u>Tolerance</u>
Passing 1-inch sieve	100	0
Passing ½-inch sieve	85	± 6
Passing No. 4 sieve	55	± 6
Passing No. 16 sieve	31	± 4
Passing No. 200 sieve	9	± 2

3.17.015 BITUMINOUS SURFACE. Where trenches are excavated through bituminous surfaced roads, driveways, parking areas, etc., the surface shall be restored and maintained as follows:

A. A temporary gravel surface shall be placed and maintained as required in Section 3.17.010 above after the required backfill and compaction of the trench has been accomplished.

B. The gravel shall be placed to such depth as to provide eight (8) inches thickness below the bottom of the asphalt pavement and shall be brought flush with the paved surface.

C. The area over trenches to be resurfaced shall be graded and rolled to provide a subgrade which is firm and unyielding. Density of the subgrade materials shall be ninety-five (95) percent AASHTO T-180 . Mud or other soft or spongy material shall be removed and the void filled with gravel and rolled and tamped thoroughly in layers not exceeding six (6) inches in thickness. The edges of trenches which are broken down during the making of subgrade shall be removed and trimmed neatly before resurfacing.

D. Before any permanent resurfacing is placed, the 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 thirty (30) feet minimum length and no deviations from such lines shall be made except as specifically permitted by the City Engineer.

E. Existing bituminous paving shall be cut back a minimum of six (6) inches beyond the limits of any excavation or cave-in along the trench so that the edges of the new paving will rest on at least six (6) inches of undisturbed soil.

F. As soon as is practical, weather permitting, the bituminous surface shall be restored by standard paving practices to the thickness shown on the Drawings and/or defined in the Proposal, or matching the existing pavement cut during excavation.

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

3.17.020 CONCRETE SURFACES. All concrete curbs, gutters, sidewalks and driveways shall be removed and replaced to the next joint or scoring line beyond the actually damaged or broken sections; or in the event that joints or scoring lines do not exist or are three (3) or more feet from the removed or damaged section, the damaged portions shall be removed and reconstructed to a neat "saw cut" vertical plane face. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements. Where necessary, lamp black or other pigments shall be added to the new concrete to obtain the desired results.

All concrete work shall conform to the requirements of Chapter 3.05 of this title.

3.17.025 PAVEMENT PATCHING. This work shall consist of the patching of various types of pavement cuts, the performance of which shall be in accordance with the requirements outlined hereinafter as shown on the standard Drawing.

All materials shall conform to the requirements specified for material in other sections of these standard Specifications.

Pavement patching shall be scheduled to accommodate the demands of traffic and shall be performed as rapidly as possible to provide maximum safety and convenience to public travel.

Failure on the part of the Contractor at any time to maintain the roadway or structures in a satisfactory condition, will result in the City Engineer immediately notifying the Contractor to comply with the required maintenance provisions. In the event that the Contractor fails to remedy unsatisfactory maintenance within twenty-four (24) hours after receipt of such notice, the City Engineer will immediately proceed with adequate forces and equipment to maintain the project and the entire cost of this maintenance shall be deducted from monies due the Contractor on his contract.

The placing and compaction of the trench backfill, and the preparation and compaction of the subgrade shall be in accordance with the requirements of the various applicable sections of these specifications.

Before the patch is constructed, all pavement cuts shall be trued so that the marginal lines of the patch will form a rectangle with straight edges and vertical faces. The use of a concrete saw will not be required unless provided for in the special provisions.

Proper signs, barricades, lights, and other warning devices, as may be approved by the Engineer, shall be maintained all twenty-four (24) hours of the day until the patch is completed and ready for traffic.

The Contractor shall furnish, place and maintain until final settlement, to the satisfaction of the City Engineer, a two (2) inch thick cold asphalt plant mix patching over trench areas when and where directed by the Engineer. Also, such temporary crushed base and asphalt concrete pavement may be required by the Engineer at any time the roadway is needed for vehicular traffic and permanent pavement cannot be placed. Stockpile of the crushed base and plant mix shall be provided on the site by the Contractor. The Contractor shall remove the temporary base and asphalt, clean the exposed face of the existing concrete and restore the concrete pavement herein specified at the time directed by the Engineer.

Streets which have rigid type pavements resurfaced with asphalt concrete shall be patched as shown on the standard Drawing, or as otherwise specified. The surface of the cement concrete portion of the patch shall be left low enough to accommodate the asphalt portion of the patch. Brush finishing will not be required. Joints shall be placed if directed by the Engineer.

Asphalt concrete or bituminous plant mix shall not be placed until the day after the cement concrete has been placed unless otherwise permitted by the City Engineer. The edges of the existing asphalt pavements and castings shall be painted with hot asphalt cement or asphalt emulsion immediately before placing the asphalt patching material. The asphalt concrete pavement shall then be placed, leveled, and compacted to conform to the adjacent paved surface. Immediately thereafter, all joints between the new and original asphalt pavement shall be painted with hot asphalt or asphalt emulsion and be covered with dry paving sand before the asphalt solidifies.

After the subgrade has been prepared as shown on the standard Drawing, or as directed by the City Engineer, asphalt concrete pavement shall be placed to a thickness of the existing asphalt pavement depth, or to a minimum of two (2) inches, whichever depth is the greater.

All incidental work required to complete the patching of street surfaces as specified, including joints where required, shall be considered as incidental to the patching and the costs thereof shall be included in the items for which payment is provided.

On all public works contracts the Contractor shall perform all work backfilling of excavations made under existing pavements, and the restoration of pavement cuts and patching in accordance with these specifications unless otherwise provided in the special provisions of the proposals.

Chapter 3.18

FENCING SPECIFICATIONS

Sections:

- 3.18.005 General
- 3.18.010 Chain Link Fence Specifications.
- 3.18.015 Wood Fence Specifications.
- 3.18.020 Construction Fence Specifications – Wire Fence.

3.18.005 GENERAL. This chapter shall cover the requirements for temporary construction fencing and permanent fencing along boundaries, property lines or open ditches as may be required by Tremonton City.

3.18.010 CHAIN LINK FENCE SPECIFICATIONS.

A. Material.

1. Fabric to be chain link which has been galvanized after weaving with a minimum of 1.2 oz. per square foot of wire surface. Six (6) foot high of two (2) inch mesh, 11-1/2 gauge.
2. Tension wire for bottom only, No. 7 gauge spring coil.
3. Top Rail. 1-3/8-inch tubular rail.
4. Corner, Gate, or End Posts. Minimum diameter 2-3/8-inch O.D. galvanized pipe at 2.65 lbs. per foot.
5. Line Posts. Minimum diameter of 1-7/8-inch O.D. galvanized pipe at 2.72 lbs. per foot.
6. Braces. For all corner and gate posts -- 1-5/8-inch O.D. galvanized pipe and adjustable 3/8-inch truss rods.

B. Concrete. Shall conform to the provisions of Chapter 3.05 Class C.

C. Construction Methods. The steel posts shall be set true to line and grade in concrete bases.

The distances between posts in any section shall be uniform, but shall not exceed the following spacing:

- Tangent sections and curves down to five hundred (500) foot radius: not more than ten (10) feet;
- Curves five hundred (500) foot radius to two hundred (200) foot radius: not more than eight (8) feet;
- Curves two hundred (200) foot radius to one hundred (100) foot radius: not more than six (6) feet;
- Curves one hundred (100) foot radius: not more than five (5) feet.

A minimum of six (6) inches of concrete shall be provided below the bottom of each post. End posts, pull posts, corner posts, and gate posts shall have a concrete base at least ten (10) inches in diameter. Bases for line posts shall be at least eight (8) inches in diameter.

Pull posts shall be provided at five hundred (500) foot maximum intervals. Changes in line of thirty (30) degrees or more shall be considered as corners.

Fence fabric shall be placed on the roadway side of posts unless otherwise specified. The fabric shall be placed approximately one (1) inch above the ground, and on a straight grade between posts by excavating high points of the ground. Filling depressions will be permitted only upon approval of the City Engineer.

The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and metal bands spaced at one-foot intervals. The fabric shall be cut and each span fastened independently at all pull and corner posts. Fastening to line posts shall be with tie wire, metal bonds, or other approved methods at fourteen (14) inch intervals. The top edge of fabric shall be attached to the top rail at approximately twenty-four (24) inch intervals. The bottom tension wire shall be attached to the fabric with tie wires at twenty-four (24) inch intervals and shall be secured to the end or pull posts with brace bands.

3.18.015 WOOD FENCE SPECIFICATIONS.

A. Materials.

1. Slats. Redwood, cedar, combed spruce, or other wood covering acceptable to the City Engineer or his/her representative.
2. Bottom and Top Rail. Minimum two (2) inch x four (4) inch x eight (8) foot cedar stud.
3. Corner, Gate, End, or Line Posts. Minimum size four (4) inch x four (4) inch cedar wood post.

B. Concrete. All corner, gate, end, or line wood posts shall be set in concrete. All concrete used for post bases shall conform to the provisions of Chapter 3.05.

C. Construction Methods. The cedar posts shall be set true to line and grade in concrete bases at least two (2) feet in depth. All posts shall be sound and free from all decay, splits, multiple cracks, or any other defect which would weaken the posts or otherwise cause them to be structurally unsuitable for the purpose intended.

The maximum distance between posts in any section shall not exceed eight (8) feet. The top and bottom railings shall be securely fastened to the posts with galvanized nails or other acceptable means. Changes in line of thirty (30) degrees or more shall be considered as corners. A minimum of six (6) inches of concrete shall be provided below the bottom of each post. End posts, corner posts, and gate posts shall have a concrete base at least twelve (12) inches in diameter. Bases for line posts shall also be twelve (12) inches in diameter.

Fence slats shall be placed on the roadway side of posts unless otherwise specified. The slats shall be placed approximately one (1) inch above the ground, and on a straight grade between posts by excavating high points of the ground. Filling depressions will be permitted only upon approval of the City Engineer. The slats shall be sound and free from all major decay or defects which would weaken or otherwise cause them to be unsuitable for fence slats. Fastening to top and bottom railings shall be done with two (2) galvanized nails at both the top and bottom rail.

3.18.020 CONSTRUCTION FENCE SPECIFICATIONS -- WIRE FENCE.

A. Material.

1. Fabric to be wire mesh which shall conform to ASTM Designation A-116, nominal 0.9999-inch Farm Grade with standard six (6) inch graduated spacing. The wire mesh shall have a Class 1 zinc coating.
2. Corner, gate, end, or line posts shall be painted metal tee, U or Y channel, angular, or other approved shapes six foot-six inch (6'6") in length.

B. Construction Methods. Metal fence posts shall be spaced a maximum interval of sixteen (16) feet. Post spacing measurements shall be made parallel to the ground slope. All posts shall be placed in a vertical position. Metal posts may be installed by driving, if this can be done without damage to the post. Otherwise, they shall be installed to the specified depth two foot-six inch (2'6") in larger drilled or dug holes and backfilled and compacted.

Corner posts shall be braced in two directions. End and gate posts shall be braced in one direction.

Wire mesh fabric shall be drawn tight enough to eliminate all sag without causing the "tension crimps" to fail to function.

Any high points along the ground surface which interfere with the placing of wire mesh shall be excavated to provide at least two (2) inches of ground clearance.

Every alternate lateral wire in the mesh fabric shall be fastened to each post by means of a clamp.

Chapter 3.19

SECONDARY WATER SYSTEM

3.19.005 SECONDARY WATER SYSTEM.

A. **Pipe Type and Classification requirements.** Reclaimed Water Pipe - PVC (Purple Pigment), Class 150 (DR-18) (C-900), Bell & Spigot (Ring Tight Joint).

B. **Fitting Type and Classification requirement.** Ductile Iron, Class 150, Mechanical Joint, Thrust Restraint Joint Rings or Thrust Blocks at all Tees, Elbows, Plugs, and any other stops or change in directions, or as City Engineer or his representative deems necessary. Resilient Seat Gate Valves, Romac-Nylon Coated-Double Stainless Steel Strap Service Saddles (Romac-202-N).

C. **Service Line Type and Classification requirements.** Polyethylene (PE) 200 psi Copper Tubing Size (CTS) Poly, all Brass Compression Fittings shall be Muller (H-15451-CTS x FMIP or H-15428 CTS x MIP) or Ford (C14 - FMIP x QJCTS or C84 - MIP x QJCTS) fittings, Curb Stops shall be Mueller (Ball Curb Valve B-20283) or Ford (Ball Valve Curb Stop B-11) shall be installed in a twelve (12) inch x eighteen (18) inch Irrigation Control Valve Box in the Park Strip between the Curb and the Sidewalk at each property line.

1. Mainline sizing will be determined by City Engineer or his representative, Main Line bury depth twenty-four (24) inches minimum from finished street surface or finish ground surface to top of secondary main line or as otherwise determined by City Engineer or his/her Representative.

2. Service Line sizing for Residential Lot shall consist of one (1) half (1/2) inch CTS-PE for dual lot connections, branching to one (1) inch for Single Lots or one (1) inch CTS-PE for single lot connections. Service Line bury depth twenty-four (24) inches minimum from finished street surface or finish ground surface to top of secondary service line or as other wise determined by City Engineer or his/her representative or twelve (12) inches minimum from finished ground surface to top of secondary service line if located in the park strip area or as other wise determined by City Engineer or his/her representative.

Chapter 3.20

STORM WATER HYDROLOGY

Sections:

- 3.20.005 Definitions.
- 3.20.010 Rainfall Hydrology.
- 3.20.015 Conveyance.
- 3.20.020 Basins.
- 3.20.025 Discharge.
- 3.20.030 Permits / Practices.

This chapter represents the construction standards for private and public construction as it relates to storm drainage within the City. All efforts have been made for this chapter to conform with the requirements of the Clean Water Act phase II and the Storm Water Management Plan of the City.

The following information is organized in such a way to follow the natural flow of storm water, from the initial rainfall hydrology (section 3.20.010), to conveying the rain water (section 3.20.015) to a basin (section 3.20.020), then discharging to a natural outlet location (section 3.20.025). Definitions (section 3.20.005) and Permits and Practices (section 3.20.030) are also discussed.

3.20.005 DEFINITIONS

Detention Basin. A depression designed to detain or slow down storm water runoff until downstream storm sewer resources are less heavily taxed. A detention basin contains an inlet and an outlet, allows debris to settle out, and regulates water flow.

Development. Any man-made change to improved or unimproved real estate, including but not limited to site preparation, filling, grading, paving, excavation, and construction of buildings or other structures.

Disturb. To alter the physical condition, natural terrain or vegetation of land by clearing, grubbing, grading, excavating, filling, building or other construction activity.

Drain Inlet. A point of entry into a sump, detention basin, or storm drain system.

Drinking Water Source Protection Zone. Zones determined by Geo-Hydrology designed to protect groundwater aquifers of a well in a Culinary Water System.

Percolation. The ability of a soil to absorb water. Typically measured by a Standard Percolation Test in units of minute per inch.

Retention Basin. A depression or cavity designed to retain or hold back all storm water runoff from flowing downstream. A retention basin contains an inlet with no outlet other than percolation or evaporation. A retention basin allows debris to settle out.

Storm Drain System. The system of conveyances (including sidewalks, roads with drainage systems, streets, catch basins, detention basins, curbs, gutters, ditches, man-made channels, sumps, storm drains, and ground water) owned and operated publically or privately, which is designed and used for collecting or conveying storm water.

3.20.010 RAINFALL HYDROLOGY

All storm drain systems shall be designed to carry the one hundred (100) year storm.

1. **STORM SPECIFICATION:** Local storm drain piping shall be designed for the ten (10) year storm where the road or other above ground conveyance will carry the difference to the one hundred (100) year storm. Local Storm Detention Basins shall be designed for the one hundred (100) year storm. Regional Storm Detention Basins shall also be designed for the one hundred (100) year storm. The intensity used for the sizing of basins shall be based upon the worst case scenario and not the time of concentration.

2. INTENSITY-DURATION-FREQUENCY (IDF): For the use of the Rational Method, an IDF curve shall be obtained from the City Engineer for the project location.

For single site plans and small subdivisions (forty (40) acres max.) the rational equation may be used. For larger sites a City Engineer-approved computer model shall be used.

3. RAINFALL PATTERN: For the use of computer models one of the following rainfall patterns shall be used.

a. Farmer-Fletcher Storm - This pattern is based upon the Farmer-Fletcher Distribution. This pattern is for a one (1) inch storm and must be modified for storms of other magnitudes. The rainfall is expressed in inches of rainfall for the given time unit. The Farmer Fletcher distribution can be adjusted for storms from thirty (30) minutes to six (6) hours based on the time unit chosen. The storm duration must be chosen on a worst case scenario.

<u>time</u>	<u>inches</u>	<u>time</u>	<u>inches</u>	<u>time</u>	<u>inches</u>	<u>time</u>	<u>inches</u>	<u>time</u>	<u>inches</u>	<u>time</u>	<u>inches</u>
1	0.000	11	0.004	21	0.033	31	0.052	41	0.012	51	0.005
2	0.000	12	0.005	22	0.034	32	0.045	42	0.011	52	0.005
3	0.002	13	0.008	23	0.035	33	0.040	43	0.010	53	0.004
4	0.002	14	0.009	24	0.038	34	0.035	44	0.009	54	0.004
5	0.002	15	0.009	25	0.039	35	0.030	45	0.009	55	0.004
6	0.002	16	0.013	26	0.045	36	0.022	46	0.008	56	0.003
7	0.002	17	0.017	27	0.052	37	0.020	47	0.006	57	0.003
8	0.002	18	0.020	28	0.054	38	0.018	48	0.006	58	0.002
9	0.003	19	0.024	29	0.054	39	0.016	49	0.005	59	0.002
10	0.003	20	0.029	30	0.054	40	0.014	50	0.005	60	0.001

b. SCS - Type II storm

4. RAINFALL TOTAL: For the use of the above rainfall pattern, a rainfall total from the NOAA Atlas for the site must be obtained. This total shall be based upon the storm duration that produces the highest flow or basin size.

5. TIME OF CONCENTRATION CALCULATION: The time of concentration must be calculated using one or a combination of the following: (1) TR-55 equations for overland flow, (2) FHWA equations for overland flow, (3) Manning's equation for open channel flow, or (4) Hazen-Williams equation for open channel flow.

The sheet flow distance may not exceed one hundred (100) feet. After one hundred (100) feet, sheet flow is to be considered shallow concentrated flow or open channel flow depending on the topography.

3.20.015 CONVEYANCE

The City requires that storm waters not be carried in irrigation ditches, nor that irrigation water be conveyed in storm drain systems.

Local pipes shall be sized for the ten (10) year storm where above ground facilities can control the difference to the one hundred (100) year storm.

1. **PIPING:** Storm drain lines shall be concrete pipe (NRCP or RCP) or corrugated high density polyethylene pipe, of appropriate class. Subsurface drains shall be PVC or reinforced concrete pipe or PVC pipe. Minimum size for storm sewer mains shall be fifteen (15) inch diameter, eight (8) inch for land drain mains and 4-inch for land drain laterals. Pipe specifications are included in the Public Works Standards. Where determined by the City Engineer, larger drain lines shall be installed to accommodate future development. The cost to provide adequate storm drainage to a development shall be paid for by the Developer

2. **ACCESS:** Drain lines shall have clean-out boxes, inlets or manholes installed at all changes in grade or alignment, with a maximum distance of four hundred (400) feet between accesses. Structures shall be installed in accordance with the standard drawings.

Requirement: As Groundwater is involved with the Waters of the State, they are not the responsibility of the City's. The City may or may not choose to address them.

3. **GROUND WATER:** Where adverse groundwater conditions exist, the City may choose to allow the installation of a subsurface land drain. Laterals may be installed to each lot for clear groundwater only (no surface water permitted). Subsurface lines shall be installed with a slope adequate for proper drainage. Some type of backflow control may be required at the confluence of the land drain pipe and storm drain system as determined by the City Engineer.

3.20.020 BASINS

Requirement: The City requires storm drainage basins for all developments (site plans or subdivisions). Exception may be allowed where there is sufficient downstream storm drain capacity or where additional local storm drainage control is not needed as determined by the City Engineer.

1. **LOCATIONS:** Sites less than one (1) acre are generally not required to have detention unless otherwise determined by the City Engineer for reasons stated herein. Storm water detention design is critical for developments that are in close proximity to a Stream or River or within Drinking Water Source Protection Zones one or two as defined by the State Division of Drinking Water Rules. All detention basin designs and calculations shall be reviewed and approved by the City Engineer.

2. OWNERSHIP:

a. **Private Basins:** Where the development will have a Home Owners Association or in commercial applications, local detention basins shall be owned and maintained by the owner, or owning association.

b. **Local Public:** In subdivisions, local detention basin shall be constructed by the developer. Following acceptance of the construction, the ownership, operation and maintenance may either be conveyed and maintained by the City.

c. **Regional Detention Basins:** Regional basins shall be owned and maintained by the City and constructed according to the criteria given herein and approved of the City Engineer. Actual ownership and responsibility shall be specifically defined in the Owners Dedication Certificates or Development Agreements or by Deed.

3. PERCOLATION: No reduction due to percolation for detention basins volumes shall be permitted in design, due to the nature of basins silting in over time and also possible frost conditions during a storm.

4. BASIN CONSTRUCTION: Basins must be construction to enhance safety, health and aesthetics of the area.

a. Engineering: Basins, whether detention or retention, must be designed and stamped by a Licensed Civil Engineer.

b. Location: Detention basins shall be located with convenient access for maintenance and repair by maintenance personnel. This means that the basin property has frontage along a public roadway and easements where necessary. Volume in ditches or roadside swales shall not be considered in the volume calculation.

c. Depth: If unfenced and open to general public, the maximum depth of water should not exceed three (3) feet for detention basins and two and a half (2.5) feet for retention basins. Basins greater than three (3) feet in depth may be allowed, but only by special permission from the Land Use Authority.

d. Side slopes: Side slopes should not exceed 3:1 (horizontal to vertical) (4.5:1 is desirable) for ease of mowing and access.

e. Bottom Slope: The basin floor shall be designed so as to prevent the permanent ponding of water. The slope of the floor of the basin shall not be less than one (1) percent to provide drainage of water to the outlet grate and prevent prolonged wet, soggy or unstable soil conditions.

f. Freeboard: There should be at least one foot of freeboard (berm above the high water mark).

g. Spillways: Spillways must be considered and a path with a maintained swale and drainage easement to a safe location. Attention should be given to the design of the spillway to avoid erosion. Overflow spillways are intended to introduce flows back into the main pipe and are typically downstream of the outlet control. Emergency Spillways are intended to carry flows beyond the capacity of the overflow spillway to a safe downstream location. All spillways shall be designed to protect adjacent embankments, nearby structures and surrounding properties.

h. Outlet Control: Small, local, private detention basins may be allowed to have calculated fixed orifice plates mounted on the outlet of the basin. Large, regional, public detention basins shall have movable screw-type head gates (Waterman C-10 O.A.E.) set at a calculated opening height for the discharge and with a chain to fix the position.

i. Grates: All grates on inlets and outlets must be hot dipped galvanized (not painted) with bars at spacing to prohibit feet from falling in and yet avoid clogging with debris. Generally bar spacing should never exceed 3" spacing.

j. Low Flow Piping: The inlet and outlet structures may be located in different areas of the basin, requiring a buried pipe to convey any base flows that enter and exit the basin. (Rather than a cross gutter.) The minimum pipe size and material for the low flow shall be as approved by the City Engineer.

k. Ground Covers: The surface area of the basin may either be seeded, sodded, or covered with cobbles, as specified by the City. If seeded, measures shall be taken to eliminate erosion until grasses are established. A minimum of four (4) inches of top soil must be installed prior to sod or seed placement. Cobble sizes shall be eight (8) inches or greater in size overlying a city-approved weed barrier. A sprinkler irrigation system may be required for all grassed basins.

l. Embankment (Fill) Construction: If a raised embankment is constructed for a basin (constructed with granular materials), it shall be provided with a minimum of six (6) inches of clay cover on the inside of the berm to prevent water passage through the soil.

m. Excavation (Cut) Construction: If the basin is constructed primarily by excavation, then it may be necessary to provide an impermeable liner and land drain system when constructed in the proximity of basements or other below grade structures as determined by a Geotechnical evaluation.

n. Multi-Use Basins: Basins may be designed as multi-use facilities when appropriate precautions are incorporated into the design. If Parks & Recreation amenities are to be constructed within the water detention area of a basin they shall be designed appropriately. Structures shall be designed for saturated soil conditions and bearing capacities are to be reduced accordingly. Restrooms shall not be located in areas of inundation. Inlet and outlet structures should be located as far as possible from all facilities. No wood chips or floatable objects may be used in the area that will be inundated.

o. Fencing: Fencing will be required for any basin over three (3) feet in depth. If a fence is required, six foot chain link fencing is desired and in accordance with these Public Works Standards and conform to City Zoning Requirements.

5. DETENTION VOLUME: Detention basins shall be sized based upon the criteria set forth in Section 3.20.20. Detention Basins are designed to allow a pre-determined amount of flow to discharge during and after a storm event as discussed above. Detention Basins are preferred over Retention Basins or Groundwater Injection.

6. RETENTION BASINS: The City does not permit Retention basins for developments unless certain criteria is met. Regional Retention basins shall not be permitted by the City.

a. Retention Basin Criteria: Retention Basins (basins which hold all water coming to them) shall not be permitted for developments unless the following conditions are all met:

1. The Basin is greater than five-hundred (500) feet or fifty (50) feet times the number of lots in the entire development (whichever is greater) from the City Storm Drain System or water way, and is topographically capable of draining to the City System;

2. The Basin is not located within a Hazardous Area (such as a steep slope) or some other fragile area (such as a Drinking Water Source Protection Zone); and

3. The Basin is temporary in nature, meaning that a master planned storm drain pipe is eminent and a funding vehicle, (Special Improvement District (SID), Impact Fees, or Pioneering Agreement) is in place.

b. Retention Basin Design Volume: If permitted, local storm retention basins shall be designed for 1.73 inches of total rainfall (the one hundred (100) year- three (3) hour storm as determined by the NOAA Atlas 14). The infiltration vs runoff quantity shall be determined using a weighted C-value as determined using the rational method.

c. Percolation Rate for Retention Basins: Due to the silting in potential, no percolation rate may be used in the calculation of volume.

d. Retention basins shall not be permitted within a zone 3 of any Drinking Water Source Protection Zone of any drinking water source.

7. **STANDING WATER:** Standing water is to be eliminated wherever possible as an effort to minimize a mosquito problem and associated viruses. Low flow bypass pipes may be required.

8. **GROUND SURFACE IMPROVEMENTS:** The finished surface of the basin shall be improved to eliminate erosion and dust and to enhance the aesthetics of the area. The Planning Commission will determine the finishing requirements on a case by case basis for new detention/retention ponds.

a. **Cobble Rock:** Cobble rock may be permitted and no other alternative purpose is proposed for the land. The cobble size shall be sufficient (eight (8) inch minimum) to eliminate erosion. Permeable weed barrier fabric shall be placed under the rock. Fencing may be required around cobble rock basins.

b. **Grass, Sod, Top Soil and Hydro seeding:** All grass or hydro-seeding on all basins shall be installed in accordance with the Public Works Standards. The basin shall be provided with an automated sprinkler irrigation system previously approved by the City Engineer. Drought tolerant grass may be used in lieu of Public Works Standard upon approval.

3.20.025 DISCHARGE.

Storm water is to be controlled at the source and minimize the potential for flooding downstream.

Storm Drainage leaving a site or subdivision shall not exceed, as much as practicable, the pre-developed quantities and qualities at a maximum rate.

1. **Allowable Discharge:** The allowable discharge from any non-regional basin shall not exceed the pre-hard surfacing discharge for the entire site for the ten (10) year storm event. This discharge shall not exceed ***0.1 cubic feet per second per total acreage (0.05 cfs in the area north of 1000 North and west of I-15)*** within the development draining to the basin. Controlled discharge may be established through an orifice or adjustable gate as approved by the City Engineer.

2. **Flow Concentration:** By nature of development, flows are concentrated to one or more locations where historically, sheet flow in lower concentrations may have left the site. Attempts shall be made to minimize the runoff concentrated quantity to the flows stated above by use of detention basins, down stream piping to safe areas or other methods as deemed necessary by the City Engineer.

3. **Discharge to Irrigation Ditches:** No discharge shall be permitted to irrigation ditches and canals unless express written permission is obtained from the responsible ditch company or ditch owners.

4. **Sump Drains (Underground Injection Wells):** Sump drains are strongly discouraged. Any sump drain used must specifically approved by the City Engineer. Sump Drains shall not be permitted within a zone 3 of any Drinking Water Source Protection Zone. Sumps within a zone 4 must be specially designed to eliminate contaminates and silt to the groundwater including oil separators.

5. **Basin Overflows:** Attention shall be given to overflow locations and pathways to safe locations downstream as discussed above. In all new construction, easements shall be obtained and pipes or swales sized to handle the one hundred (100) year flow.

3.20.030 PERMITS / PRACTICES.

Designs shall comply with all State and Federal requirements, this is to include applications, permits, plans and implementation.

1. PERMITS: The State requires a Storm Water Activity Permit for all sites greater than 1.0 Acres.

a. **Utah Pollution Discharge Elimination System (UPDES) Permit.** This permit is filed with the Utah Division of Water Quality, Department of Environmental Quality. The permit can be obtained from the internet at: <http://waterquality.utah.gov/updes/stormwater.htm>

Then click on “Online Application Process Notice of Intent”. All sites with a total plan to effect greater than 1.0 acre must apply (this area includes staging and stock piling). The appropriate fee must be paid to the state.

A Storm Water Pollution Prevention Plan (SWP3, or Erosion Control Plan or Pollution Prevention Plan) must be prepared and on site for this application. As a minimum, The BMPs discussed herein must be addressed.

b. **Stream Alteration Permit.** A Stream Alteration Permit is filed with the State Department of Natural Resources, Division of Water Rights. This permit overlaps the 404 wetlands permit, discussed below, because it is applicable to the area equal to the stream plus two times the bank full width (up to 30 feet). Any modifications to the stream or banks within this area must comply with the Stream Alteration Permit. Permit information may be obtained online at: <http://nrwrt1.nr.state.ut.us/strmalt/default.asp>

c. **EPA 404 Wetlands Permit** this permit is filed with the US Army Corp of Engineers through the Utah Division of Water Rights using the Joint Permit Application Form referenced in Section 6.1.3. It is applicable for all wetlands within a development. This will apply to all wetlands depending upon the presence of water, soils type and vegetation as determined in a Wetlands Delineation Report.

All “waters of the US” are effected to the normal high water mark. No fee is typically required for this permit. A letter of non-regulated wetlands may also be applicable. Any mitigation that may be required must be done prior to recording a Final Plat. Permit information may be obtained at: <http://nrwrt1.nr.state.ut.us/strmalt/default.asp>.

3.20.035 STORM DRAINAGE - RETENTION. All commercial, institutional, or industrial development, construction, reconstruction, alteration, or expansion which generates any storm drainage, or any multiple-family housing development containing four (4) or more units shall be required to retain all storm water drainage on its own property, or if able to connect to a public storm drain system providing engineering analysis and approval by the city engineer.

REV 05-97.1
REV 05-03.0
REV 03-07.0
(Am 05-18-10)
REV 06-10-1

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