BRIGHAM CITY CORPORATION

PUBLIC WORKS STANDARDS

3rd Edition

Revised: JULY 2005

BRIGHAM CITY, UTAH CORPORATE SEAL

JONES & ASSOCIATES
CONSULTING ENGINEERS

PUBLIC WORKS STANDARDS

AND

TECHNICAL SPECIFICATIONS

for

Brigham City, Utah

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TECHNICAL SPECIFICATIONS

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SECTION 1

GENERAL PUBLIC WORKS AND SUBDIVISION REQUIREMENTS

1.1 SCOPE: This section 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. All public utility systems must be accessible for maintenance and equipment. Design must provide for future extension to adjacent development and to 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.

1.2 CONSTRUCTION DRAWINGS: Complete and detailed construction plans and drawings of improvements shall be submitted to the City Engineering Department for the review by the City Engineer 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.

1.3 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 drawn with ink on approved mylar sheets. Size of drawings shall be 24" x 36" with ½ inch border on top, bottom and right sides, left side 1-1/2 inches.

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

(1) North arrow (plan).
(2) Scale and elevations referenced to an approved datum.
(3) Stationing and elevations for profiles.
(4) Title block, located in lower right corner of sheet 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 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 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" = 2', 1" = 5', or 1" = 10' vertical (may be shown on street drawings).
(2) Location, size and Slope of mains.
(3) Manhole size, location and flow line elevation.
(4) Type of pipe.
(5) 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) Type of pipe.

E. Irrigation Water Facility 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 irrigation pipe.
(3) Clean out and control box locations.
(4) Type of pipe.
(5) B.M. location and elevation (use approved datum) shall be noted.

F. 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 Brigham City Standards.

G. Separate drawings of elements of the Brigham City Standards shall <u>not</u> be required to be redrawn and submitted with the construction drawings <u>unless</u> specific deviations from the standards are requested for approval, however, the construction drawings <u>shall</u> refer to the specific items of the Standards that are to be incorporated into the work.

The mylar plan and profile construction plans shall be submitted in duplicate (minimum) with one set retained by the City and one set returned to the Subdivider, Developer, Contractor or Project Manager. This approved set shall bear the signature of the City Engineer and shall be kept available at the

construction site. 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 "as constructed" drawings for permanent city file record.

1.4 PRECONSTRUCTION CONFERENCE: The preconstruction conference shall not be held until the City Engineer has approved and signed the construction plans. A preconstruction conference shall be held before any excavation or other work is begun in the subdivision or Project. The meeting will be held in the City Municipal Building and will include: (a) City Engineer; (b) Developer or Project Manager; © Subdivision or Project Engineer; (d) all Contractors and Subcontractors involved with installing the subdivision or project improvements; (e) representatives of affected Brigham City Departments; (f) representatives of local utility companies as may be required by Brigham City. Items pertaining to the construction and inspection of the subdivision or Project improvements will be discussed.

1.5 INSPECTION: All construction work involving the installation of improvements in the subdivision or project shall be subject to inspection by the City. It shall be the responsibility of the person responsible for construction to insure 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, irrigation 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 City Engineer.

1.6 REQUESTS FOR INSPECTION: Requests for inspections shall be made to the City by the person responsible for the construction. Requests for inspection on work requiring continuous inspection shall be made three (3) working days prior to the commencing of the work. Notice shall also be given one day in advance of the starting of work requiring periodic inspection, unless specific approval is given otherwise by the City Engineer, or his duly authorized representatives.

1.7 CONSTRUCTION COMPLETION INSPECTION: An inspection shall be made by the City Engineer or authorized representative after all construction work is completed. Any faulty or defective work shall be corrected by the persons responsible for the work within a period of thirty (30) days of the date of the City Engineer's or authorized representative's Inspection Report defining the faulty or

defective work.

1.8 CONSTRUCTION TESTING: All in-place density testing shall be performed and paid for by the Subdivider, Developer, Contractor or Project Manager. 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.

1.9 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".

1.10 DRAWINGS: All references within these specifications to "The Drawings" shall mean the City approved construction drawings or the Brigham City Public Works Standards and Technical Specifications as is applicable.

SECTION 2

PERMIT REQUIREMENTS FOR WORK IN THE PUBLIC WAY

2.1 PURPOSE OF INTENT: The purpose of this section is to describe Brigham City's Department of Public Work's policies for issuing permits and to control any excavation and construction operations in the public way in Brigham City. All contractors and utility companies proposing to construct, repair or replace any facility within the public way, shall contact the Brigham City Department of Public Works and complete all permit requirements prior to commencing proposed work as outlined in this section.

Work by utility companies and contractors in constructing facilities in new subdivision streets shall be required to obtain a "No Fee Public Way Permit" and will be subject to City inspection and compliance with subdivision requirements. Excavations for driveway approaches that are subsequent to the initial construction of the curb and gutter shall be subject to the normal process and fee.

2.2 POLICIES:

A. Permittee must be licensed with the State of Utah: It is the policy of Brigham City that contractors desiring to perform work in the City's public way shall be properly licensed in the State of Utah. The acceptable licenses include.

	TYPE OF WORK	LICENSE			
1.	Any type of concrete work	E100	B100	R100	S260
2.	Paving		E100	S400	
3.	Landscaping	E100	S330		
4.	Buried gas, telephone, water, irrigation and power lines	E100	S390	S410	
5.	Sanitary sewer and storm drains	E100	S210	S216	S390
6.	Asphalt Patching	E100	S400		
7.	Trenching	E100	S310		
8.	Highway Sign Installation	E100	S440		
9.	Manhole Covers	E100	S210	S390	S410
10.	Paint Striping Highways		E100	S300	

Exceptions: A license shall not be required by the City when the permittee is:

(1) A public utility company

B. Policy for determining when "permit waivers" can be granted: Working within the public way without a permit violates Title 24.03 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 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. Policy for 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.

(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 roadbase material.

D. Policy for 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 shall serve written notice which defines the problems encountered and the time (at least one 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. Policy for completion of work by City, Liability for costs: If the work is unduly delayed by the permittee, or if the public interests so demand, the Public Works Department shall have authority to complete the permit work. The Public Works Department shall do the work only after written notice 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 fifteen percent (15%) overhead charge shall be paid by the permittee.

F. Policy for 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. The length of the extension determined by the permittee shall be subject to the approval of the Public Works Department.

2.3 GENERAL CONDITIONS:

A. Utility drawing requirements: Whenever the work involves the extension, placement or the relocation of a utility facility, two (2) copies of the drawings shall be provided for the Public Works Department which detail 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 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 will be notified within one (1) hour of the start of work on the first regular business day of 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 the 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 with the following provisions: Within five working days from the completion of the excavation the permittee provides/maintains a 11/2" thick temporary winter asphalt surface until such time as the permanent asphalt surface is installed; the permittee shall provide/maintain a temporary untreated base course surface until such time as the temporary winter asphalt surface is installed. For a fee of $2.00 per sq. ft. the permittee may request in writing on said permit for City crews to install temporary winter asphalt surfacing. These provisions apply 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, television lines, water lines, gas lines, poles or other appurtenances during the course of construction of this project. Any such conflict, contact or damage shall be immediately communicated to said utility company and Public Works Department.

G. Preconstruction pictures of existing public way improvements: The permittee may secure pictures of the conditions 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 pictures are taken, the Public Works Department will assume the correction of the damage is the responsibility of the permittee.

H. Construction and Excavation Testing: All in-place density testing shall be performed and paid for by the City. Any test that fails minimum density requirements shall be retested at the expense of the subdivider, developer, contractor or project manager. All proctors shall be provided and paid for by the City.

2.5 EXCAVATION OPERATIONS:

A. Blue stakes: Before commencing excavation operations, the permittee shall call "Blue Stakes" at 1-800-662-4111.

B. Traffic control devices: Traffic control devices such as construction signs, 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 one block at a time.

2.6 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 City Engineer reserves the right to shut down the work or issue a citation if dust is not controlled.

B. Noise: The permittee or contractor shall keep neighborhood free of noise nuisance in accordance with the Noise Ordinance.

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.

2.7 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 one year (1 year) following completion of said work, or in the event of repairs thereto, one year (1 year) 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 hours (48 hrs.) after notice, the Public Works Department is hereby authorized to make such repairs and charge all costs including fifteen percent (15%) 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 shall indemnify and hold the City harmless from the 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 limits of $100,000.00 for injury to or death of one person, and $300,000.00 for one accident; and Property Damage Liability Insurance with limits of $100,000.00 for each accident and $100,000.00 aggregate.

2.8 ENFORCEMENT: Violators of these regulations of working within the Public Way shall be subject to the provisions of Section 1-9 and Section 24-38 of the Brigham City Ordinance.

SECTION 3

EARTHWORK

3.1 GENERAL: This section defines the requirements for excavation and backfill for structures, construction requirements for embankments and fills, and subgrade preparation for pavements and other surface improvements.

3.2 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-180 in lifts not to exceed 10".

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-180. Coarse gravel or crushed stone may be used for subsoils reinforcement if satisfactory results can be obtained thereby. Such material shall be applied in thin layers not to exceed 4", 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.

3.3 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 the 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-180.

3.4 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.

3.5 COMPACTING EARTH MATERIALS: The material shall be deposited in horizontal layers having a thickness of not more than 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.

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 one foot 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 90% of maximum dry density as measured by AASHTO T-180.

3.6 ROAD SUBGRADE PREPARATION: In both cut and fill areas the paving subgrade shall be scarified to a depth of eight inches and compacted to the equivalent of 95% of maximum dry density as measured by AASHTO T-180. No rocks larger than four inches in diameter, organic material, soft clay, spongy material, or other deleterious material will be permitted in this scarified subgrade layer. Rough subgrades 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 inches.

Under mining of asphalt should be removed for proper compaction and saw cut square before patching.

SECTION 4

BITUMINOUS PAVING

4.1 GENERAL: This section 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.

A. 8-inch minimum compacted thickness of untreated base course gravel over prepared subgrade. When subgrade soils have a C.B.R. less than 10, additional gravel base shall be required as dictated by a pavement design approved by the City Engineer.

B. 3-inch minimum compacted thickness of plant mix bituminous surface course.

C. UDOT Type A Bituminous Seal Coat or Slag Type A Chip and Seal as directed by the City Engineer

These pavement thicknesses shall be considered as City Standards and necessary to provide sufficient stability. The designer and/or developer may submit an alternative pavement design based on a detailed soils analysis for approval by the City Engineer which may modify pavement thicknesses, but in no case shall the bituminous surface course be less than 3" thick and the untreated base course less than 4" thick.

4.2 UNTREATED BASE COURSE: Untreated 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

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

3/4 Inch Gradation

3/4 Inch	100	0
3/8 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 unaccessible to rolling shall be compacted with mechanically operated hand tampers.

The gravel base course shall be compacted to not less than 95% maximum dry density as determined by AASHTO T-180. 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.

4.3 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:

Sieve Size	Ideal Gradation (Percent Passing)	Ideal Gradation
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 3% voids in the aggregate.

The bituminous material for the surface course shall be AC-10 asphalt cement conforming to the requirements of AASHTO M-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 period of 24 hours.

4.4 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.

4.5 SPREADING AND COMPACTION: the bituminous mixtures shall be spread with self-propelled, mechanical spreading and conditioning equipment capable of distributing at least a 12-foot width. The mixture shall be spread and struck off in such a manner that the finished surface shall result in a uniform, smooth surface. The longitudinal joints in succeeding courses shall be offset at least six inches transversely to avoid a vertical joint through more than one course. Compacted surface course lifts shall be limited to a maximum of 3". Prior to placement of bituminous material, all exposed vertical facings on curb and existing pavement shall receive a thorough 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 95% 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 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.

4.6 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. The air temperature shall be measured in the shade.

4.7 BITUMINOUS SEAL COAT: Following installation of surface course, all completed asphalt areas shall receive a bituminous seal coat preferably a minimum of 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.

Sieve Size	Percentage Passing Sieves		
	UDOT Type A	UDOT Type B	UDOT Type C
½ inch	100	--	100
3/8 inch	85-100	--	70-90
No. 4	0-20	100	0-5
No. 8	0-5	85-100	0-3
No. 16	--	10-25	--
No. 50	--	0-5	--
No. 200	0-1	0-2	0-2

Acceptance of cover material with respect to gradation shall be based on the average gradation of five 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 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 and when they are not outside the band by more than two 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 80 percent by weight, of particles with at least one clean mechanically fractured face, when tested in accordance with UDOT Department Test Procedure 8-929.

C. The aggregate shall have a percentage of wear not exceeding 30 when tested in accordance with AASHTO Designation T-96.

D. The crushed mineral aggregate shall have a weighted percent of loss not exceeding 10 percent by weight when subjected to five cycles of sodium sulfate and tested in accordance with AASHTO Designation 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 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 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.

4.8 SEAL COAT PREPARATION: 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 days after such surfaces are laid and preferably a minimum of 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.

4.9 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 0.40 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 50 and 100 centistokes as determined in accordance with ASTM Designation D-2170. The exact temperature range shall be designated by the City Engineer.

4.10 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, shall be 22 pounds per square yard, or as directed 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 with a minimum12 ton pneumatic-tired rollers. Rolling performed with pneumatic-tire rollers shall adequately seat the cover material and shall consist of at least two complete coverages. 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.

4.11 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 Engineer, and then only when the air temperature in the shade and the roadbed temperature are above 70˚ F.

4.12 BITUMINOUS PLANT MIX SEAL COAT: Where determined by the City Engineer that the bituminous surface coarse 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:

Sieve Size	% Passing	
	Type A	Type B
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 3% voids in the mix.

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

4.13 SLURRY SEAL COAT

4.13.01 GENERAL: The slurry seal coat shall consist of a mixture of emulsified asphalt, mineral aggregate and water. The slurry mixture of proper proportions shall be evenly spread on the surface as specified by the contract or as directed by the City Engineer. The slurry shall be such that a rapid setting, homogeneous surface treatment can be applied to the existing bituminous pavement surface and not involve an extended inconvenience to the general public. The mixture shall adhere firmly to the

existing pavement, fill cracks and provide a skid resistant wearing surface.

4.13.02 APPLICABLE SPECIFICATIONS: The following specifications and methods are a part of this specification:

Aggregate and Mineral Filler / Emulsified Asphalt

AASHTO T2	Sampling stone, slag, gravel sand and stone block for use in highway materials.
AASHTO T27	Sieve analysis of fine or course aggregate.
AASHTO T11	Amount of material finer than No. 200 sieve in aggregate.
AASHTO T84	Specific gravity and absorption of fine aggregate.
AASHTO T19	Unit Weight of aggregate.
AASHTO T96	Abrasion of coarse aggregate.
AASHTO T37	Sieve analysis of mineral filler.
AASHTO T40	Sampling of bituminous materials.
AASHTO T59	Testing emulsified asphalt.
AASHTO T140	Specifications for anionic emulsified asphalt.
AASHTO T208	Specification for cationic emulsified asphalt.
AASHTO T164	Mixture by centrifuge.
AASHTO T30	Mechanical analysis of extracted aggregate.
AASHTO T176	Plastic fines in graded aggregates and soils by use of the sand equivalent test
AASHTO T104	Soundness of aggregate by use of sodium sulfate or magnesium sulfate.

4.13.03 MATERIALS:

a. Asphalt Emulsions:

The emulsion shall conform to the requirements of ASTM or ISSA specification for type SS1h, CSS1h, CQS-1h or QUICK SETTING, MIXING GRADE EMULSION.

b. Aggregate:

The mineral aggregate shall consist of natural or manufactured sand, slag, crusher fines and others or a combination thereof. Smother-textured sand of less than 1.25 percent water absorption shall not exceed 50 percent of the total combined aggregate. The aggregate shall be clean and free from vegetation and other deleterious matter. When tested by AASHTO T176, the aggregate blend shall have a sand equivalent of not less than 45. When tested according to AASHTO T104 or T88, the aggregate shall show a loss of not more than 15 percent.

Mineral fillers such as Portland Cement, limestone dust, fly ash and others shall be considered as part of the blended aggregate and shall be used in minimum required amounts. They shall only be used if needed to improve the workability of the mix or gradation of the aggregate.

The combined mineral aggregate shall conform to one of the following gradations when tested by the previous mentioned test:

Sieve Size	**Type I** Percent Passing	**Type II** Percent Passing	**Type III** Percent Passing
½	100	100	100
3/8	100	100	100
#4	90-100	90-100	70-90
#8	90-100	65-90	45-70
#16	65-90	45-70	28-50
#30	40-60	30-50	19-34
#50	25-42	18-30	12-25
#100	15-30	10-21	7-18
#200	10-20	5-15	5-15

c. Water:

All water used with slurry seal mixtures shall be portable and free from harmful soluble salts.

4.13.04 APPLICATIONS:

a. Type I:

The aggregate blend is used to seal cracks, fill slight voids and correct minimal surface conditions. An approximate application rate of 6 to 10 pound per square yard, based on dry aggregate, is used when standard aggregates are utilized. The fineness of this design provides it with maximum crack penetration properties.

b. Type II:

This aggregate blend is used to fill surface voids, correct moderate surface conditions and provide sealing an minimum wearing surface. An approximate application rate of 10 to 15 pounds per square yard based on dry aggregate weight is used when standard aggregates are utilized. The use of Type II slurry material shall be used on pavements with medium textured surfaces which would require this size aggregate to fill in the cracks and provide a minimum wearing surface. This material could also be used on flexible base, stabilized base or soil cement as a sealer prior to final paving.

c. Type III:

The aggregate blend is used to correct severe surface conditions and to fill surface voids and to provide a moderate wearing surface. An approximate application rate of 15-20 pounds per square yard based on dry aggregate weight is used when standard aggregates are utilized.

4.13.05 TESTING:

Sources of all materials shall be selected and representative samples tested prior to their use in the work. All samples shall be gathered and tested according to procedures outlined by AASHTO specifications and as directed by the Engineer. All material test reports shall be provided to the Engineer for approval before commencement of the work. The cost of material testing shall be borne by the owner. Should any material testing indicate defective materials, the contractor shall resubmit new samples for testing prior to application. These new materials shall be retested in accordance with the related AASHTO specifications. The cost of retesting rejected or defective materials shall be borne by the contractor.

Recertification of the materials will be required in the following circumstances:

a. A change of material sources or suppliers.
b. A change in the Type of slurry used.
c. If problems occur on the project regarding material quality.
d. At the request of the Engineer.

4.13.06 CONSTRUCTION:

a. Stockpiling of Aggregates:

The aggregate stockpile shall be protected against contamination with oversized rock, clay, silt or excessive amounts of moisture. The stockpiles shall be located in areas with adequate drainage to avoid damage to the materials by moisture. Storage and loading techniques should

be such that segregation of materials is minimized.

b. Emulsion Storage:

The contractor shall provide suitable facilities for the asphalt emulsion. The container shall be a cylindrical shaped, vertical standing tank which will prevent water from contaminating the emulsions. The tank shall be equipped to provide suitable heat and mixing to maintain the stability of the materials.

c. Equipment:

All equipment, tools and machines used to perform the work shall be maintained in satisfactory working order at all times.

1. Slurry Mixing:

The Slurry mixing machine shall be a continuous flow mixing unit capable of distributing an accurate, predetermined proportion of aggregate, water and asphalt emulsion to the mixing chamber and discharging a thoroughly mixed product on a continuous basis. The mixing unit shall be capable of blending all slurry ingredients together without violent mixing. The mixer shall be equipped with a calibrated feeder used to provide an accurate metering and delivery of mineral filler into the mixer in conjunction with the aggregate feed.

2. Slurry Spreading Equipment:

Attached to the mixing machine shall be a mechanical type squeegee distributor equipped with a flexible material contact with the surface to prevent loss of slurry from the distributor. The spreader box shall provide an even distribution of the mixed slurry material to the pavement course.

3. Auxiliary Equipment:

The spreader box may be equipped with burlap drag material. Hand squeegees, drags and other items may be used to provide even coverage.

d. Placement of the Slurry Seal Coat:

Immediately prior to applying the slurry, the surface shall be cleaned of loose materials, silt spots, vegetation and other objectionable materials. Any standard cleaning method

may be used with the exception of water flushing in those areas where considerable cracks are present in the pavement.

The slurry seal surface shall not be applied if either the pavement or air temperature is below 60 degrees F. for more than one third of an eight hour work day. No work shall be permitted during adverse weather conditions. The mixture should not be applied when high relative humidity or the prevailing conditions prolongs curing beyond a reasonable time period. A reasonable time period is understood to be no longer than

four (4) hours.

Suitable methods, such as barricades, flagmen, cones, shall be used to control the traffic. The contractor shall be responsible to phase his construction schedule such that local traffic will have reasonable access to the homes and/or businesses.

The surface may be pre-wetted if required by local conditions to prevent rapid breaking of the emulsion. A sufficient amount of slurry shall be applied by the distributor to evenly cover the pavement area with no segregation, lumping or balling. Streaks and seams will not be allowed. The contractor shall recover areas that show streaks, seams or missed areas. Hand work shall be used to spread slurry seal coat in non-accessible areas to the spreader box.

The surface shall be protected from traffic and allowed to cure until the surface will not "scuff" of "ravel" under use.

All manhole covers, valve box covers and survey monuments shall be covered with thin plywood or other acceptable material to prevent the slurry seal from adhering to the structure. All covers shall be removed immediately after the surface is cured.

e. Public Notification:

A notice must be distributed to every home and/or business at least 24 hours before the slurry seal project begins. The notice must include the name of the company, a telephone number, the day or days of the construction and the latest hour of the day by which vehicles must be moved from the street.

4.13.07 "SLURRY MAC:"

a. General: The contractor shall furnish and install "Slurry Mac" pavement sealing product at the locations shown on the drawings. "Slurry Mac" is a mineral filled sanded Cationic asphalt emulsion base weather protective seal coat manufactured and supplied by Asphalt Systems Inc. P.O. Box 25511, Salt Lake City, Utah, telephone number 801-972-2757.

b. Materials: "Slurry Mac" is supplied in a concentrated form. Water should be added to "Slurry Mac" prior to application on asphalt pavements. Specifications for "Slurry Mac" are as follows:

Uniformity	Homogeneous with not separation or coagulation that cannot be overcome by moderate agitation.
Weight	10-12 pounds per gallon
Residue by Evaporation	63% minimum
Penetration of Reside	40 dmm maximum

Nonvolatile Mater Soluble in 1,1,1 Trichloroethane	15% minimum
Ash Content of Residue from Evaporation	75% to 80%
Water Content	37% maximum
Flammability	No tendency to ignite or flash
Wet Flow	No sagging or flow of undiluted emulsion
Firm Set, 24 hour	No tendency of film to break, roll or peel
Heat Test at 176 ˚F	No blistering, sagging or slipping
Resistance to Water	No blistering or tendency to re-emulsify
Direct Flame Test	No run down, or ignition of cured film
Aggregate passing #16 Sieve	100%
Wet Track Abrasion Test	12.5 g/sq. ft. maximum

c. Appropriate standards and test methods applicable to this product:

ASTM C 136-84a
ASTM D 5-86
ASTM D 2042-81
ASTM D 2939-78
ASTM D 3910-84

d. Rubber and Polymers: Cationic latices of rubber and polymers shall be added to the Slurry Mac to enhance adhesion, toughness, and increase resistance to oxidation, and fuel spillage. These additives shall be provided by the supplier and shall be generally 1% to 5% by volume added to diluted Slurry Mac and mixed thoroughly just prior to applying the product. Anionic latex should not be used.

e. Surface Primer: Prior to the application of the Slurry Mac, the pavement shall be cleaned and a gilsonite primer applied. The gilsonite primer shall be GSB-78 as supplied by Asphalt Systems Inc. The primer shall be uniformly spread across the pavement surface at a rate of 0.05 to 0.08 gallons per square yard.

f. Rate of Application: Rate of application for Slurry Mac may vary with the texture, porosity and age of the asphalt pavement to be sealed. The following application rates shall be used in the installation:

Furnish and install two (2) coats of Slurry Mac

First Coat	0.20 - 0.30 gallons per square yard
Second Coat	0.15 - 0.20 gallons per square yard

g. Installation: Installation of Slurry Mac shall be in accordance with the manufacture recommendations. In addition, the installation shall comply with the requirements of Section 4.13.06 of these specifications which outlines the general construction requirements for slurry seal installations. All testing of Slurry Mac Materials shall be in accordance with Section 4.13.05 of these specifications.

SECTION 5

PORTLAND CEMENT CONCRETE

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

5.2 MATERIALS: Materials used in portland cement concrete and reinforcing of portland cement 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 portland cement 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.

5.3 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:

Class	Minimum Cement (sacks/c.y.)	Minimum 28-day Comp. Strength (psi)	Primary Use
A	6-1/2	4000	Reinforced structural concrete
B	6	3500	Sidewalks, curbs & gutters, cross gutters, pavements and unreinforced footings and foundations

Class	Minimum Cement (sacks/c.y.)	Minimum 28-day Comp. Strength (psi)	Primary Use
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.

The maximum permissible water-cement ratio (including free moisture on aggregates) shall be 5 and 5 3/4 gallons per bag of cement respectively for Class A and B air entrained concrete.

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

Course Aggregate Size (In.)	Air Content (%)
1 ½ to 2 ½	5 ± 1
3/4 or 1	6 ± 1
3/8 or ½	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.

5.4 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 appreciable from the arc of the curve.

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

5.5 JOINTS: Joints shall be provided for sidewalk and curb and gutter as follows:

A. Sidewalks: Shall have scribed joints at intervals of 4 feet which joints shall be approximately 1/16" wide and be approximately 1/4 of the total slab thickness. In addition, ½ inch expansion joints shall be provided at 32 foot intervals and at locations where sidewalks adjoin curbs or existing sidewalks. Slabs shall be ruled at 4 foot intervals.

B. Curb and Gutter: Shall be cut into lengths of 10 feet by the use of 1/8 inch steel division plates of the exact cross section of the curb and gutter or shall be scribed when installed by a laydown machine. Also, ½ 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 50 feet, unless otherwise specified by the City Engineer.

Material for ½ inch expansion joints shall be as defined in AASHTO M-33, and shall be installed with its top approximately 1/4 inch below the concrete surface.

5.6 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 1 ½ inch concrete cover.

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

5.7 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 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 subgrade 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.

5.8 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 5.3 (b).

5.9 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 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.

5.10 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˚ 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 while 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 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 24 hours after the artificial heating is discontinued. Combustion heaters shall

not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

5.11 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 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 (1/4) of an inch, nor shall any portion of the surface or face of the curb or gutter depart more than one-fourth (1/4) of an 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.

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

A. Ponding of water on the surface or continuous sprinkling.

B. Application of absorptive mats such as 3-inch of cured hay, clean straw or fabric kept continuously wet.

C. Application of two 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 manufactures 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.

5.13 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.

5.14 A.D.A. ACCESS RAMPS: Access ramps shall be constructed in sidewalk facilities at all street intersections and all other applicable locations shown on City approved construction drawings. Concrete quality, installation and finish shall be as specified in the applicable portions of this section. The geometric design of sidewalk access ramps shall be as shown on the Brigham City Public Works Standard Construction Drawings.

Each access ramp shall be installed with a 2 foot by 4 foot detectable warning panel. Each panel shall be a high strength precast concrete unit with high tensile stainless steel tendons, homogeneous integral color (RED – UV stable) and skid resistant with truncated domes in compliance with ADAAG Standard 4.29.2. Installation of detectable warning panels shall follow manufactures recommendations.

SECTION 6

EXCAVATION AND BACKFILL FOR PIPELINES

6.1 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.

6.2 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.

6.3 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, cobblerock, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation four 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, cobblerock, stones, mud, or other material unsatisfactory for pipe foundation shall extend to a depth of at least four inches below the bottom of the pipe. A bedding of special material shall be placed and thoroughly compacted with pneumatic tampers in four-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 inches below grade will be removed and backfilled with crushed rock or gravel to provide a stable subgrade.

C. The maximum width of trench, measured at the top of the pipe shall be as narrow as possible but not wider than twelve inches on each side of sewer pipe or drainage pipe and fifteen 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 6.7.

6.4 GRAVEL FOUNDATION FOR PIPE: Wherever the subgrade 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 subgrade 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:

Screen	% Passing
1-1/2"	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.

6.5 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 shall be fully responsible for all damage attributable to his 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.

6.6 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.

6.7 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 Brigham City Standard Drawings and in the Specifications for each pipe type.

Trench backfilling above the level of the pipe bedding shall normally be accomplished with native

excavated materials and shall be free from rocks larger than eight inches in diameter.

6.8 COMPACTION OF BACKFILL: compacted backfill shall be placed by means of pneumatic tire rollers, hoe packs or other mechanical tampers of a size and type approved by the City Engineer.

The backfill in all utility trenches shall be compacted according to the requirements of the materials being placed. Under pavements or other surface improvements the in-place density shall be a minimum of 95% of laboratory standard maximum dry density, as determined by AASHTO T-180. In shoulders and other areas the in-place density shall be a minimum of 90% of laboratory standard maximum dry density, as determined by the same laboratory method. A City approved testing laboratory shall provide in-place density tests at various depths throughout the trench backfill. In-place density tests shall be taken every 200 feet of trench section (mainline and service laterals) unless otherwise directed by the City Engineer. A copy of all in-place density tests shall be delivered to the City Public Works Department for review and approval. Any portion of the trench backfill which does not meet the minimum compaction requirements of this section, shall be removed , recompacted and retested at the cost of the contractor until passing tests are obtained.

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 one foot (10" maximum lifts in the pipe bedding section) or as recommended by the project soils engineer. Prior to compaction, each layer shall be evenly spread and moistened , if required, as approved by the project soils 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 to make tests for relative densities for the approval of the City Engineer.

6.9 IMPORTED BACKFILL MATERIAL: In the event the native excavated materials appear to be very difficult to compact or are unacceptable as backfill in the opinion of the City Engineer, the Contractor shall furnish and install imported granular material. This granular material shall pass a 1 inch square sieve and shall not contain more than 15% of material passing a 200 mesh sieve, and shall be free from sod, vegetation, and other organic or deleterious materials.

SECTION 7

CONCRETE PIPE

7.1 GENERAL: This section covers the requirements for pipe materials and installation of concrete pipe. Concrete pipe is to be used for storm drainage systems and irrigation piping.

7.2 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 ½ 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.

7.3 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 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.

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

7.4 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 concrete pipe foundation shall be clean crushed rock or gravel with 100% passing a 1 ½ inch screen and 5% passing a No. 4 sieve.

7.5 INSTALLATION REQUIREMENTS FOR LINE AND GRADE: All concrete 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 feet, and not to exceed one-half inch in ten feet, provided that such variation does not result in a level or reverse sloping invert; provided also that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one sixty-fourth (1/64) inch per inch of pipe diameter, or one-half (½) inch maximum.

7.6 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 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 in 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 under the pipe and on each side of and to the level of 12 inches above the top of the pipe.

Modified bedding material shall be graded as follows: 100% passing a 1-1/2 inch screen and 5% passing a No. 4 sieve.

7.7 TESTS: Prior to acceptance by the City, the Contractor shall conduct and successfully pass a pipe displacement test, a pipe system air test and a TV pipe inspection in the presence of the City Engineer or his representative. If directed by the City Engineer, the contractor shall also conduct an infiltration test. The cost of all pipe testing shall be borne by the contractor, developer or project manager. Tests shall be performed as follows:

A. Displacement Test: In conducting the displacement test a light will be flashed between manholes (in the presence of a City Representative) 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 internal TV inspection test shall be used to review displacement.

B. Infiltration Test: The Contractor shall furnish labor, equipment and materials, including pumps, and shall assist the a City Representative 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 not exceed 150 gallons per inch diameter per mile per 24 hours for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the City Engineer at the expense of the Contractor.

C. Air Testing: The Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the a City Representative, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the service laterals (and plugs) have been installed. Each test section shall be pressurized to 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.

D. Television Testing: The Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including camera and video tapes, and shall perform, in the presence of a City Representative, an internal television test of the completed pipe before it can be placed in service. The contractor shall supply the City with a copy of the video tape. The television test shall be subject to the City Engineer's approval. Any defects in the pipe or the pipe installation noted on the internal TV inspection shall be corrected by the contractor and the repaired section shall be TV inspected after the repair to verify that the defective section has been corrected.

7.8 SEWER LATERAL CONNECTIONS: All sewer lateral connections into new sewer mains shall be through pre-formed wyes. All connections into existing sewer line shall be done with a sewer tapping machine and as shown on the City Standard Drawings. The City shall furnish all materials and perform all labor to tap the existing main and install the required tapping saddle. Cost of this work shall be paid for by the property owner, developer or subdivider through the required City connection fee and/or direct reimbursement of said work.

SECTION 8

PVC PLASTIC SEWER PIPE

8.1 GENERAL: This section covers the requirements for PVC plastic sewer pipe. PVC plastic sewer pipe shall be used in City sanitary sewer, storm drainage and gravity irrigation systems. PVC plastic sewer pipe shall be used for all sanitary sewer lines 4" to 18" diameter. Any sanitary sewer main which is 21" diameter and larger shall use reinforced or non-reinforced concrete pipe as approved by the City Engineer.

Ownership and maintenance responsibility for lateral upon completion and acceptance by the City of sewer lateral construction shall be assumed by the owner. Each owner will be responsible for their individual laterals extending to the main sewer collection system.

8.2 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 35.0 and shall be supplied in 13.0-foot laying lengths. Pipe shall carry the IAPMO UPC 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.

8.3 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.

8.4 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.

8.5 PIPE LAYING: All pipe installation shall proceed up grade 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 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.

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

8.6 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 compacted into place. Gravel foundation material for pipe shall be placed only when, and to the depth, requested by the Engineer or as specified on the Drawings.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with 100% passing a 1 inch screen, a maximum of 5% passing a No. 4 sieve and no more than 5% passing the #200 sieve.

8.7 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 (½) 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 (½) inch maximum.

8.8 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 (native or imported as approved by the City).

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, is 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 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 12 inches above the top of the pipe. Each 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 Section 6.

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.
Imported bedding material shall be gravel which is clean crushed rock or gravel with 100% passing a 1 inch screen, a maximum of 5% passing a No. 4 sieve and no more than 5% passing a #200 sieve.

8.9 TESTS: Prior to acceptance by the City, the Contractor shall conduct and successfully pass a pipe displacement test, a pipe system air test, a TV pipe inspection and a pipe deflection test in the presence of the City Engineer or his representative. If directed by the City Engineer, the contractor shall also conduct an infiltration test. The cost of all pipe testing shall be borne by the contractor, developer or project manager. Tests shall be performed as follows:

A. Displacement Test: In conducting the displacement test a light will be flashed between manholes (in the presence of a City Representative) 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 internal TV inspection test shall be used to review displacement.

B. Infiltration Test: The Contractor shall furnish labor, equipment and materials, including pumps, and shall assist the a City Representative 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 Representative. The maximum allowable infiltration shall not exceed 150 gallons per inch diameter per mile per 24 hours for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the City Engineer at the expense of the Contractor.

C. Air Testing: The Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the a City Representative, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the service laterals (and plugs) have been installed. Each test section shall be pressurized to 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.

D. Television Testing: The Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including camera and video tapes, and shall perform, in the presence of a City Representative, an internal television test of the completed pipe before it can be placed in service. The contractor shall supply the City with a copy of the video tape. The television test shall be subject to the City Engineer's approval. Any defects in the pipe or the pipe installation noted on the internal TV inspection shall be corrected by the contractor and the repaired section shall be TV inspected after the repair to verify that the defective section has been corrected.

E. Pipe Deflection Testing: The Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment and materials to perform a pipe deflection test in the presence of a City Representative. Those performing this test shall pass a pipe mandral or other approved devices through the completed pipe sections to determine the degree of pipe deflection in the PVC pipe. Testing for pipe deflection in PVC pipe cannot be performed until the completed pipe section has been installed for a minimum period of 30 days complete with the total anticipated backfill height over the pipe sections being tested. Pipe deflection testing shall be considered passing when all tested pipe sections show a pipe deflection not exceeding 5% of the pipe diameter. The contractor shall provide the City with a copy of all pipe deflection results. Any excessive deflections in the completed

pipe section shall be corrected by the contractor and the repaired section shall be retested after the repair to verify that the defective section has been corrected.

8.10 SEWER LATERAL CONNECTIONS: All sewer lateral connections into new sewer mains shall be through pre-formed wyes. All sewer lateral stub ins to extend fifteen feet inside property line, plugged and a marker (2x4 or 4x4) placed at the end of the lateral, painted green on portion sticking out of ground. All connections into existing sewer line shall be done with a sewer tapping machine and as shown on the City Standard Drawings. The City shall furnish all materials and perform all labor to tap the existing main and install the required tapping saddle. Cost of this work shall be paid for by the property owner, developer or subdivider through the required City connection fee and/or direct reimbursement of said work.

8.11 RESPONSIBILITY: All sewer laterals from main sewer line to building is the responsibility of the owner.

8.12 SEWER TAPS: Contractor to provide trench box for safety during sewer tap in accordance with OSHA regulations (29 CFR 1926.652 (a) (1))

SECTION 9

PVC PRESSURE PIPE

9.1 SCOPE: This specification applies to the furnishing and installation of PVC plastic pressure pipe. This pipe shall be used in pressure sanitary sewer mains and pressurized sprinkler irrigation systems. In the case of the PIP pipe, this product can be used for gravity flow irrigation systems.

9.2 PIPE: All PVC plastic pressure pipe with integral bell and spigot joints shall be made from clean, virgin, Type 1, Grade 1, unplasticized polyvinyl chloride (PVC) and shall meet the requirements of the latest revision of ASTM D-1784, ASTM D-2241, with standard dimension ratio (SDR) of 21 (Class 200 psi) for all pipe, unless otherwise approved. All pipe and fittings shall be NSF approved.

PVC pressure pipe used for gravity irrigation systems shall be Pressure Irrigation Pipe complying with the requirements of SCS 430DD, shall be rubber gasketed pipe and supplied with a pressure rating of 100 p.s.i. and a SDR of 41.

9.3 JOINTS: The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the requirements of ASTM D-1869. The bell section shall be designed to be at least as strong as the pipe wall.

9.4 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.

9.5 SERVICE CONNECTIONS: Service connection to PVC plastic pressure pipe shall be by bronze service saddles specifically designed for plastic pipe (equal to Christy) or polypropylene saddles with stainless steel reinforcing caps (equal to Smith-Blair); reducing bushings shall be of nylon.

9.6 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 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.

9.7 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 100% passing a one inch screen and 5% passing a No. 4 sieve.

9.8 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 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 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 12 inches above the top of the pipe.

Modified bedding material shall be graded as follows: 100% passing a one inch screen and 5% passing a No. 4 sieve.

SECTION 10

SUBSURFACE DRAIN PIPE

10.1 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.

10.2 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 feet. To insure open joints between lengths of pipe, spacer lugs approximately 1/8 inch high located on the 1/3 or 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 1/4" 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 feet.

10.3 LAYING PIPE: Gravel backfill shall be placed under the over the pipe to the minimum depth as shown on the drawings. A geotextile drainage fabric, approved by the City Engineer shall be used to enclose the gravel envelope around the pipe section. 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 4 ½ inches in each direction from the joint.

The maximum allowable departure from grade shall not exceed 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 2 percent of the pipe diameter per joint of pipe. The maximum allowable departure from alignment shall not exceed 20 percent of the inside diameter of the drain pipe, with a rate of return to the established line not to exceed 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 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 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 Section 6.

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 a sun reflector, a device approved by the City Engineer, having a diameter one 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.

SECTION 11

POLYETHYLENE DRAIN PIPE

11.1 SCOPE: This specification applies to the furnishing and installation of polyetheylene drain pipe. This pipe may be used in storm drainage or gravity flow irrigation systems when specific approval is granted for it's use by the Brigham City Public Works Department.

11.2 PIPE: All polyethylene drain pipe shall be high density polyethylene corrugated pipe with an integrally formed smooth interior. All polyethylene drainage pipe shall be "ADS N-12" or a City approved equal. All pipe shall conform to the test methods, dimensions and markings as required in AASHTO Designation M-252 and M-294 and ASTM F-405 and F-667. Pipe shall be made of polyethylene compounds which meet or exceed the requirements of Type II, Category 4 or 5, Grade P33 or P34, Class C per ASTM D-1248. Clean reworked material may be used.

11.3 JOINTS: Joints for Polyethylene drainage pipe shall be watertight joints with approved rubber gaskets sufficient to pass applicable air testing requirements.

11.4 INSTALLATION: The installation of Polyethylene drainage pipe shall comply with all the requirements of installation for PVC Plastic Sewer Pipe as found in Sections 8.5, 8.6, 8.7 and 8.8 of these specifications.

11.5 TESTS: Prior to acceptance by the City, the Contractor shall conduct and successfully pass a pipe displacement test, a pipe system air test, a TV pipe inspection and a pipe deflection test in the presence of the City Engineer or his representative. If directed by the City Engineer, the contractor shall also conduct an infiltration test. The cost of all pipe testing shall be borne by the contractor, developer or project manager. Tests shall be performed as follows:

A. Displacement Test: In conducting the displacement test a light will be flashed between manholes (in the presence of a City Representative) 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 internal TV inspection test shall be used to review displacement.

B. Infiltration Test: The Contractor shall furnish labor, equipment and materials, including pumps, and shall assist the a City Representative 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 Representative. The maximum allowable infiltration shall not exceed 150 gallons per inch diameter per mile per 24 hours for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the City Engineer at the expense of the Contractor.

C. Air Testing: The Contractor or his representative (a qualified firm or individual agreed

upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the a City Representative, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the service laterals (and plugs) have been installed. Each test section shall be pressurized to 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.

D. Television Testing: The Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment, and materials, including camera and video tapes, and shall perform, in the presence of a City Representative, an internal television test of the completed pipe before it can be placed in service. The contractor shall supply the City with a copy of the video tape. The television test shall be subject to the City Engineer's approval. Any defects in the pipe or the pipe installation noted on the internal TV inspection shall be corrected by the contractor and the repaired section shall be TV inspected after the repair to verify that the defective section has been corrected.

E. Pipe Deflection Testing: The Contractor or his representative (a qualified firm or individual agreed upon by the City Engineer and the Contractor) shall furnish labor, equipment and materials to perform a pipe deflection test in the presence of a City Representative. Those performing this test shall pass a pipe mandral or other approved devices through the completed pipe sections to determine the degree of pipe deflection in the pipe. Testing for pipe deflection in the pipe cannot be performed until the completed pipe section has been installed for a minimum period of 30 days complete with the total anticipated backfill height over the pipe sections being tested. Pipe deflection testing shall be considered passing when all tested pipe sections show a pipe deflection not exceeding 5% of the pipe diameter. The contractor shall provide the City with a copy of all pipe deflection results. Any excessive deflections in the completed pipe section shall be corrected by the contractor and the repaired section shall be retested after the repair to verify that the defective section has been corrected.

11.6 MANHOLE CONNECTIONS: Corrugated polyethylene pipe connections to manholes shall be achieved by the use of manhole coupling adapters, rubber boots with 300 series non-magnetic corrosion resistant steel bands or water stop gaskets.

11.7 LATERAL CONNECTIONS: All lateral connections into new mains shall be through preformed tee fittings installed in the main line or with field installed service saddles. All connections by field installed service saddles on new or existing mains shall be done in accordance with manufacturers' recommendations and with all required fitting materials. Connections shall be at the locations shown in the drawings.

SECTION 12

MANHOLES

12.1 GENERAL: This section covers the requirements for manhole materials and installation.

12.2 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 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 ½ 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 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 junction manholes with three or more pipes located in the base shall be 60 inch inside diameter. All manholes with the mainline size being 12 inch diameter or larger shall be 60 inch inside diameter. All other manholes shall be 48 inch inside diameter.

Concrete for manhole bases shall comply with the requirements of Section 5 of these Specifications.

12.3 WALL AND CONE SECTIONS: all manholes shall be precast, sectional, reinforced concrete pipe of either 48 or 60 inch I.D., as specified. Both cylindrical and taper sections shall conform to all requirements of ASTM Designation C-478 for Precast Reinforced Concrete Manhole Sections. The manhole sections shall also comply with the following:

A. The throat section of the manhole shall be adjustable, by use of pipe sections, up to 18 inches in height.

B. The taper section shall be a maximum of three feet in height, shall be of eccentric conical design, and shall taper uniformly to 30 inches inside diameter.

C. The pipe used in the base section shall be furnished in section lengths of 1, 2, 3, and 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.

12.4 MANHOLE INSTALLATION: 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 1 part cement and 1 ½ 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.

12.5 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 30" diameter as supplied in "D&L Supply" Model A-1181 or an approval equal. Each cover shall contain one (1) pick hole and shall contain air vent holes. The cover shall be marked "SEWER" or "STORM DRAIN" or "WATER", as appropriate.

All manhole rings shall be carefully set to the grade shown on the Drawings or as directed by the City Engineer. All manhole covers shall be set to final finish grade following the paving of the associated street and raised to the finish grade with a concrete collar as shown on the drawings. The concrete collar shall be a minimum thickness of 8 inches and shall be held down ½" below the top of the adjacent asphalt pavement.

12.6 MANHOLE STEPS: all sanitary sewer and storm drain manholes over six 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 1'-0" maximum and shall be polypropylene covered steel steps, Model PSI-PF as manufactured by "M.A. Industries" or an approved equal.

SECTION 13

CULINARY WATER SYSTEM

PART 1 GENERAL

13.1.01 WORK INCLUDED

A. Inspection

B. Preparation

C. Water pipe installation

D. Valve and fitting installation

E. Thrust block installation

F. Corrosion protection

G. Field quality control

H. Metered Services

I. Pressure Reducing Stations

J. Fire Hydrants

K. Fire Lines

L. General

1. The work to be done consists of furnishing all necessary qualified labor, materials and equipment to provide complete installation and testing of water system facilities. Modifications to existing facilities shall conform to Brigham City specifications.

2. The construction of water mains shall include: excavation, backfill and compaction, construction of concrete structures, anchors, thrust blocks, supports, encasements; furnishing, installing, testing and disinfecting water pipelines, fittings, valves, blow offs, air valves, services, fire hydrants, and all appurtenances; removal and restoration of existing improvements and all work in accordance with the project plans and specifications.

M. Unacceptable Work

1. Unacceptable work as determined by Brigham City whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause, found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner at the contractor's expense.

13.1.02 RELATED WORK

A. Regulations for Excavation on Brigham City Rights-of-Way -- Section 2

B. Excavation and Backfill for Pipelines -- Section 6

C. Disinfection of Water Distribution Systems -- Section 14

13.1.03 QUALITY ASSURANCE

A. Comply with federal, state, and local codes and regulations. Underground piping pressure testing shall be witnessed by the Brigham City Engineer, if required.

B. Pipe, valve, and appurtenance materials and workmanship shall be in accordance with AWWA Standards or other standards as specified herein.

13.1.04 REFERENCES

A. American Water Works Association (AWWA)
   1. C105, "Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids".
   2. C111, "Rubber-Gasket Joints for Ductile-Iron and Gray-iron pressure Pipe and Fittings".
   3. C151, "Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids".
   4. C504, "Rubber-Seated Butterfly Valves".
   5. C509, "Resilient-Seated Gate Valves for Water and Sewer Systems".
   6. C600, "Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances".

B. American Society for Testing and Materials (ASTM):
   1. A-126: For valve bodies.

13.1.05 SUBMITTALS

A. Submit manufacturer's specifications for all products to Brigham City for approval.

13.1.06 DELIVERY, STORAGE AND HANDLING

A. Load and unload pipe, fittings valves, and accessories by lifting with hoists or skidding

so as to avoid shock or damage. Do not skid or roll pipe on skid ways against pipe already on the ground.

B. Each length of pipe shall be unloaded opposite or near the place where it is to be laid in the trench.

C. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by Brigham City.

PART 2 PRODUCTS

13.2.01 DUCTILE IRON PIPE

A. Buried Applications
1. Standard: AWWA C151.
2. Pressure Rating (class) - Pipe Diameters 4" to 12" shall be thickness Class 50, Pipe Diameters 14" and larger shall be pressure Class 250 p.s.i.
3. Cement lined and bituminous coated in accordance with AWWA C104.
4. Rubber gasketed slip-on pipe joints in accordance with AWWA C111.
5. Class 250 psi mechanical joint fittings in accordance with AWWA C110.
6. Alternate : AWWA C900 (for questionable soil conditions, as approved by City Engineer)

B. Above Ground Applications
1. Same as below ground except joints and fittings to be flanged in accordance with AWWA C115.
2. Gaskets to be full faced, 1/16th inch thick rubber.

13.2.02 ACCESSORIES

A. Nuts and Bolts as required.

B. Gaskets to be 1/16th inch full face rubber.

C. 8 mil. polyethylene wrap in accordance with AWWA C105.

13.2.03 CORROSION PROTECTION

A. Bolts: Apply 2 coats of no oxide wax to all exposed surfaces of bolts and to all bolt threads after installation of piping, fittings, valves, and couplings.

B. Encase all buried ductile iron valves, fittings, connections and specialties in minimum 8 mil. polyethylene sheets in accordance with AWWA C-105. Duct tape shall be used to secure polyethylene sheets to the pipe.

C. Encase buried ductile iron pipe in minimum 8 mil. polyethylene sheets in accordance with AWWA C-105 in selected areas and soil types which required corrosion protection as approved and directed by the City Engineer.

13.2.04 VALVES

A. Gate valves (8" and smaller):
   1. Cast Iron Body, Bronze Mounted: Furnish resilient-seated gate valves 3 inches through 12 inches that conform to the requirements of AWWA C509, non-rising stem design with "O" ring seals.
   2. Operating Direction: Open counterclockwise.
   3. Buried Valves: Flanged, mechanical joint, or as indicated.

B. Tapping valves and sleeves:

   1. Tapping valves shall have large diameter seat rings to permit entry of tapping machine cutters. Inlet shall be flanged. Outlet shall suit branch piping and shall include the required flange for tapping machine adapter connection. In other details, tapping valves shall conform to the requirements outlined for gate valves in Paragraph 13.2.06 A.
   2. Tapping sleeves shall be suitable for assembly around the existing main. Body shall be high strength ribbed construction. End gaskets shall be sized to suit the existing main, and the seals between the pipe and the gaskets shall be formed around the perimeter of the pipe.
   3. Tapping valves and sleeves shall be split cast iron or stainless steel fully gasketed.

C. Butterfly valves (10" and Larger):

   1. Shall comply with the requirements of AWWA C504, Class 150 B.
   2. Valve bodies shall be cast in conforming to ASTM A126, Class B. Ends shall be flanged unless otherwise specified.
   3. Valve discs shall be streamlined and shall have a continuous 360°sealing surface of stainless steel, ASTM A276, type 304.
   4. Valve shafts shall be stainless steel ASTM A276, type 304, of stub construction with at least 1-1/2 shaft diameter engagement into the disc and shall be fastened to the disc with upset pins.
   5. Valve seats shall be of Buna N material bonded to the valve body.
   6. Valve bearings shall be self-lubricating and non-corrosive and shall have a significant difference in hardness from the valve shaft.
   7. Valve actuators shall be designed as an integral part of the valve and shall meet all the requirements of AWWA C504. All actuators shall be hermetically sealed and permanently lubricated with no exposed moving parts. All manual actuators will meet the requirements of AWWA C504 for nut input.

13.2.05 VALVE BOXES

A. Shall be suitable for HS-20 traffic loading.

B. Shall be furnished and installed over each line valve and over each auxiliary hydrant

valve. All buried valves shall be installed complete with a Tyler 564A slip valve box or approved equivalent. Valves over 5' in depth shall have a valve nut extension stem installed.

13.2.06 FITTINGS

A. Mechanical joint:
   1. Mechanical joint fittings shall be cast iron class 250 and shall conform to AWWA C-110 and C-111. Mechanical joint fittings shall be coated with a petroleum asphaltic coating 1 mil thick.

B. Flanged fittings:
   1. Flanged fittings shall conform to AWWA C-110 and C-111 Cast Iron Fittings. Flanges shall be faced and drilled and shall be Class 250. Flanged fittings shall be coated with a petroleum asphaltic coating 1 mil thick.

13.2.07 METERED SERVICES

A. 1" Service Laterals (see Standard Details):
   1. All supplies, labor, machinery, etc. will be supplied by the contractor. Brigham City will supply and set the meter only on 1" connections. The contractor shall supply meters for connections greater than 1". All 1" meters shall be Sensus model SR2-TRPL(Automated Meter Reading capabilities).
   2. All connections must be made with compression copper fittings made of brass.
   3. Brass corporation stops Mueller B-25008 or equivalent. Tap directly into the main. All corps shall be CC thread. No saddles are allowed on ductile iron mains.
   4. Type K soft drawn copper pipe installed as one solid piece from main to meter.
   4a. An alternate 1" copper tube size poly SDR9 (200 psi) with stainless steel inserts and tracer wire at locations approved by the Water Superintendent.
   5. 18" meter yokes. Mueller B-2434-6A or equivalent (copper or brass).
   6. Meter Boxes: 21" diameter white “ADS” N-12, “Hancor” white poly meter box, P.V.C. or 21" diameter concrete meter box as approved and directed by the City.
   7. Cast iron ring and lid with locking nut (D&L Supply L-2244 or City approved equal).

B. 1-1/2" and 2" Service Laterals (see Standard Details):
   1. All supplies, labor, machinery, etc. will be provided by the contractor. Brigham City does not provide or set the meter if it exceeds 1" in size.
   2. 1 ½ -2" copper tube size poly SDR9 (200 psi) with stainless steel inserts with trace wire.
   3. Copper or brass screw type fittings (ball valves, strainers, nipples, tees, bends, etc.).
   4. Sensus meters:
      a. 1 ½" and 2" shall be turbo magnetic drive type or disk type meter as determined by Brigham City.
      b. 1 ½" and 2" meters shall be model SR with Automated Meter Reading capabilities.

5. 30" diameter concrete meter vault with 30" cast iron ring and lid suitable for HS-20 traffic loading (D & L Supply 1181 or City approved equal). Cast iron lid shall have a 2" hole in center with plug. An alternate 30" diameter poly meter vault section can be used with the prior approval of the City Engineer.
6. Meter box to have 12" gravel floor.

C. 3" Service Laterals (see Standard Details):

Specifications for 3" services shall be the same as 2" connections with the following exceptions:

1. Where possible flanged fittings may be substituted for screw on type fittings.
2. Sensus meters. The meter shall be a turbine meter or as directed by the Brigham City Engineer.
3. Meter Vault to have concrete floor and 18" diameter concrete drain sump with personnel access manhole and steps. See Brigham City Standard Details.

D. 4" and Larger Service Laterals:

1. Ductile iron pipe.
2. Cast iron, flanged gate valves and fittings.
3. Concrete meter vault with cast iron lid, concrete floor and 18" diameter drain sump with personnel access manhole and steps.
4. Sensus meters. The meter shall be a turbine type meter or as directed by the Brigham City Engineer. The meter shall have Automated Meter Reading capability.
5. Floor supports.

E. All service laterals are to have 48 inches min. cover and are to be installed using one seamless section of pipe from the water main to the meter.

13.2.08 PRESSURE REDUCING VALVE STATIONS (See Standard Details)

A. All pressure reducing valves (PRV) shall be ”Clayton” or “Ames” brand Pressure Reducing and Sustaining Valves as shown on the Standard Drawings. Specific brand name to be installed for each specific installation shall be directed by the City Engineer.

B. All PRV stations because of the weight of the combined fittings, must have support blocks for support. Supports shall be screw jack type and shall not restrict access to any of the bolts.

C. On PRV's over 6", Brigham City may determine that a low flow PRV in excess of 2" is required.

D. Vault:

1. Vault shall have a concrete floor with an 18" concrete pipe sump. The pipe sump shall be located near the access lid and the floor shall slope towards the sump (2% slope minimum).
2. Vault shall have 6'-6" clearance between the floor and ceiling of the vault.
3. Vault shall have two access lids:
   a. A 36" diameter clear opening manhole ring and lid shall be centered over the PRV to provide easy access for possible removal. Ring and lid

shall be D & L Supply A-1460 or equivalent.

b. A 24" diameter clear opening manhole ring and lid shall be located at a corner of the vault. Ring and lid shall be D&L Supply A-1181 or equivalent. All access lids (personnel lids) must be accompanied by ladder either poured into or securely fastened to the vault wall. All ladders will have rungs not farther than 1' apart. Steps poured into the vault wall shall be rubber coated as are found in pre-poured sewer cones and sections. Ladders fastened to the walls shall have lag bolts connections as shown on the plans.

c. The vault shall have min. 8" thick walls. Wall and roof shall have steel reinforcement designed for HS-20 traffic loading.

d. All piping which penetrates wall sections shall have "Romac" MJRG retainer glands and 24" square steel plate for thrust restraint on each side of the wall opening as detailed on the drawings.

4. See Standard Details for PRV general specification details.

13.2.09 FIRE HYDRANTS (See Standard Details)

A. All fire hydrants shall be red in color and shall be one of the following 6" compression type hydrants:
   1. Mueller Centurion
   2. Clow Medallion

B. Auxiliary valve complete with valve box.

C. Gravel for sump.

D. Concrete for blocking and setting hydrant (Mega-lug connections utilized to replace concrete blocking is acceptable with the prior authorization of the City).

E. All hydrants shall conform to AWWA Specifications C-502.

F. Hydrant shall be equipped with two 2 ½" hose nozzles and one 4 ½" nozzle, and nozzles shall have the national standard threading.

G. Each hydrant shall be supplied with O-ring seals and a national standard pentagon operating nut designed for clockwise rotation closing.

H. Auxiliary valve shall conform to Brigham City Specification for gate valves. The water line from the main to the hydrant shall be 6" minimum.

I. Blocking shall conform to Brigham City Specifications for thrust blocking.

13.2.10 FIRE SPRINKLER/SUPPRESSION LINES

A. All fire lines must be equipped with a gate valve. The valve shall conform to Brigham City specifications for gate valves.

B. All fire lines shall be ductile iron pipe, thickness class 50 or as shown on the City

approved site plans. Fire lines shall meet Brigham City's specifications for main lines.

C. Fire line locations shall be approved by Brigham City.

D. Notify Brigham City Water Inspector 48 hours prior to installation.

E. Unless written authorization is given by Brigham City, no services shall be connected to the fire sprinkler/suppression lines.

PART 3 EXECUTION

13.3.01 INSPECTION

A. All pipe fittings, valves and other appurtenances shall be examined by Contractor carefully for damage and other defects immediately before installation.

B. Defective materials shall be marked and held for inspection by the Brigham City Engineer, who may prescribe corrective repairs or reject the materials.

C. Prior to installation, valves shall be inspected for direction of opening, freedom of operation, tightness of pressure-containing bolting, cleanliness of valve ports and seating surfaces, handling damage, and cracks. Defective valves shall be corrected or held for inspection by the Brigham City Engineer.

13.3.02 PREPARATION

A. Furnish temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work.

B. The trench bottom and pipe bedding surface shall be prepared in accordance with the approved plans, the excavation and backfill specifications in the Brigham City Public Works Standards and The Regulations for Excavation on Brigham City Rights-of-Way prior to pipe installation.

C. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid. Bevel and file plain end of pipe to prevent gasket damage during joint assembly.

D. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water-main materials and protective coatings and linings. Under no circumstances shall water system materials be dropped or dumped into the trench.

13.3.03 WATER PIPE INSTALLATION

A. The water pipe shall be laid and maintained to lines and grades established by the drawings and specifications with fittings and valves at the required locations unless otherwise approved by Brigham City. Unless otherwise shown, all water lines shall have 4.0' minimum cover to final finish grade. All main lines are to be located 4' off the lip of the north or east curbs unless otherwise specified. All valves and fire hydrants are to be installed as noted on the approved plans.

B. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Brigham City Engineer to provide clearance as required by federal, state, or local regulations or as deemed necessary by Brigham City to prevent future damage or contamination of either structure.

C. Lay all water lines on a continuous grade to avoid high points except as shown on the plans.

D. Prevent foreign material from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.

E. As each length of pipe is placed in the trench, the joint shall be assembled in accordance with manufacturer's recommendations.

F. The pipe shall be brought to correct line and grade, and shall be secured in place with approved backfill material in accordance with the Brigham City Public Works Standards.

G. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or plumb stems or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that recommended by pipe manufacturer and shall be approved by the Brigham City Engineer.

H. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Brigham City. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

I. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe or lining.

J. Cut ends and rough edges shall be ground smooth. For push-on joint connections, the

cut end shall be beveled.

K. Whenever possible, all tie-ins will be made dry. Brigham City shall turn off the water upon 48 hours minimum advance notice by the contractor. It shall be the contractor's responsibility to advise all affected water users of the interrupted service a minimum of 24 hours prior to any service interruption. In large areas where there is heavy use, where shutting down the line is not feasible in the opinion of the Brigham City Engineer, the contractor shall be required to tie onto the main by using a wet tap.

L. All dead ends shall be plugged complete with a 2" wash out assembly (see Standard Details).

13.3.04 VALVE AND FITTING INSTALLATION

A. Valves shall be as located on Brigham City Standard Details.

B. Valve-operating stems shall be oriented in a manner to allow proper operation.

C. A valve box shall be provided for every valve that has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a gear case. The valve box shall not transmit shock or stress to the valve and shall be centered over the operating nut of the valve, with the box cover flush with the surface of the finished area or such other level as may be directed by the owner. In paved areas, a concrete collar around the valve box is required.

D. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

13.3.05 THRUST BLOCK INSTALLATION

A. Thrust blocks shall be provided at reducers, valves, tees, plugs, and caps, and at bends deflecting 22-1/2 degrees or more. 11-1/4 degree pipe bends shall be installed with approved ductile iron retainer glands.

B. Thrust block shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that shown on the drawings. The block shall, unless otherwise shown or directed, be so located as to

contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair. Concrete shall not be located within 1-1/2" of the joints and bolts.

C. Concrete for thrust blocks shall have a compressive strength of not less than 2500 psi in 28 days.

D. Care shall be taken to not pour concrete around bolts.

E. Refer to Standard Details for thrust block details.

13.3.06 CORROSION PROTECTION

A. Bolts: Apply 2 coats of no oxide wax to all exposed surfaces of bolts and to all bolt threads after installation of piping, fittings, valves, and couplings.

B. Encase all buried ductile iron valves, fittings, connections, and specialties in minimum 8 mil. polyethylene sheets in accordance with AWWA C-105.

C. In areas where corrosive soils may be present, all buried ductile iron pipe is to be poly-wrapped in accordance with AWWA C-105. The Brigham City Engineer will designate areas where an appropriate soils analysis is required to determine soil characteristics. Contractor shall bare the expense for soils analysis.

13.3.07 1" SERVICE LATERALS

A. Laterals shall be installed prior to the construction of concrete curb and gutter. The contractor shall be responsible to have sufficient elevation controls at the construction site to set water meter boxes at the City approved finish grades.

B. Locate all laterals as close as possible to the center of the lot and have all meter locations cleared with Brigham City.

C. All meters shall be located between the curb and the sidewalk unless approved otherwise by the Brigham City Engineer.

D. Corporation stops shall be tapped at 45 degree angles unless approved otherwise by the Brigham City Engineer. The installer should firmly compact dirt around and under the corporation stop and copper loop.

E. Type K soft drawn copper shall be connected to the top of the water main at a 45° angle by using a brass nut and a compression fitting on the end of the copper. All tubing shall be cut straight.

F. A small loop (goose neck) of excess copper must be put in the copper tubing to accommodate for settlement that may occur (see Standard Details).

G. All laterals must be of one continuous copper tube or approved CTS poly SDR9 (200 psi) with trace wire between the corp stop and the meter box. No joints or copper to copper connectors will be allowed.

H. All laterals shall have a minimum of 48" cover from top of copper tubing to finished grade.

I. All yokes shall be 18" Mueller B-2434-6A or approved equivalent and are to be connected to the service line by use of Mueller compression fittings or equivalent.

J. From the top of the lid (cast iron) to shut off valve on the yoke, there must be a distance of not less than 18" or more than 24". No meter will be set if this or any other

specification is not met.

K. All pig-tails will be type K hard drawn copper pipe or CTS poly with trace wire and will be stubbed into the property a minimum of 15'.

L. All meter boxes shall be centered squarely over the yoke to provide access to the connection nuts on the bottom of the yoke. Meter box interior shall be kept clear of dirt so that connecting nuts are visible.

M. All meter boxes will be installed so the lid of the meter box will be level with the adjacent curb after any settlement has occurred..

N. See Standard Details for typical installation detail.

O. Precautions should be used to prevent any foreign materials from entering the pipe. All pig-tails will be mashed on the end which is stubbed into the property. Contractor will make every effort to ensure that no kinks or restrictions occur in the copper service.

Brigham City may require the compression fitting on the cold side of the yoke to be tested by inserting a jumper in between the yoke. Jumper shall be complete with gaskets and will be installed and ready for inspection prior to calling the City.

P. Copper laterals and CTS poly pipe SDR9 (200 psi) may, at the discretion of the Brigham City Engineer, be required to be bedded in sand. If sand bedding is required, a minimum of 6" below and 6" above the pipe shall be placed.

13.3.09 1 ½" AND 2" SERVICE LATERALS

A. All meter vaults shall have a gravel base (floor) not less than 1' thick.

B. The meter shall be a minimum of 36" and a maximum of 42" from the top of the box (see Standard Details). In cases where the main water line is deeper, the service lateral will be raised to conform to this specification.

C. A bypass shall be installed on the metered line.

D. The area where the pipe comes into and out of the vault shall be grouted to prevent debris from washing into the box.

E. No sprinkler systems shall be tied into the line inside of the meter vault.

F. When subject to traffic, the box must be designed for HS-20 traffic loading and be equipped with an appropriate cover approved by the City Engineer.

G. 1 ½" and 2" taps to the main line shall be made with a saddle. Saddles shall be bronze with two stainless steel straps which hold the saddle to the main. On 1 ½" and 2" taps only, a compression type corporation stop is acceptable. Saddle is to be bronze saddle with two stainless straps (Romac style 202BS or equivalent).

H. See Detail Drawings for typical meter installation detail.

13.3.10 3" AND LARGER SERVICE LATERALS

A. The meter vault shall have a gravel base (floor) not less than one foot in depth.

B. In case of extreme depth (over 36") a ladder shall be poured into or securely fastened to the vault wall. The access lid shall be moved so that it is centered over the ladder.

C. The bypass shall be the same size as the metered line.

D. No sprinkling system shall be tied inside the meter vault. Such tie-ins must be made on the owners side of the meter station (outside the vault).

E. When subject to traffic the box must be designed for HS-20 traffic loading and be equipped with an appropriate lid approved by the City Engineer.

F. The meter vault shall be poured so that 12" minimum clearance exists between all sides of the vault and the piping.

G. See Detail Drawings for typical installation detail.

13.3.11 FIRE HYDRANT INSTALLATION

A. The trench for the hydrant shall be slightly over excavated to provide a 1 cubic yard gravel sump as shown on the drawings.

B. Concrete thrust blocking shall be set behind the hydrant for support.

C. The drain holes shall not be covered by the concrete blocking.

D. All hydrants shall be level both at the side and at the back.

E. All hydrants shall be turned on after installation and inspected by Brigham City Water Department and Fire Marshall for proper operation.

F. See Detail Drawings for Fire Hydrant Connection Detail.

13.3.12 FIELD QUALITY CONTROL

A. Temporary connections for pressure testing shall be made by the Contractor at his expense and removed by him after the satisfactory completion of the testing work.

B. Pressure Test:

1. After completion of the installation of the system, or any reasonable length thereof, prior to backfilling and after thorough flushing of the portion to be tested, pressure tests shall be made. The system to be tested shall be subjected to a hydrostatic pressure of 200 pounds per square inch, unless otherwise noted on the drawings, for a period of not less that 2 hours duration.

2. The portion to be tested shall be filled with water slowly and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Brigham City Engineer. The Contractor shall make the temporary connection for pressure testing.
3. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged by the Contractor with a brass plug.
4. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the Brigham City Engineer, at no cost to the Owner.

C. Leakage Test:
1. A leakage test shall be conducted concurrently with the pressure test.
2. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
3. Maximum leakage during the pressure test shall not exceed one gallon per inch diameter per 1000 feet of pipe.
4. Acceptance of installation shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified above, the contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.
5. All visible leaks, other than a minor amount of sweating, shall require immediate stoppage of the test and tightening of the joints so that, when pressure is again put on the system, there will be no leakage.

D. Disinfection of Water Distribution Systems:

1. Refer to Section 14.

13.03.13 CROSS CONNECTION CONTROL AND BACKFLOW PREVENTION

A. It shall be unlawful at any place supplied with water from the Brigham City Water Distribution System to do any of the following:

1. To install after written notification from Brigham City Water System Manager or use any physical connection or arrangement of piping or fixtures which may allow any fluid or substance not suitable for human consumption to come in contact with potable water in the Brigham City Water Distribution System.

2. To install any connection, arrangement, or fixtures without using a backflow prevention device or assembly designed to prevent a violation of subsection A. Any

such device or assembly must be approved for installation by the Brigham City Water System Manager with respect to each application.

3. To install any backflow prevention device or assembly described in subsection B which is not installed as required in the Utah Plumbing Code.

B. Officers and employees of Brigham City shall have the right to enter any place which is supplied with water from the Brigham City Water Distribution System and conduct a hazard survey or any other examination or test reasonably necessary to the enforcement of this section.

C. Any user of water from the Brigham City Water Distribution System, and not Brigham City, shall pay all costs of installation and testing of backflow prevention devices or assemblies.

D. Backflow prevention devices or assemblies required by this section shall be tested not less than once each year by a technician certified by the Safe Drinking Water Committee of the State of Utah. Test results shall be furnished to the Brigham City Water System Manager.

E. Water service may be discontinued to any user who is found to be in violation of this ordinance and who fails to take corrective action within ten (10) days after violation notification, except that water service may be discontinued immediately if an immediate threat to the water supply exists.

F. Any person who violates the provisions of the section shall be civilly liable to Brigham City, and to third persons other than Brigham City, for all damages proximately caused by said violation.

PART 4 WATER REQUIREMENTS FOR AREAS ABOVE 4,535 FOOT ELEVATION

13.04.01 It shall be the requirement of Brigham City to provide culinary water service to those areas above 4,535 feet elevation (approximately 40 psi of static pressure) provided the following conditions are met:

A. Developer, subdivider, or proposed user shall provide pumping stations and/or storage reservoirs to service the desired area with added pressure.

B. The City Engineer, in consultation with the requesting party, shall design all pumping facilities, special pipelines and/or reservoirs needed for the added pressure. All cost of said design shall be borne by the requesting party.

C. Individual home service lateral sizing shall be recommended by the City Engineer.

D. All pressurization facilities shall be constructed to specified city standards and subject to construction inspection by city staff.

E. The full cost of construction pressurization systems shall be borne by the requesting party.

F. Following construction, all completed facilities shall be turned over to Brigham City for ownership, operation and maintenance.

G. Users in any special pressure service area shall pay a monthly surcharge for this service in addition to regular water use billings.

SECTION 14

DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

14.1.01 WORK INCLUDED

A. Flushing of water distribution system and supply lines

B. Chlorine disinfection

C. Final flushing

14.1.02 QUALITY ASSURANCE

A. All disinfection and testing procedures shall be in accordance with applicable Federal, State, and local standards, and in accordance with applicable provisions of AWWA C651.

14.1.03 REFERENCES

A. American Water Works Association (AWWA).
   1. C651.
   2. B300 - Standard for Hypochlorite
   3. B301 - Standard for Liquid Chlorine

B. "Standard Methods for Examination of Water and Wastewater", American Public Health Association, AWWA, and Water Pollution Control Federation.

C. "Utah Administrative Code" Section R309.

14.1.04 SUBMITTALS

A. Results of chlorine residual tests.

B. Results of bacteriological quality tests.

PART 2 PRODUCTS

14.2.01 CHLORINE

A. Sodium Hypochlorite:
   1. Shall be in accordance with AWWA B300.
   2. Shall be stored as recommended by manufacturer.

B. Calcium Hypochlorite:

1. Shall be in accordance with AWWA B300.
2. Shall be in granular or tablet (5 gram) form.
3. Shall be stored in a cool, dry, and dark environment or as recommended by manufacturer.

C. Liquid shall conform to AWWA B301.

PART 3 EXECUTION

14.3.01 PREPARATION

A. Notify Brigham City at least 72 hours prior to any flushing or disinfecting.

B. Contractor shall install temporary connections for flushing water lines after disinfection. After the satisfactory completion of the flushing work, the Contractor shall remove and plug the temporary connection.

14.3.02 TABLET METHOD

A. Tablet Method PG AWWA C651-92, Section 5.1

B. The tablet method consists of placing calcium hypochlorite granules and tablets in the water main as it is being installed and filling the main with potable water when installation is completed.

C. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.

D. Placing of calcium hypochlorite granules: During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules shall be as shown in Table 1. Warning: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

TABLE 1
Ounces of Calcium Hypochlorite Granules to be Placed
at Beginning of Main and Each 500-ft Interval

Pipe Diameter (in.)	**Calcium Hypochlorite Granules (oz.)**
4	0.5
6	1.0
8	2.0
10	3.0
12	4.0
16 and larger	8.0

E. Placing of calcium hypochlorite tablets: During construction, 5 gram calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch main, and other appurtenances. The number of 5 gram tablets required for each pipe section shall be $0.0012d^2L$ rounded to the next higher integer, where d is the inside pipe diameter, in inches, and L is the length of the pipe section, in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. The tablets shall be attached by an adhesive such as Permatex No. 1, or equal. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

F. When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 ft/s. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41° F, the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service.

TABLE 2
Tablets to be Placed in Pipe Sections

Pipe Diameter, Inches	Length of Pipe Section, ft.				
	13 or less	18	20	30	40
	Number of 5 gram Calcium Hypochlorite Tablets				
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13
20	5	8	10	14	18

* Based on 3.25 g available chlorine per tablet (65% available chlorine per 5 gram tablet); any portion of tablet rounded to next higher number. Dose of 25 mg/l required.

G. Chlorination of the completed culinary water distribution system shall be provide with a disinfection dosage of 25 mg/l. The dosage shall be of sufficient strength to provide a minimum of 10 ppm residual after a 24 hour contact in the pipeline.

H. If directed by the City, the completed piping system, or specified sections, shall be "super chlorinated." :Super chlorination" shall provide doesage of 100 mg/l of chlorine for a period of at least 3 hours. The chlorine residual shall be a minimum of 50 mg/l after the 3 hour contact time.

14.3.03 ALTERNATIVE METHODS

A. Alternative disinfection methods:
   1. Continuous-Feed Method PG AWWA C651-92, Section 5.2.
   2. Slug Method PG AWWA C651-92, Section 5.3

14.3.04 FINAL FLUSHING

A. Clearing the main of heavily chlorinated water:

   1. After the applicable retention period, the chlorinated disinfection water shall be drained from the line.
   2. Flushing shall continue until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally

prevailing in the system.

B. Disposing of heavily chlorinated water:

1. The environment to which the chlorinated water is to be discharged shall be inspected. Do not discharge to any fish habitat, agricultural lands or other location where damage may occur.
2. If there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.
3. Contractor to comply with Federal Clean Water Act. If necessary, secure permission from Utah "DEQ" or County Health Department for disposal of heavily chlorinated water.

14.3.05 BACTERIOLOGICAL SAMPLING AND TESTING

A. Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulfate. A minimum of two (2) consecutive samples must be taken; 24 hours apart. A sampling tap shall be provided by the Contractor. Brigham City shall be responsible for sampling and bacteriologic analysis by a certified testing laboratory. Contractor to give minimum 48 hours notice to Brigham City prior to required sampling.

B. Water line:

1. After final flushing and before the water main is placed in service, a sample shall be collected from the water line and tested for the absence of coliform organisms in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater". The testing shall be by either the multiple tube fermentation technique or the membrane filter technique.
2. All samples shall be taken from a sampling tap or fire hydrant at a representative point on the system.
3. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained.
4. If check samples show the presence of coliform organisms, then the main shall be re-chlorinated by the continuous-feed or slug method of chlorination until satisfactory results are obtained.
5. High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, water entering the new main shall also be sampled.
6. When the samples are satisfactory, the water line may be placed in service upon receiving notification from the Brigham City Engineer to do so.

14.3.06 DISINFECTION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING MAINS

A. The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be

returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water present little danger of contamination and require no disinfection.

1. Trench treatment: When an old main is opened, either by accident or by design, liberal quantities of hypochlorite shall be applied to open trench areas.
2. Swabbing with hypochlorite solution: The interiors of all pipe and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a 1-percent hypochlorite solution before they are installed.
3. Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

14.3.07 SPECIAL PROCEDURE FOR CAULKED TAPPING SLEEVES

A. Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be dusted with calcium hypochlorite powder, at the rate of 100 mg per square foot.

SECTION 15

GRATES AND FRAMES

15.1 GENERAL: Grates and grate frames shall be the size and type shown on the drawings and shall be galvanized were specified. Frames shall be securely embedded in concrete by use of approved anchors. Covers for irrigation boxes shall be 1/4" thick diamond plate steel with an approved corrosion resistant painted surface complete with hinges and locking devices.

15.2 Any miscellaneous metal components required on public works projects and not shown on the Standard Drawings, shall be reviewed and approved by the City Engineer prior to construction.

SECTION 16

RESTORATION OF SURFACE IMPROVEMENTS

16.1 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 Section 2 - "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.

16.2 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 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:

	Ideal	Tolerance
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

16.3 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 Paragraph 16.2 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 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 unyielded. Density of the subgrade materials shall be 95% of 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 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 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 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 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 of 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.

16.4 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 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 Section 5 of these specifications.

SECTION 17

FENCING SPECIFICATIONS

17.1 GENERAL: This section shall cover the requirements for temporary construction fencing and permanent fencing along boundaries, property lines or open ditches as may be required by Brigham City.

17.2 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 Section 1.4.03 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 500 foot radius: not more than 10 feet.

Curves 500 foot radius to 200 foot radius: not more than 8 feet.

Curves 200 foot radius to 100 foot radius: not more than 6 feet.

Curves 100 foot radius: not more than 5 feet.

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

Pull posts shall be provided at 500 foot maximum intervals. Changes in line of 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 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 stretches 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 14 inch intervals. The top edge of fabric shall be attached to the top rail at approximately 24 inch intervals. The bottom tension wire shall be attached to the fabric with tie wires at 24 inch intervals and shall be secured to the end or pull posts with brace bands.

17.3 WOOD FENCE SPECIFICATIONS:

A. Materials:

(1) Slats: Redwood, cedar, combed spruce, or other wood covering acceptable to the City Engineer or his representative.

(2) Bottom and Top Rail: Minimum 2 inch x 4 inch x 8 foot cedar stud.

(3) Corner, Gate, End, or Line Posts: Minimum size 4 inch x 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 Section 1.4.03 of the Subdivision Technical Specifications.

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 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 bot the top and bottom rail.

17.4 CONSTRUCTION FENCE SPECIFICATIONS - TYPE “D”:

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 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 (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.

SECTION 18

FIBER OPTIC COMMUNICATION LINES

18.1 OVERVIEW: This section is intended to define communications construction and general conduit placement guidelines for new developments. It is intended for use by developers to ensure the coordination of communications infrastructure with all utility placements to minimize future impact.

18.2 UNDERGROUND LINES:

A. All new communications facilities shall be constructed underground unless otherwise authorized by the City.

B. Construction methods should follow the highest standards (see Standard Details).

C. No overhead communication lines will be allowed unless required by the Utility and authorized by the City.

D. All conduit will be placed in accordance with the highest of industry standards and adhere to any City, State or Federal guidelines that govern buried utility placement.

18.3 GENERAL PLACEMENT & LOCATION GUIDELINES: In new developments Communications conduit shall be installed to serve all lots. Communications conduits shall be placed in conjunction, or in a joint trench alongside, any power conduit being installed (see Standard Details). This ensures proper area distribution and coverage. This includes placing Communications conduit alongside power conduit being installed to any new building or structure. In addition, these conduits may be placed in a joint trench alongside Water, Sewer or most any other utility as approved by the City. Conduit shall be installed at any planned street crossing.

A. Communications conduit shall be placed in the location as specified in the Standard Details. Any variance from this location placement shall be authorized by the City.

B. 4 each 1.25" HDPE conduits orange in color shall be placed along both sides of any major thoroughfares or roads consisting of more than 2 traffic lanes.

C. 2 each 1.25" HDPE conduits orange in color shall be placed along both sides of any secondary collector street.

D. If communications conduit is to be placed in the same trench or near other utilities, it shall be located a minimum of 2 diameters of the main service of the utility or 36" away from the communications conduit to ensure that repairs to either conduit can be made without disturbing the other (see Standard Details).

18.4 DEPTH:

A. When placing conduit along major thoroughfares, or roads, conduit shall be installed with a minimum of twenty four inches (24") of cover from the final grade. In the

immediate vicinity of service boxes, the conduit shall be laid at a shallower depth with a cover of 15", such that they are directly below the bottom of the service box. The conduit shall be visible when the cover of the box is removed. The conduit is not to be cut at service boxes, but it to be laid continuously under the boxes.

B. When placing conduit to any new building or structure, conduit shall be installed with a minimum of twelve inches (12") of cover from the final grade.

18.5 CONDUIT SPECIFICATIONS:

A. Conduit for fiber optic cable shall be placed if the development activity:

1. is greater than 400 lineal feet.
2. runs down a City-owned Street.
3. runs down a Private Street that crosses a City-owned Street.
4. passes through a City-owned Street.

B. All conduits shall be communication grade conduit. HDPE conduit shall be SDR-11, or equivalent, orange in color, meeting ASTM-3035 specifications unless otherwise specified by the City.

C. Each conduit shall have "FIBER" permanently marked on it at a minimum interval of 3 feet.

D. Proper HDPE couplers shall be used to join any two conduits.

18.6 TELECOMMUNICATIONS CONDUIT FOR FUTURE USE (OTHER THAN IN NEW DEVELOPMENTS)

A. Conduit Material shall be one 4" schedule 40 PVC conduit rated at 194° F meeting NEMA TC-2, NEMA TC-3, UL listed.

B. Conduits shall be installed across streets from right-of-way line to right-of-way line. Crossing shall be at intersections (generally at about the end of the curb return) and at approximately 400' intervals. Locations shall be shown on the improvement plans and approved by the City. In order to mark the location of conduits, a "C" shall be stamped in the top of curb (before it is cured) at locations where the conduit crosses the curb and gutter. Conduit shall be laid 36" below the finished road grade, measured to the top of the conduit.

18.7 CONDUIT INSTALLATION:

A. Conduit shall be inspected for defects before installation. Any defects shall be repaired or the conduit shall be replaced, whichever is deemed necessary by the Engineer.

B. All conduits shall be laid and maintained to the required lines and grades. The Contractor shall be responsible to install the conduit line to the alignment set by the Engineer or as shown on the Drawings.

C. Cutting of conduit for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method recommended by the manufacturer.

D. Where water is encountered in the trench, it shall be removed during conduit laying operations and the trench so maintained until the ends of the conduits are sealed.

E. The Contractor shall take the necessary precautions such that foreign materials do not enter into the conduit. No debris, tools, or other materials shall be placed in the conduit during laying operations. When laying of conduit is not in progress, the conduit shall be closed by a watertight plug.

F. At no time shall the conduit be deformed to make any bend. Maximum vertical or horizontal deflections of conduit are not to exceed a ratio of 10:1 along its length (e.g. no more than 4”deflection per 40” length). The total number of bends in any conduit run shall not exceed three hundred sixty degrees (360°).

G. A pull rope or jet line shall be left inside all conduits compete with access to both ends and characteristics suitable to pull stiff innerduct or cables with relative ease.

H. All conduit shall be proofed. For this purpose, telecommunications conduit shall include a 3” magnetic locator tape installed in the conduit trench approximately 12” below the ground surface, with the words “CAUTION: BURIED FIBER OPTIC CABLE” printed on it.

I. All service conduit stubs and junctions shall be installed complete with metal detection material (tracer wire) and capped ends. Trace wire shall be twelve (12) gauge solid THHN wire installed along all conduits according to NESC standards.

J. The contractor shall provide all materials used in the installation of conduits, such as bends, adapters, couplings, glue, plugs and fittings, to meet or exceed all of the recommendations of the conduit manufacturer for suitable installation.

K. In the event trench materials are not, in the judgment of the Engineer, satisfactory for conduit bedding, imported granular bedding will be required.

18.8 SERVICE BOX ACCESS POINTS: Placement of service boxes for access shall be required as part of conduit placement. Installation of service boxes shall be per the guidelines listed below.

A. When placing communications conduit along a new neighborhood, business corridor etc., install service boxes at a minimum of every other parcel passed.

B. Service boxes shall be green 15” deep, 14” x 20” HDPE Newbasis Splice/Valve Box S1420 with cover assembly, including stainless steel lock bolt (part no. SGA142015Y000) or an approved equal authorized by the City. The label “TELECOM” shall be imprinted on the cover.

C. Service Boxes shall be placed flush with the ground surface and located 24" (measured from the property line to the center of the enclosure) to one side of the property line

between adjacent parcels so as not to obstruct possible future fence installation.

D. Conduit/Cable service box spacing shall not exceed 1000'.

E. Install service boxes along major thoroughfares at 500’ intervals or at every intersection.

F. All service boxes shall be set according to communications utility construction standards (see Standard Details).

G. Service boxes shall be rated to handle loads required of the specific Right of Way where they are being placed and approved by the City.

H. Service boxes shall be placed on top of drain rock or gravel beds to ensure proper drainage and flooding control.

I. All conduit entering or existing Service boxes shall be sealed or capped to maintain conduit integrity.

18.9 FIBER OPTIC CABLE INSTALLATION:

A. Fiber Optic Cable shall be installed in conduits designated as Fiber Optic Conduit.

B. Fiber Optic Cable shall not be pulled through a conduit that is already occupied by other cable or services (such as power lines) as damage may result.

C. Fiber Optic Main communication cable shall be made ready for connection to all possible future services at each service box.

18.10 RECORDING OF PLACEMENT & RECORD DRAWING DOCUMENTATION:

A. Each conduit, hand hole, and access point placement shall be recorded using a common GIS coordinate system provided by the City.

B. Location and type attributes of infrastructure should be recorded in either an approved GIS database, or in electronic annotation as specified by the City. A precise (+/- 12 inches) x, y, and z (horizontal and vertical) coordinates shall be recorded for each transition point, running line change, or infrastructure change.

C. Conduit type, size, count and color shall be recorded. Conduit shall be represented as line or poly-line data.

D. Access points and hand holes should have precise (+/- 12 inches) x and y (horizontal) coordinates recorded. Type and size shall be recorded. Access points shall be represented as point data.

BRIGHAM CITY CORPORATION

PUBLIC WORKS STANDARD DRAWINGS

SUBMITTED & RECOMMENDED

Kent L. Jones — 7-01-05

KENT L. JONES P.E. — DATE
BRIGHAM CITY ENGINEER

REGISTERED PROFESSIONAL ENGINEER
No. 134045
Kent Lessing Jones
STATE OF UTAH

APPROVAL

7-01-05
LOU ANN CHRISTENSEN — DATE
BRIGHAM CITY MAYOR

7-01-05
BRUCE LEONARD — DATE
BRIGHAM CITY PUBLIC WORKS DIRECTOR

7-01-05
BLAIR BLONQUIST — DATE
BRIGHAM CITY WATER SUPERINTENDENT

7-01-05
DARIN MCFARLAND — DATE
BRIGHAM CITY STREET SUPERINTENDENT

7-01-05
DAVID L. COATES — DATE
BRIGHAM CITY WASTE TREATMENT SUPERINTENDENT

7-01-05
ATTEST, CITY RECORDER — DATE

SEAL

BRIGHAM CITY, UTAH
CORPORATE SEAL

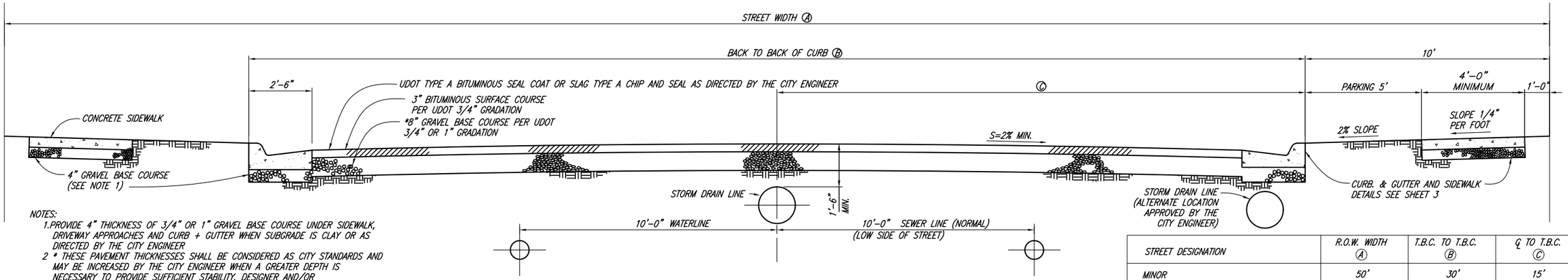
3rd Edition

July 2005

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

Index of Drawings

CS-01.....TITLE PAGE & INDEX OF DRAWINGS
CS-02.....ROADWAY SURFACE IMPROVEMENTS
CS-03.....STANDARD STREET INTERSECTION DETAILS
CS-04.....TYPICAL WHEELCHAIR RAMP, DEFECTIVE CONCRETE REPLACEMENT & IRRIGATION BOX
CS-05.....CUL-DE-SAC DETAILS
CS-06.....FIRE HYDRANT AND WATER SERVICE CONNECTIONS
CS-07.....TYPICAL WATER METER STATIONS
CS-08.....PRESSURE REDUCTION STATION - TYPE I & AIR VACUUM RELIEF STATION
CS-09.....SANITARY SEWER DETAILS & CLEANOUT
CS-10.....SANITARY SEWER MANHOLE DETAILS
CS-11.....TYPICAL SEWER LIFT STATION
CS-12.....TYPE I THROUGH TYPE IV CATCH BASINS & CLEANOUT MANHOLE
CS-13.....TYPE V CATCH BASIN & OUTLET DIPSTONE DETAILS
CS-14.....STORM DRAIN MANHOLE & SUBSURFACE DRAINAGE DETAILS
CS-15.....FENCING STANDARDS
CS-16.....STANDARD FIBER OPTIC COMMUNICATION LINE DETAILS

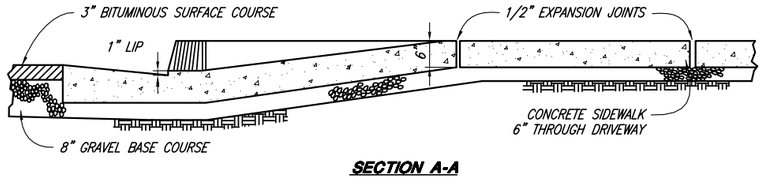


NOTES:
1. PROVIDE 4" THICKNESS OF 3/4" OR 1" GRAVEL BASE COURSE UNDER SIDEWALK, DRIVEWAY APPROACHES AND CURB + GUTTER WHEN SUBGRADE IS CLAY OR AS DIRECTED BY THE CITY ENGINEER
2. * THESE PAVEMENT THICKNESSES SHALL BE CONSIDERED AS CITY STANDARDS AND MAY BE INCREASED BY THE CITY ENGINEER WHEN A GREATER DEPTH IS NECESSARY TO PROVIDE SUFFICIENT STABILITY. DESIGNER AND/OR DEVELOPER MAY SUBMIT AN ALTERNATIVE PAVEMENT DESIGN BASED ON A DETAILED SOILS ANALYSIS FOR APPROVAL BY THE CITY ENGINEER WHICH MAY MODIFY PAVEMENT THICKNESS, BUT IN NO CASE SHALL THE BITUMINOUS SURFACE COURSE BE LESS THANN 3" AND GRAVEL BASE COURSE LESS THAN 4" THICK

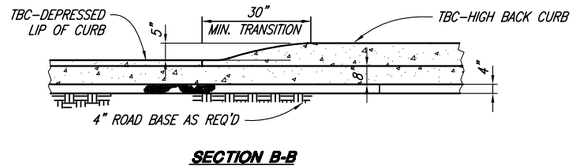
STANDARD BRIGHAM CITY ROADWAY SECTION

STREET DESIGNATION	R.O.W. WIDTH Ⓐ	T.B.C. TO T.B.C. Ⓑ	℄ TO T.B.C. Ⓒ
MINOR	50'	30'	15'
STANDARD RESIDENTAL	60'	40'	20'
COLLECTOR	66'	46'	23'
MINOR ARTERIAL	84'	64'	32'
MAJOR ARTERIAL	100'	80'	40'

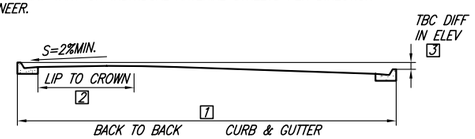
NOTES:
1. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURBS ON OPPOSITE SIDES OF THE STREET SHALL NOT EXCEED THOSE SHOWN IN DETAIL & TABLE BELOW
2. ON ARTERIAL STREETS AND CERTAIN STREETS APPROVED BY THE CITY COUNCIL THE CITY ENGINEER WILL PROVIDE A PAVEMENT DESIGN LOCATION OF SIDEWALK AND CURB + GUTTER MAY VARY ON INDIVIDUAL ARTERIAL STREETS PER DIRECTION OF THE CITY ENGINEER.



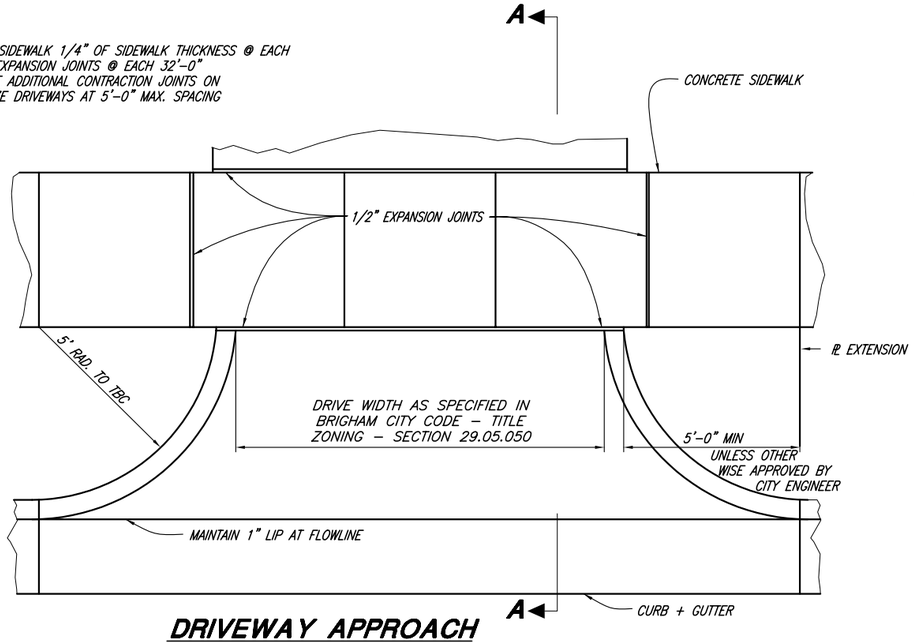
SECTION A-A



SECTION B-B



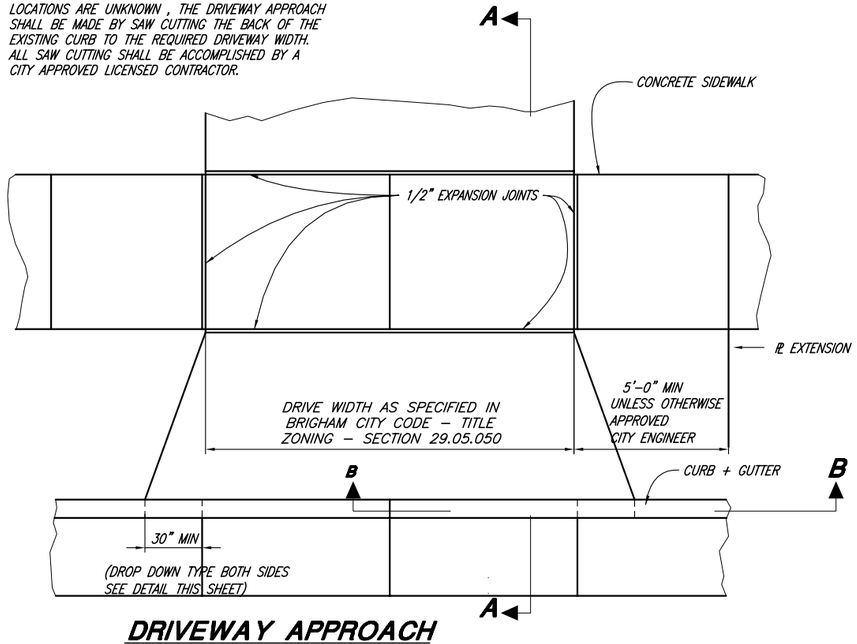
NOTE: SCORE SIDEWALK 1/4" OF SIDEWALK THICKNESS @ EACH 4'-0" EXPANSION JOINTS @ EACH 32'-0" PROVIDE ADDITIONAL CONTRACTION JOINTS ON OVERSIZE DRIVEWAYS AT 5'-0" MAX. SPACING



DRIVEWAY APPROACH

CURB RADIUS STYLE (SPECIAL CASE APPROVAL REQUIRED)

NOTE: IN NEW SUBDIVISIONS WHERE FUTURE DRIVEWAY LOCATIONS ARE UNKNOWN , THE DRIVEWAY APPROACH SHALL BE MADE BY SAW CUTTING THE BACK OF THE EXISTING CURB TO THE REQUIRED DRIVEWAY WIDTH. ALL SAW CUTTING SHALL BE ACCOMPLISHED BY A CITY APPROVED LICENSED CONTRACTOR.



DRIVEWAY APPROACH

DROP DOWN STYLE

CROWN LOCATION TABLE

1	2	3
40'	20'	0.00
40'	12.0'	0.50
40'	10.0'	1.00
46'	23.5'	0.00
46'	10.5'	0.50
46'	10.5'	1.00

CROWN LOCATION FOR VARIOUS CROSS SLOPES

NOTE: ALL OTHER PROPOSED STREET X-SECTION SHALL BE AS APPROVED BY THE CITY ENGINEER

REGISTERED PROFESSIONAL ENGINEER No. 134045 Kent Lessing Jones STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

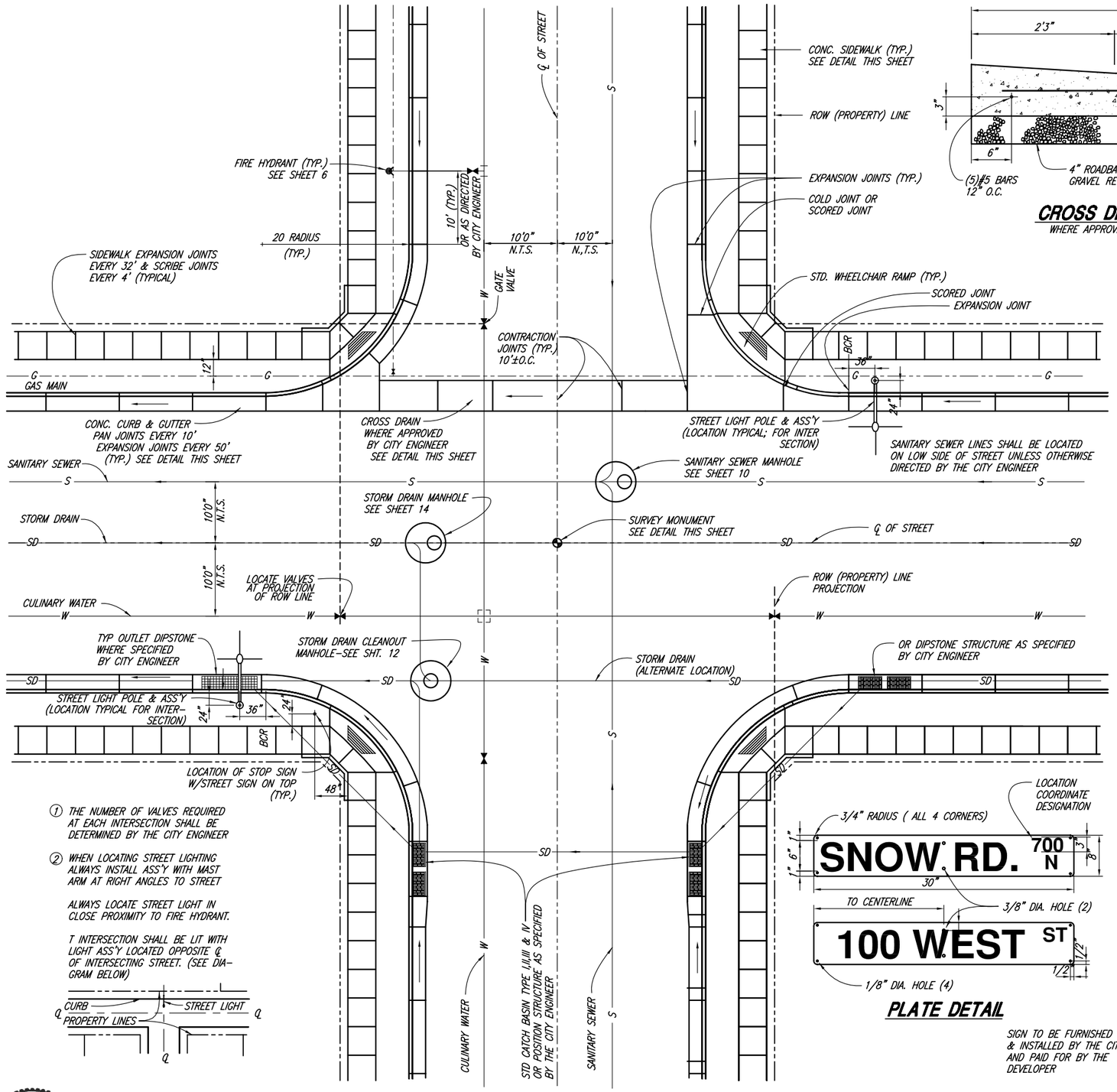
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
ROADWAY SURFACE IMPROVEMENTS

SHEET: CS-02
OF 16 SHEETS



1. THE NUMBER OF VALVES REQUIRED AT EACH INTERSECTION SHALL BE DETERMINED BY THE CITY ENGINEER

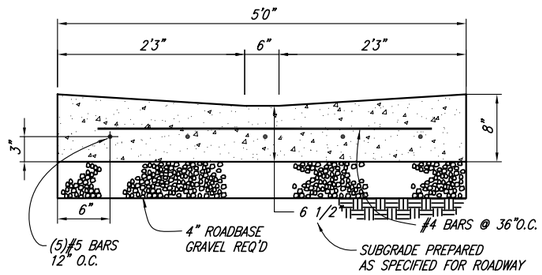
2. WHEN LOCATING STREET LIGHTING ALWAYS INSTALL ASS'Y WITH MAST ARM AT RIGHT ANGLES TO STREET

   ALWAYS LOCATE STREET LIGHT IN CLOSE PROXIMITY TO FIRE HYDRANT.

   T INTERSECTION SHALL BE LIT WITH LIGHT ASS'Y LOCATED OPPOSITE ℄ OF INTERSECTING STREET. (SEE DIA-GRAM BELOW)

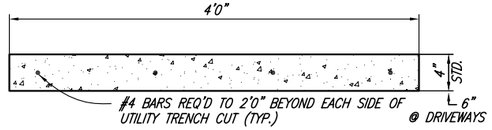
PLATE DETAIL

SIGN TO BE FURNISHED & INSTALLED BY THE CITY AND PAID FOR BY THE DEVELOPER

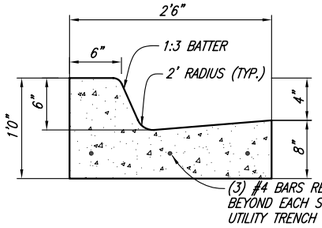


CROSS DRAIN SECTION

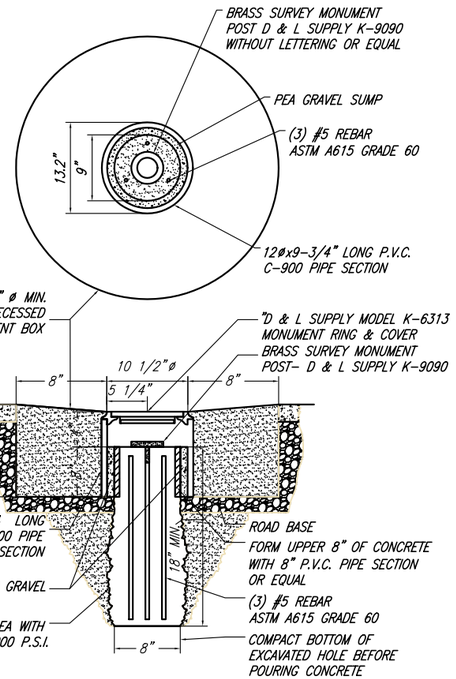
WHERE APPROVED BY CITY ENGINEER



SIDEWALK SECTION

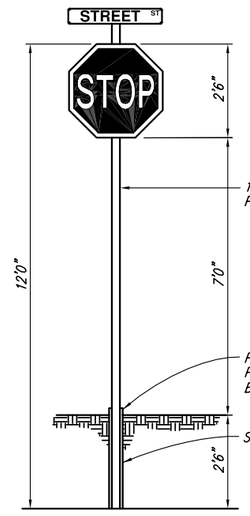


CURB & GUTTER SECTION



SURVEY MONUMENT DETAIL

ALL SIGNS SHALL CONFORM TO THE REQUIREMENTS OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES"



TRAFFIC SIGN & POST

TRAFFIC SIGN NOTES:

1. BACKGROUND SHALL BE GREEN, HIGH INTENSITY REFLECTIVE SHEETING 9FP-85 TYPE IIIA)
2. LEGEND SHALL BE WHITE LETTERS, HIGH INTENSITY REFLECTIVE SHEETING 9FP-85 IIIA)
3. SIGN BLANK SHALL BE 6081-T6 HEAT TREATED HIGH TENSILE DEGREASED ALUMINUM W/ALODINE 1200 FINISH-THICKNESS SHALL BE 0.08"
4. EACH SIGN SHALL CONSIST OF TWO PLATES RIVETED TOGETHER & MOUNTED AS SHOWN
5. SIGN ON PRIVATE ROADS SHALL MEET ALL SPECIFICATIONS FOR STANDARD SIGNS, EXCEPT BACKGROUND SHALL BE BLUE
6. ALL STREETS WITH NAMES MUST ALSO SHOW LOCATIONS COORDINATE DESIGNATION
7. ADDRESS COORDINATE MUST BE CONTACTED PRIOR TO MAKING SIGNS TO VERIFY PROPER NAMES AND COORDINATES

REGISTERED PROFESSIONAL ENGINEER — No. 134045 Kent Lessing Jones — STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
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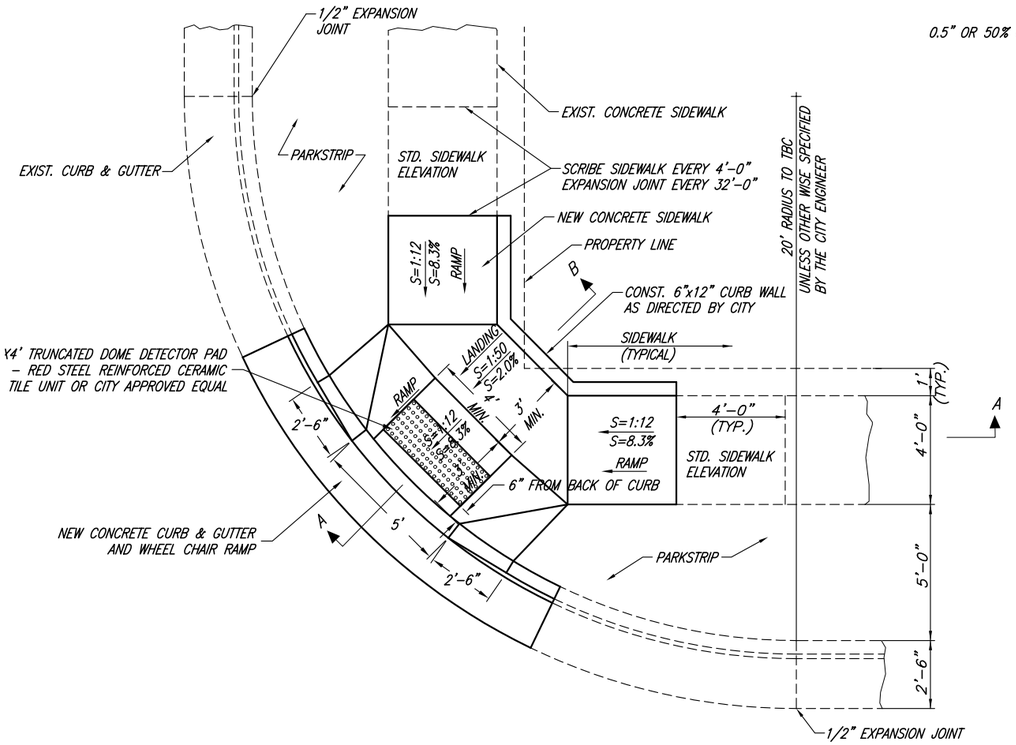
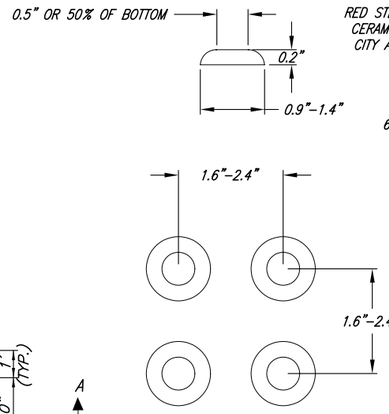
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
STANDARD STREET INTERSECTION DETAILS

SHEET: CS-03 OF 16 SHEETS

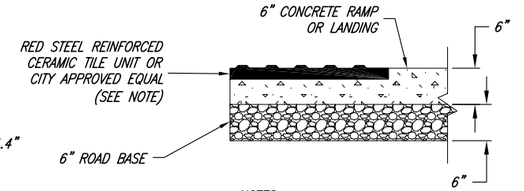




NOTES:
1. LOCATE DETECTABLE WARNINGS SO THAT THE EDGE NEAREST THE BACK OF CURB OR OTHER POTENTIAL HAZARD IS 6 INCHES FROM THE BACK OF CURB OR OTHER POTENTIAL HAZARD. PROVIDE 2-FOOT MINIMUM DEPTH.

SEE FIGURE FOR TRUNCATED DOME SIZE AND SPACING DIMENSION DETAILS.

TRUNCATED DOME DETAIL



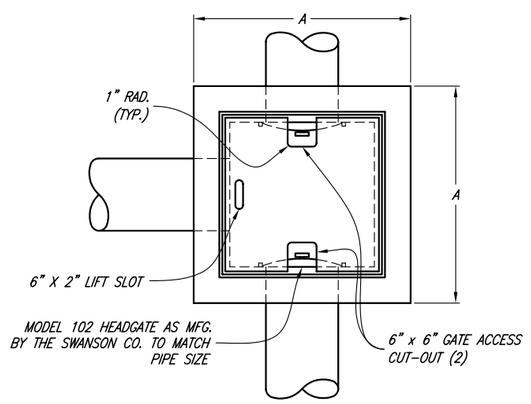
NOTES:
1. INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

TILE DETAIL

GENERAL NOTES:
A. THE DETECTABLE WARNING SURFACE DOMES SHALL BE ORIENTED SUCH THAT THE ROWS ARE PARALLEL WITH THE DIRECTION OF PEDESTRIAN TRAVEL TO THE RAMP ON THE OPPOSITE SIDE OF THE STREET.

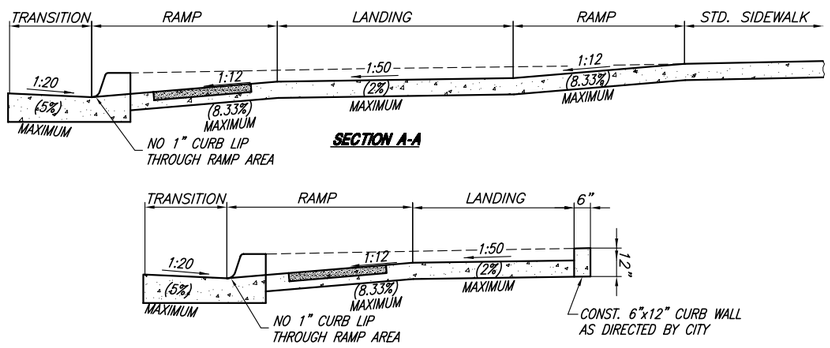
B. THE COLOR FOR THE DETECTABLE WARNING SURFACE SHALL BE RED IN COLOR AS APPROVED BY THE CITY OR AUTHORIZED REPRESENTATIVE.

C. WHEN A DETECTABLE WARNING SURFACE DOME IS CUT, THE REMAINING PORTION OF THE DOME SHALL BE BEVELED TO A MAXIMUM SLOPE OF 1:2.

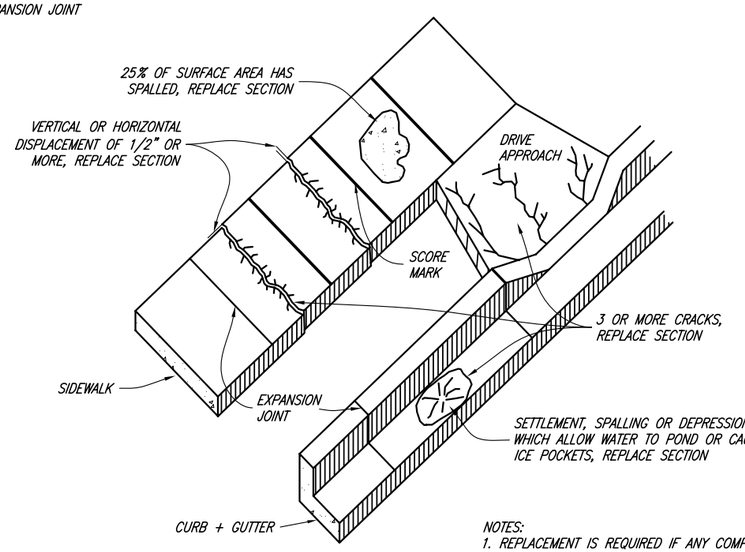


PLAN

DIMENSION	TYPE I	TYPE II
A	3'-0"	4'-0"
B	2'-1 1/2"	3'-1 1/2"
C	2'-1"	3'-1"
D	2'-0"	3'-0"

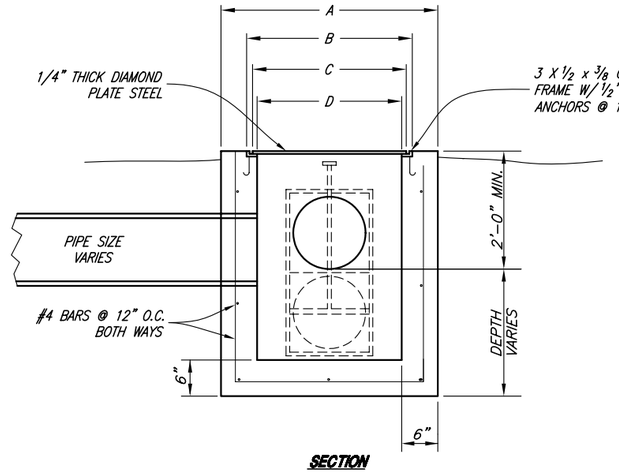


TYPICAL WHEEL CHAIR RAMP



NOTES:
1. REPLACEMENT IS REQUIRED IF ANY COMPONENT HAS ONE OR MORE OF THE CONDITIONS SHOWN ABOVE.
2. ANYTIME CONCRETE IS CUT TO REPLACE A DEFECTIVE COMPONENT, THE CUT SHOULD EXTEND COMPLETELY THROUGH THE PIECE BEING REPLACED.

DEFECTIVE CONCRETE REPLACEMENT CRITERIA



SECTION

NOTES:
1. PIPE MATERIALS & SIZE SHALL BE APPROVED BY IRRIGATION COMPANY.
2. HORIZONTAL & VERTICAL ALIGNMENT TO BE APPROVED BY BRIGHAM CITY.

IRRIGATION BOX

REGISTERED PROFESSIONAL ENGINEER — No. 134045 Kent Lessing Jones — STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

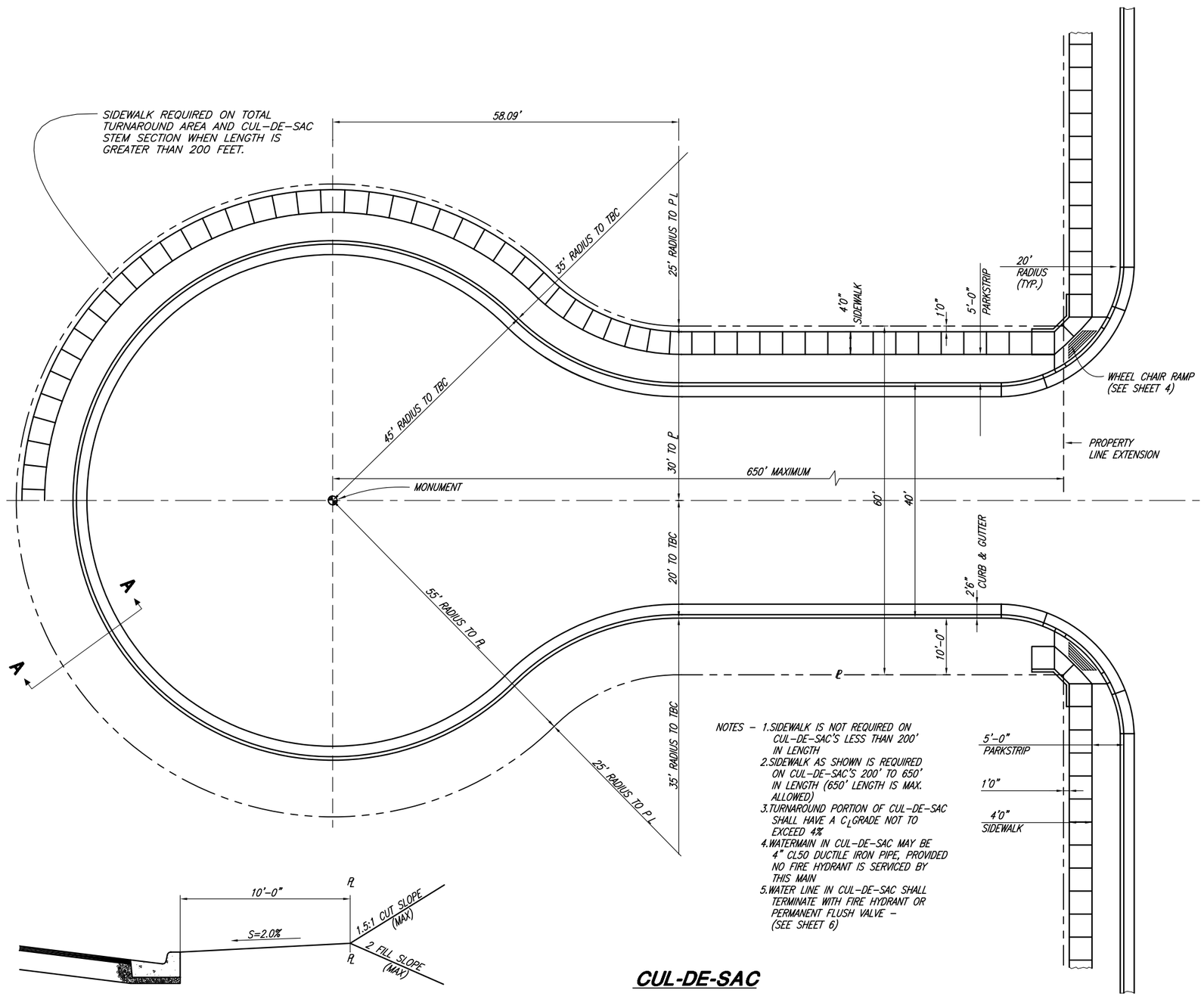
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES — CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
TYPICAL WHEELCHAIR RAMP, DEFECTIVE CONCRETE REPLACEMENT & IRRIGATION BOX

SHEET: CS-04
OF 16 SHEETS

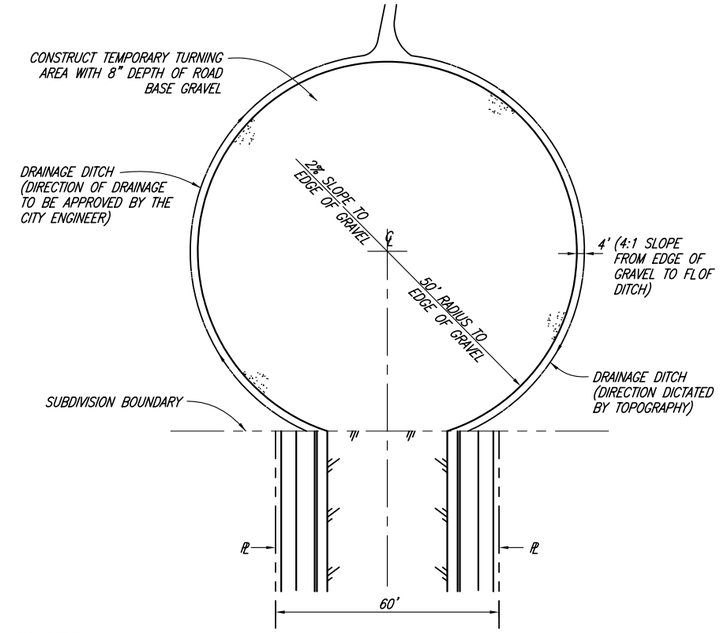


NOTES –
1. SIDEWALK IS NOT REQUIRED ON CUL-DE-SAC'S LESS THAN 200' IN LENGTH
2. SIDEWALK AS SHOWN IS REQUIRED ON CUL-DE-SAC'S 200' TO 650' IN LENGTH (650' LENGTH IS MAX. ALLOWED)
3. TURNAROUND PORTION OF CUL-DE-SAC SHALL HAVE A C_L GRADE NOT TO EXCEED 4%
4. WATERMAIN IN CUL-DE-SAC MAY BE 4" CL50 DUCTILE IRON PIPE, PROVIDED NO FIRE HYDRANT IS SERVICED BY THIS MAIN
5. WATER LINE IN CUL-DE-SAC SHALL TERMINATE WITH FIRE HYDRANT OR PERMANENT FLUSH VALVE – (SEE SHEET 6)

CUL-DE-SAC

SECTION A-A

REQUIRED GRADING BETWEEN TBC AND PROPERTY LINE



TEMPORARY TURNAROUND

NOTE: WHEN TURNAROUND CANNOT BE CONSTRUCTED OUTSIDE OF THE SUBDIVISION, IT SHALL BE LOCATED ON A PORTION OF THE SUBDIVISION LOTS (AS NEEDED) WITH THE SUBDIVIDER PLACING IN ESCROW AN AMOUNT OF MONEY SUFFICIENT TO COMPLETE THE STREET IMPROVEMENTS TO THE SUBDIVISION BOUNDARY. THESE FUNDS WILL BE USED AT SUCH TIME THE STREET IS EXTENDED.

℄ OF ROAD

NOTE: THE CIRCULAR CUL-DE-SAC LAYOUT SHOWN ON THIS SHEET IS TO BE CONSIDERED AS THE CITY STANDARD DESIGN. OTHER ALTERNATE DESIGN MAY BE CONSIDERED AS APPROVED BY THE CITY ENGINEER.

REGISTERED PROFESSIONAL ENGINEER — No. 134045 Kent Lessing Jones — STATE OF UTAH

Kent L. Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

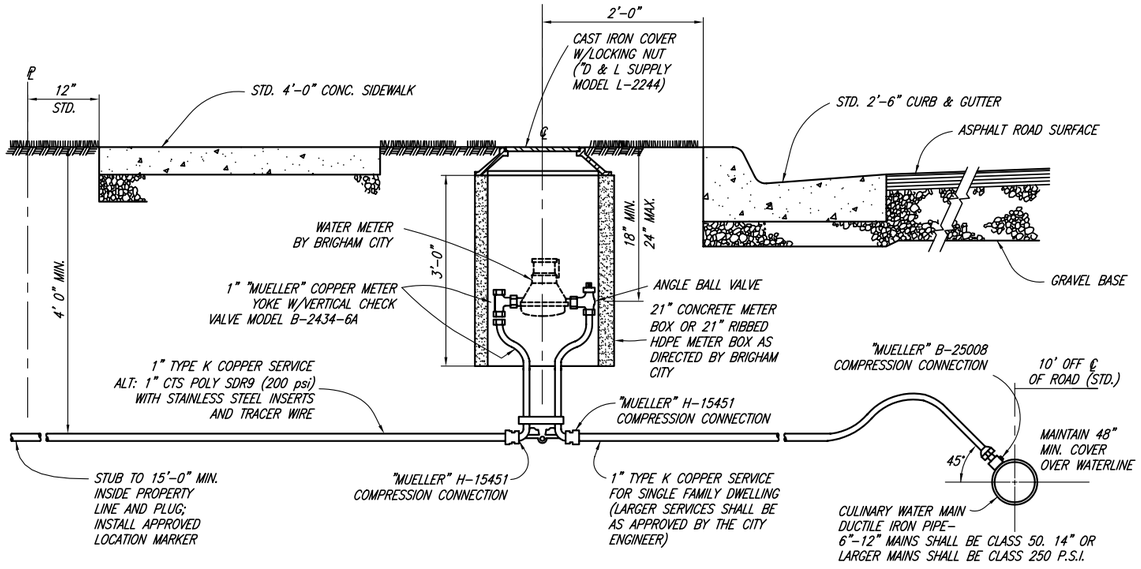
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
CUL-DE-SAC DETAILS

SHEET: CS-05
OF 16 SHEETS



TYPICAL CULINARY WATER SERVICE CONNECTION

THRUST PER P.S.I. OF WATER PRESSURE AT VARIOUS FITTINGS				
PIPE SIZE	DEAD END OR TEE	90° ELBOW	45° ELBOW	22 1/2° ELBOW
4	19	27	15	7
6	39	55	30	15
8	67	94	51	26
10	109	154	84	43
12	155	218	119	61
14	210	296	161	82
16	272	383	209	106
18	351	494	269	137
20	434	611	333	169
24	623	878	478	244

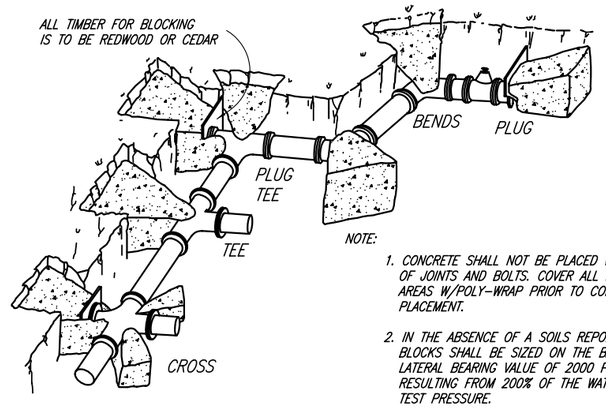
EXAMPLE:

8-INCH 90° ELBOW, PRESSURE 200 LB./SQ. IN.
FROM TABLE : THRUST = 94 x 200 = 18,800 LB.
ASSUME BEARING STRENGTH OF SOIL = 2000 LB./SQ. FT.

$\frac{18,800}{2,000}$ = 9.4 SQ. FT. AREA OF BEARING REQUIRED FOR THRUST BLOCK

NOTES:

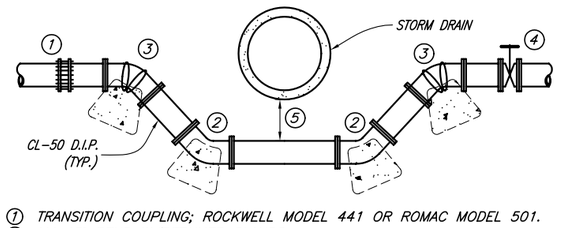
1. IN USING THE ABOVE TABLES, USE THE MAXIMUM INTERNAL PRESSURE ANTICIPATED (I.E. HYDROSTATIC TEST PRESSURE, POSSIBLE SURGE PRESSURE DUE TO PUMP SHUT OFF, ETC.).
2. SEE SOILS REPORT FOR BEARING STRENGTH OF SOIL. IN THE ABSENCE OF A SOILS REPORT, AN AVERAGE SOIL (SPADABLE MEDIUM CLAY) CAN BE ASSUMED TO HAVE A BEARING STRENGTH OF 2000 P.S.F.



THRUST BLOCKING

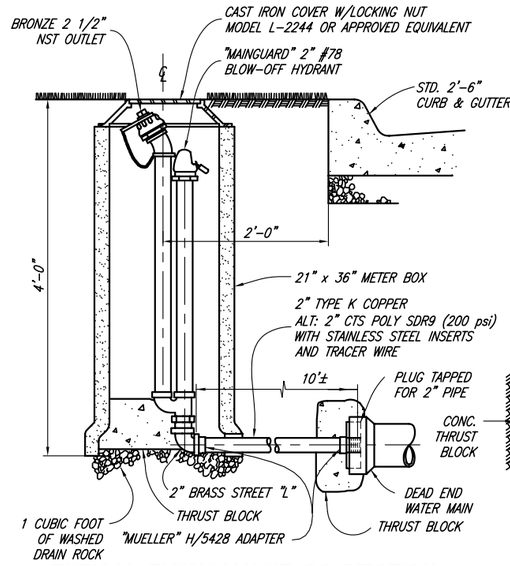
NOTE:

1. CONCRETE SHALL NOT BE PLACED WITHIN 1-1/2" OF JOINTS AND BOLTS. COVER ALL METAL CONTACT AREAS W/POLY-WRAP PRIOR TO CONCRETE PLACEMENT.
2. IN THE ABSENCE OF A SOILS REPORT, ALL THRUST BLOCKS SHALL BE SIZED ON THE BASIS OF A MAX. LATERAL BEARING VALUE OF 2000 P.S.F. AND A THRUST RESULTING FROM 200% OF THE WATERLINE STATIC TEST PRESSURE.
3. THRUST BLOCKS ARE REQ'D. AT ALL BENDS OF 22-1/2" OR MORE.
4. CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF NOT LESS THAN 2500 PSI IN 28 DAYS.

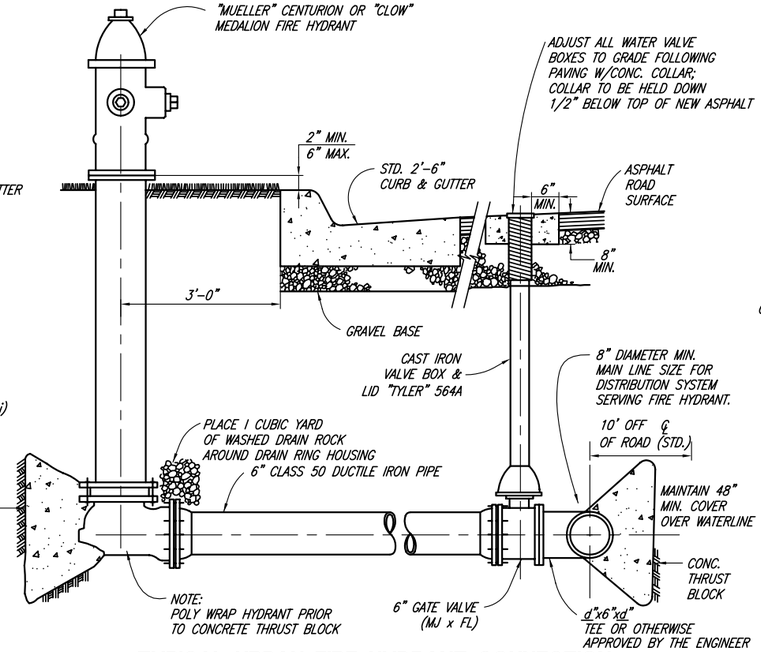


1. TRANSITION COUPLING; ROCKWELL MODEL 441 OR ROMAC MODEL 501.
2. MJ 45° BEND W/RETAINER GLANDS.
3. CONSTRUCT THRUST BLOCKS AT EACH 45° BEND W/(3) #6 REBARS SECURING BLOCK TO FITTING (EPOXY COATING).
4. FURNISH & INSTALL MJ GATE VALVE & BOX.
5. MINIMUM OF 12" COVER BETWEEN THE WATERLINE AND STORM DRAIN PIPE TO BE CROSSED.

TYPICAL WATERLINE LOOP

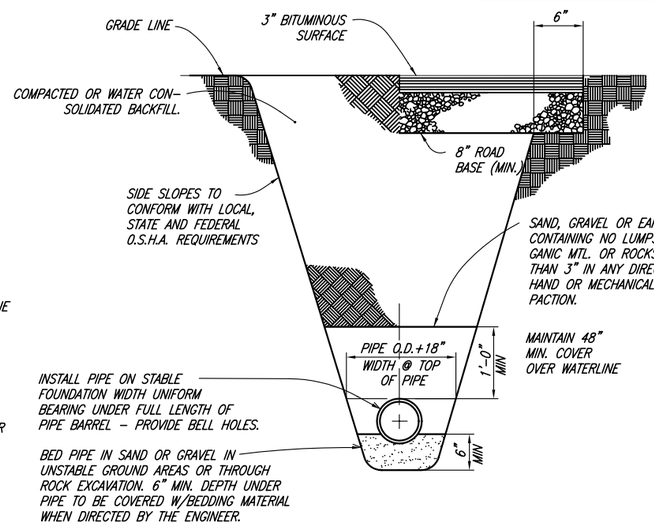


TYPICAL FLUSH VALVE CONNECTION

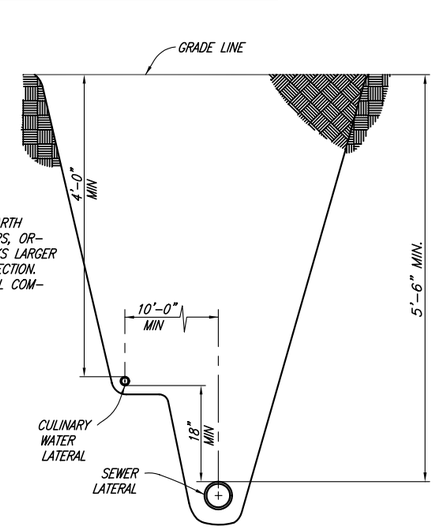


TYPICAL URBAN FIRE HYDRANT CONNECTION

NOTE:
ALL SPECIFIED BRANDS OF MATERIALS SHOWN ON THESE DRAWINGS ARE "CITY STANDARDS." OTHER EQUIVALENT BRANDS MAY BE USED WITH THE PRIOR APPROVAL OF THE CITY ENGINEER AND THE CITY WATER DEPARTMENT SUPERINTENDENT.



TYPICAL TRENCH SECTION



COMBINED WATER & SEWER LATERAL SECTION

REGISTERED PROFESSIONAL ENGINEER — No. 134045 Kent Lessing Jones — STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

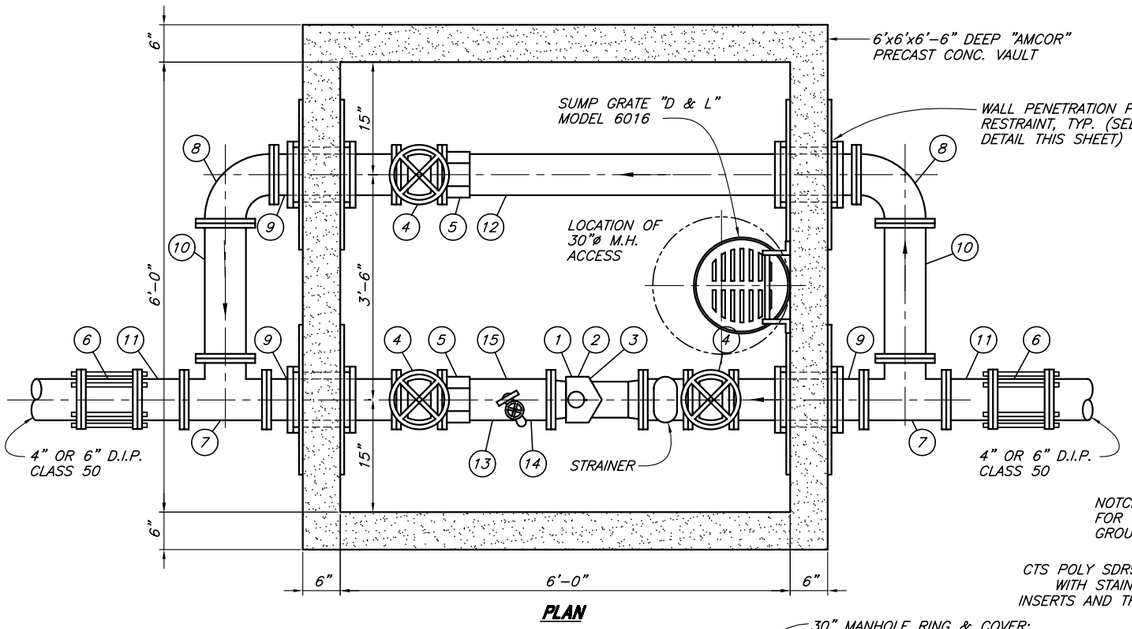
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

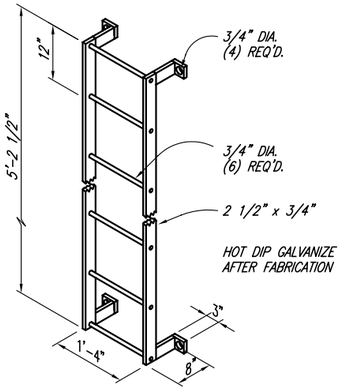
BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
FIRE HYDRANT AND WATER SERVICE CONNECTIONS

SHEET: CS-06 OF 16 SHEETS



PLAN



LADDER DETAIL

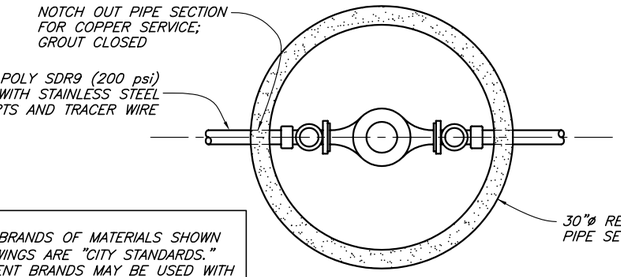
PIPE & FITTING SCHEDULE

NO.	DESCRIPTION (3",4" & 6" METER STA.)	JOINT TYPE	3" LINE	4" LINE	6" LINE
1	"SENSUS" W-350DR METER W/ STRAINER	FL	3"	–	–
2	"SENSUS" W-1000DR METER W/STRAINER	FL	–	4"	–
3	"SENSUS" W-2000DR METER W/STRAINER	FL	–	4"	6"
4	GATE VALVE	FL	3"	4"	6"
5	"ROMAC" FCA501 FLANGED COUPLING ADAPTER	FLxPE	3"	4"	6"
6	"ROMAC" 501 FLEXIBLE PIPE COUPLING	FLxPE	3"	4"	6"
7	TEE	FL	3"	4"	6"
8	90° ELBOW	FL	3"	4"	6"
9	SPOOL PIECE	FL	3"x24"	4"x24"	6"x24"
10	SPOOL PIECE	FL	3"x31"	4"x29"	6"x26"
11	NIPPLE	FLxPE	3"x12"	4"x12"	6"x12"
12	NIPPLE	FLxPE	3"x74"	4"x74"	6"x74"
13	NIPPLE	FLxPE	3"x23"	–	–
14	NIPPLE	FLxPE	–	4"x19"	–
15	NIPPLE	FLxPE	–	–	6"x12 3/8"

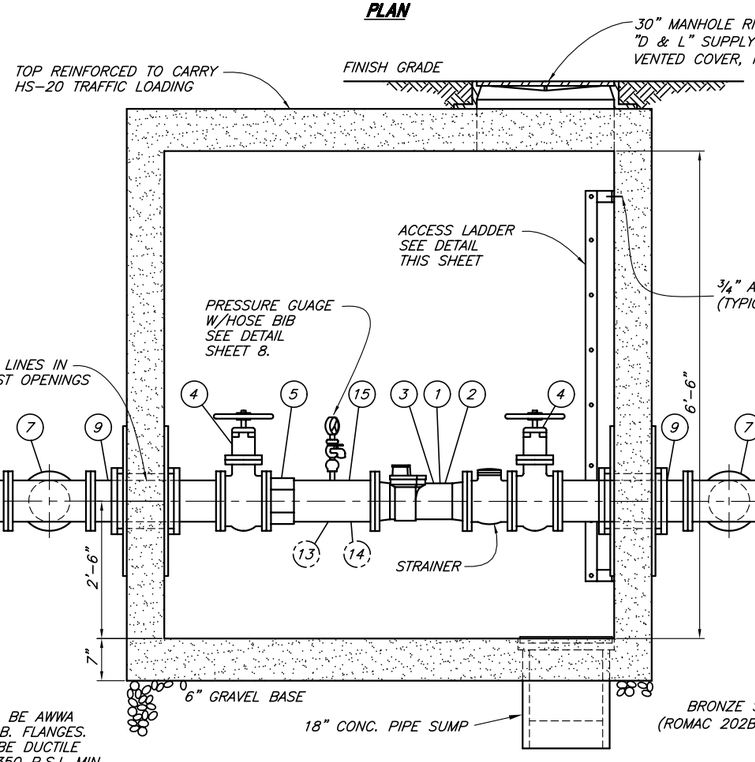
NO.	DESCRIPTION (1 1/2" & 2" METER STA.)	JOINT TYPE	1 1/2" LINE	2" LINE
16	"ROCKWELL/SENSUS" SR WATER METER	FL	1 1/2"	2"
17	"MUELLER" B-2423-2 METER YOKE (18" HEIGHT)	–	1 1/2"	2"
18	"MUELLER" 110 COMPRESSION CONN. COUPLING	–	1 1/2"	2"

GENERAL NOTES:

1. PROPERTY OWNER OR CONTRACTOR SHALL PAY FOR ALL COSTS OF INSTALLATION INCLUDING ALL MATERIALS, ALL EXCAVATION AND FILL, ASPHALT REPLACEMENT AND WATER MAIN CONNECTION.
2. INSPECTION OF ALL WATER LINE INSTALLATIONS WILL BE DONE BY BRIGHAM CITY WATER DEPT., WITH A 48 HOUR MINIMUM NOTICE REQUIRED PRIOR TO START OF WORK.
3. IF APPLICABLE, A BRIGHAM CITY CUT PERMIT MUST BE REQUESTED AND APPROVED PRIOR TO START OF WORK.



PLAN



SECTION

NOTE:
ALL FITTINGS SHALL BE AWWA C-110 WITH 125 LB. FLANGES. ALL PIPING SHALL BE DUCTILE IRON PIPE-CLASS 350 P.S.I. MIN.

3", 4" & 6" WATER METER STATION

NOTE:
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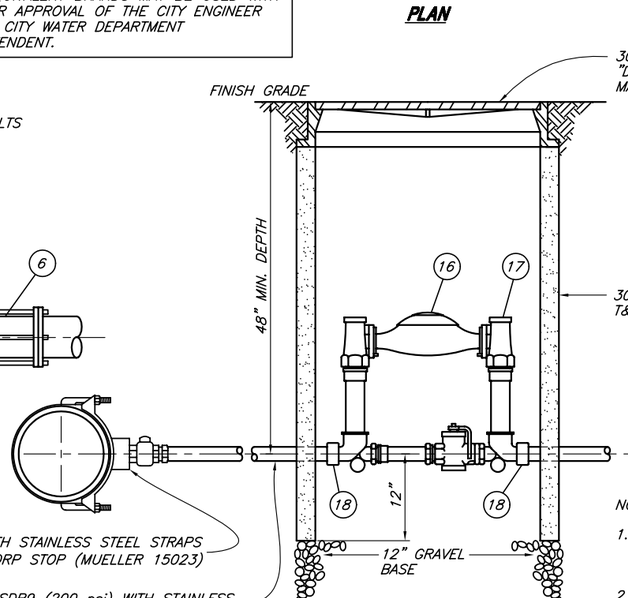
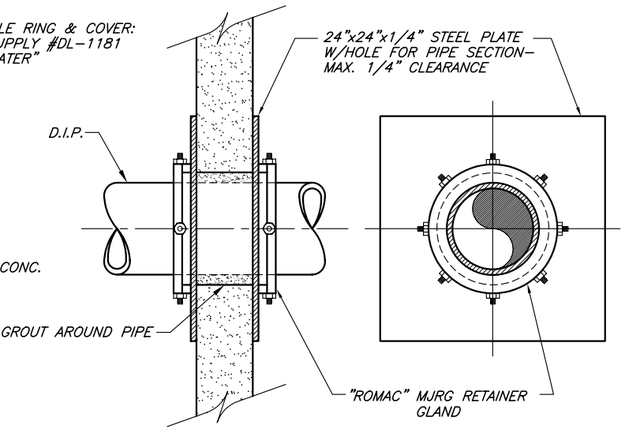


SECTION



WALL PENETRATION DETAIL

NOTES:

1. ALL SERVICE LINES TO AND FROM METER TO BE CTS POLY SDR9 (200 psi) WITH STAINLESS STEEL INSERTS AND TRACER WIRE
2. 1 1/2" SERVICE LINE-13"METER
   2" SERVICE LINE-17"METER

1 1/2" & 2" WATER METER STATION

REGISTERED PROFESSIONAL ENGINEER No. 134045 Kent Lessing Jones STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

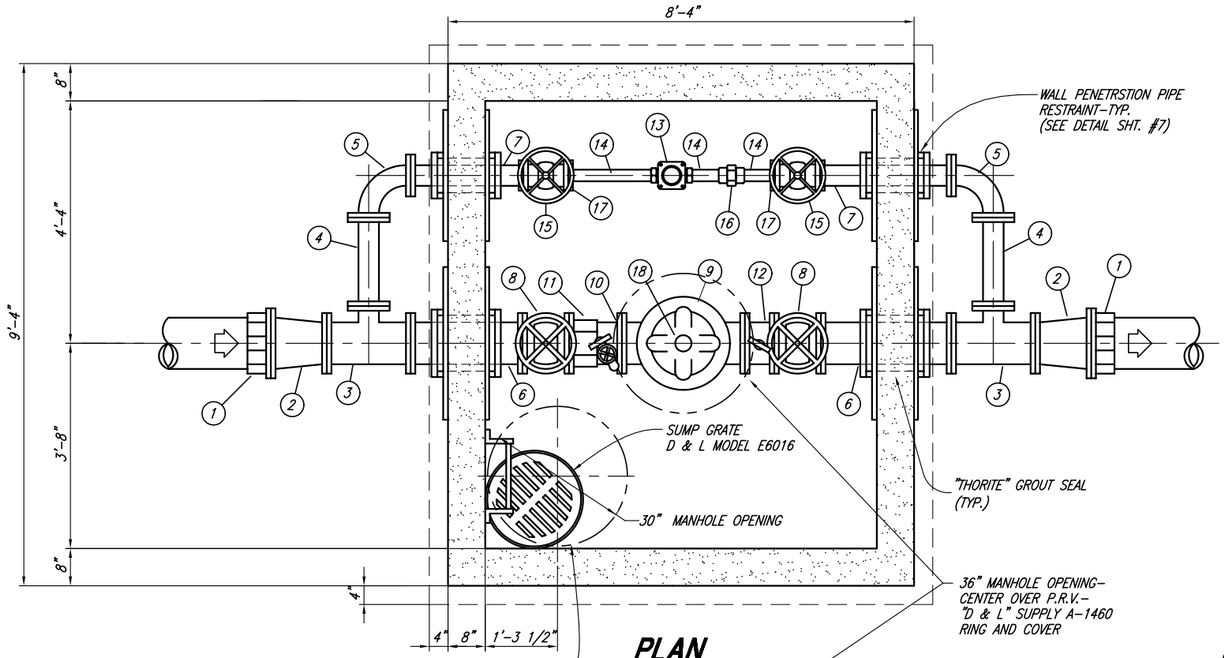
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

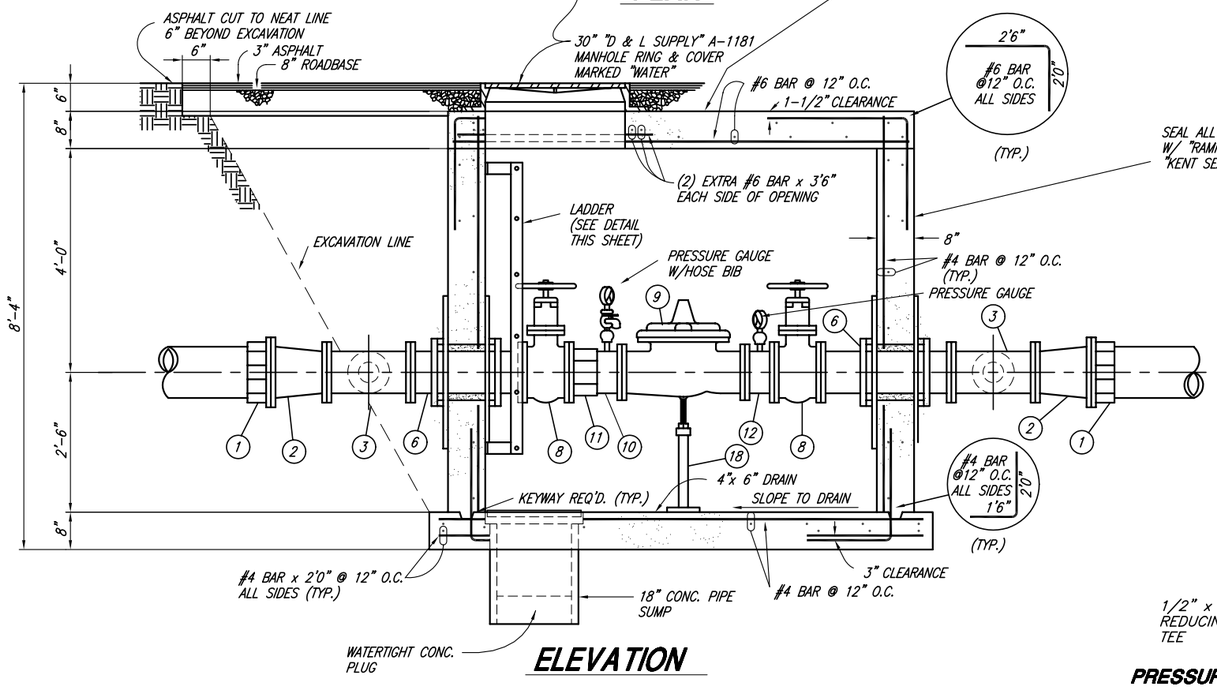
BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
TYPICAL WATER METER STATIONS

SHEET: CS-07 OF 16 SHEETS

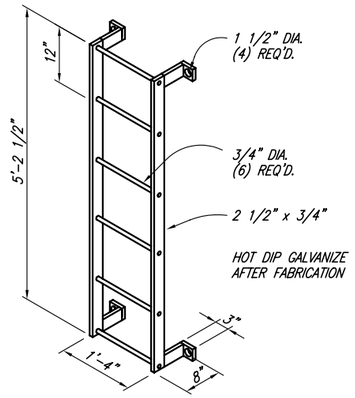


PLAN



ELEVATION

PRESSURE REDUCTION STATION - TYPE 1

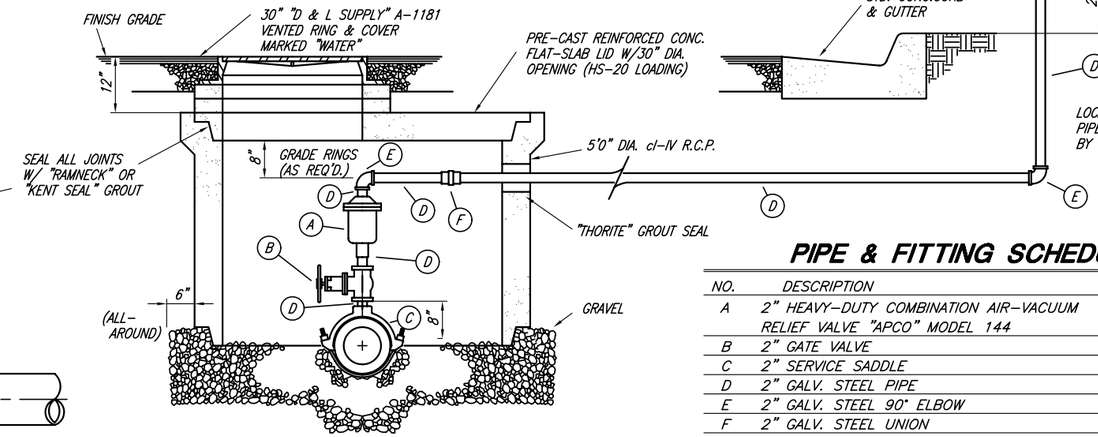


LADDER DETAIL

PIPE & FITTING SCHEDULE

NO.	DESCRIPTION	JOINT TYPE	6" LINE	8" LINE	10" LINE
1	CAST FLANGED COUPLING ADAPTOR (2)	FLxPE	6"	8"	10"
2	REDUCER (2)	FL	6"x4"	8"x6"	10"x8"
3	REDUCING TEE (2)	FL	4"x4"x4"	6"x6"x4"	8"x8"x4"
4	SPOOL PIECE (2)	FL	4"	4"	4"
5	90° ELBOW (2)	FL	4"	4"	4"
6	WALL SPOOL PIECE (2)	FL	4"	6"	8"
7	WALL SPOOL PIECE (2)	FL	4"	4"	4"
8	GATE VALVE (2)	FL	4"	6"	8"
9	PRESSURE REDUCTION VALVE ("CLAYTON" OR "AMES")	FL	4"	6"	8"
10	NIPPLE	FLxPE	4"	6"	8"
11	CAST FLANGED COUPLING ADAPTER	FLxPE	4"	6"	8"
12	SPOOL PIECE	FL	4"	6"	8"
13	PRESSURE REDUCTION VALVE ("CLAYTON" OR "AMES")	FL	2"	2 1/2"	2 1/2"
14	GALVANIZED PIPE (3)	FL	2"	2 1/2"	2 1/2"
15	GATE VALVE (2)	FL	4"	4"	4"
16	GALVANIZED UNION	FL	2"	2 1/2"	2 1/2"
17	BLIND FLANGE W/THR. CONNECTION (2)	FL	4"x2"	4"x2 1/2"	4"x2 1/2"
18	ADJUSTABLE PIPE SUPPORT (CLOW F-1608)	–	–	–	–

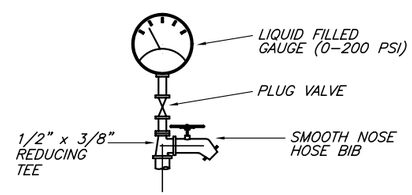
NOTE – STRUCTURE, PIPING & VALVE SIZES FOR P.R.V. STATIONS ON LINE SIZES GREATER THAN 10" SHALL BE SPECIFIED BY THE CITY ENGINEER.



PIPE & FITTING SCHEDULE

NO.	DESCRIPTION	FITTING
A	2" HEAVY-DUTY COMBINATION AIR-VACUUM RELIEF VALVE "APCO" MODEL 144	THR.
B	2" GATE VALVE	THR.
C	2" SERVICE SADDLE	–
D	2" GALV. STEEL PIPE	THR.
E	2" GALV. STEEL 90° ELBOW	THR.
F	2" GALV. STEEL UNION	THR.

AIR/VACUUM RELIEF STATION



PRESSURE GAUGE W/HOSE BIB DETAIL

NOTE:
ALL SPECIFIED BRANDS OF MATERIALS SHOWN ON THESE DRAWINGS ARE "CITY STANDARDS." OTHER EQUIVALENT BRANDS MAY BE USED WITH THE PRIOR APPROVAL OF THE CITY ENGINEER AND THE CITY WATER DEPARTMENT SUPERINTENDENT.

REGISTERED PROFESSIONAL ENGINEER — No. 134045 Kent Lessing Jones — STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
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DATE

SCALE: N.T.S.

DESIGNED
DRAWN
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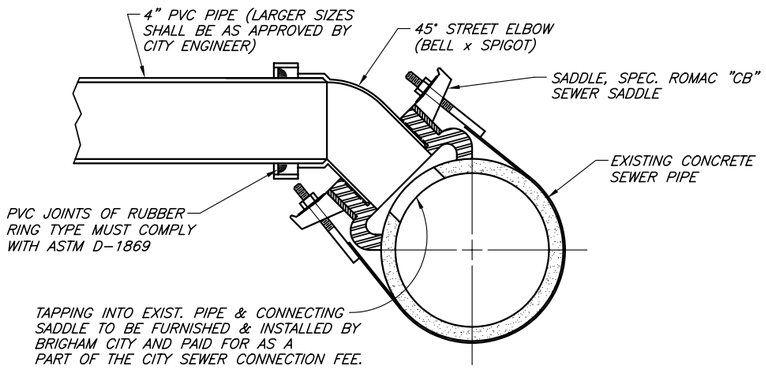
JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
PRESSURE REDUCTION STATION -TYPE I & AIR/VACUUM RELIEF STATION

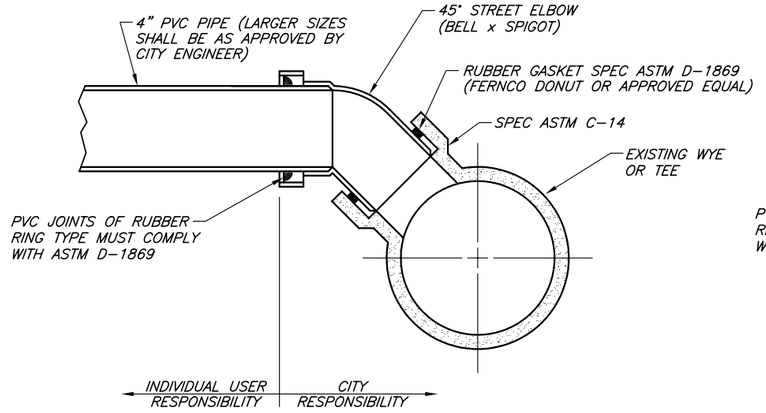
SHEET: CS-08 OF 16 SHEETS

NOTE:
PVC PIPE FITTINGS ASTM D-3034
WITH A S.D.R. 35



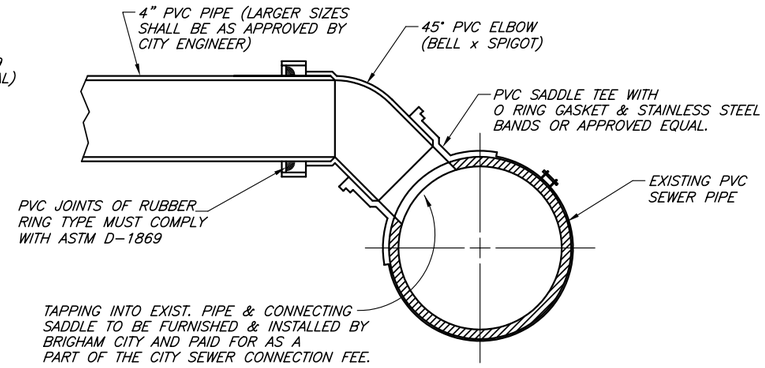
TAPPING INTO EXISTING CONCRETE PIPE

NOTE:
PVC PIPE FITTINGS ASTM D-3034
WITH A S.D.R. 35

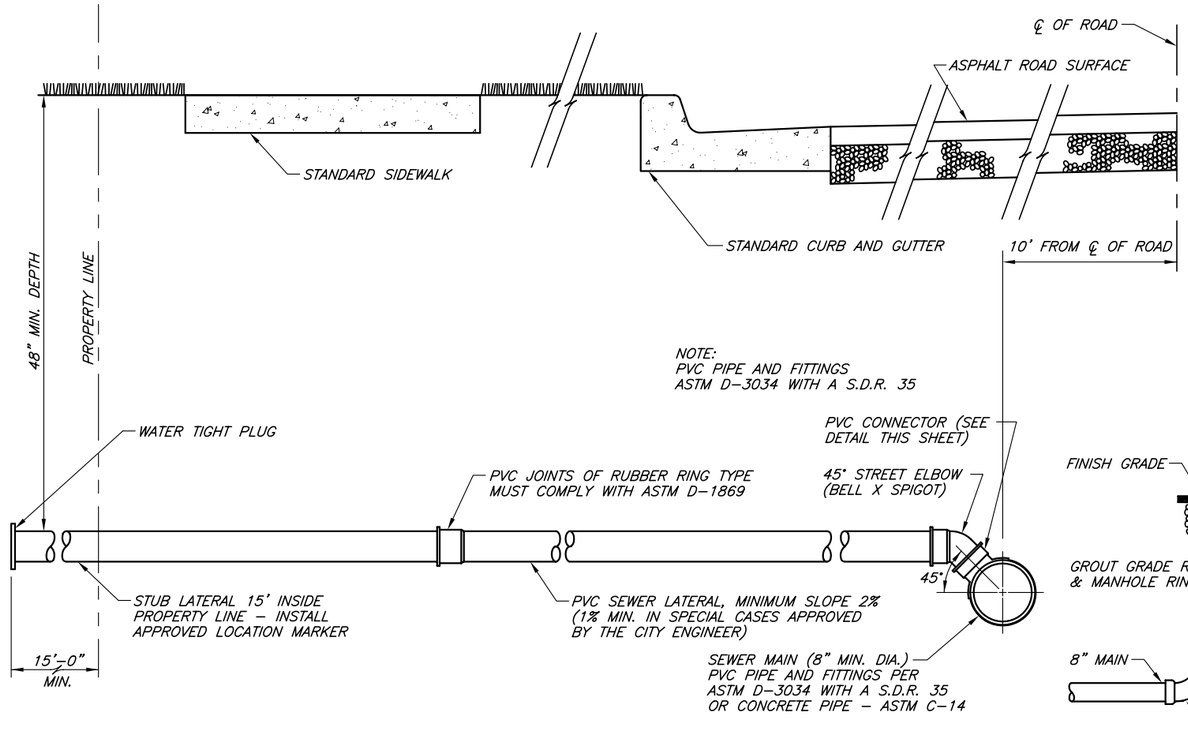


CONNECTING INTO EXISTING WYE OR TEE

NOTE:
PVC PIPE FITTINGS ASTM D-3034
WITH A S.D.R. 35



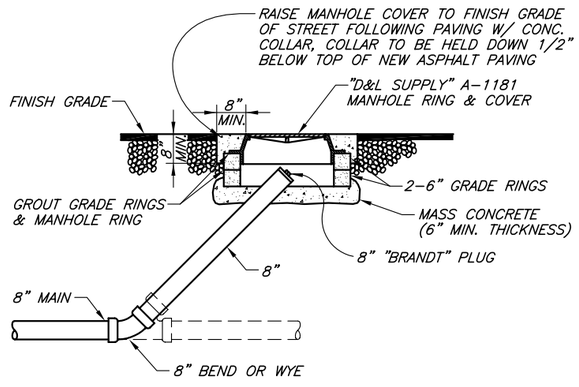
TAPPING INTO EXISTING PVC PIPE



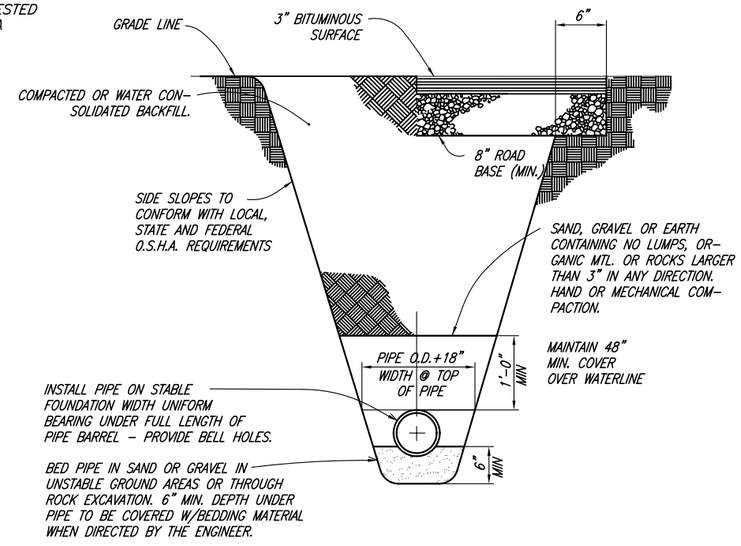
TYPICAL SEWER LATERALS CONNECTION

NOTES:

1. ALL SANITARY SEWER LATERAL CONNECTIONS ON SEWER MAINS IN NEW SUBDIVISIONS SHALL BE MADE WITH IN LINE PRE-FORMED WYES OR TEES UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. FLOWLINE ELEVATION OF LATERALS SHALL EQUAL THE INSIDE TOP OF PIPE ON MAINLINE AT THE CONNECTING POINT.
3. SANITARY SEWER PIPES SHALL BE "WHITE" IN COLOR SUB-SURFACE DRAIN LINES SHALL BE A COLOR OTHER THAN "WHITE".
4. ALL SANITARY SEWER LINES SHALL BE AIR TESTED AND INSPECTED BY MEANS OF VIDEO CAMERA WHEN CONSTRUCTED.



DRAIN/SEWER MAINLINE CLEANOUT



TYPICAL TRENCH SECTION

REGISTERED PROFESSIONAL ENGINEER
No. 134045
Kent Lessing Jones
STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

DESIGNED
DRAWN
CHECKED

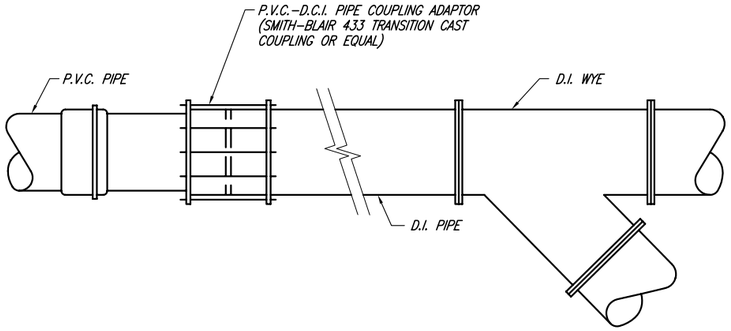
JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

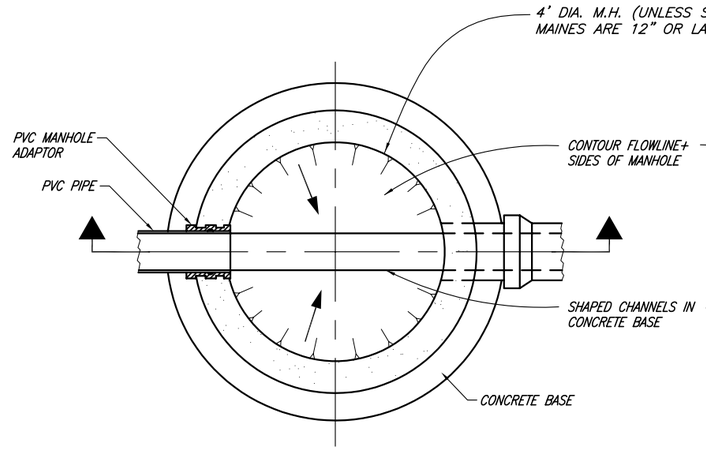
BRIGHAM CITY
PUBLIC WORKS STANDARDS
SANITARY SEWER DETAILS & CLEANOUT

SHEET: CS-09
OF 16 SHEETS

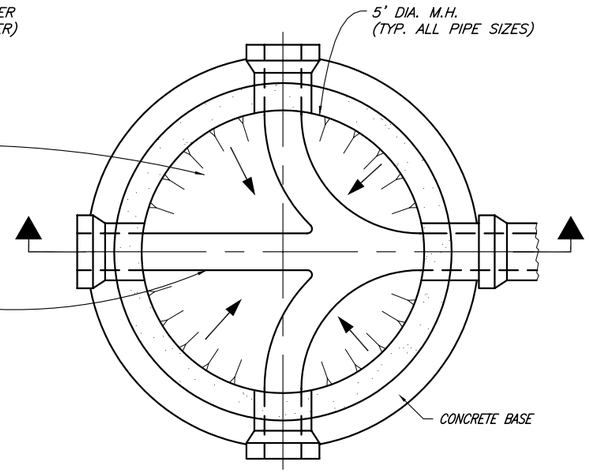
NOTE:
ALL SANITARY SEWER LINES SHALL BE INSPECTED BY MEANS OF VIDEO CAMERA & AIR TESTED WHEN CONSTRUCTED



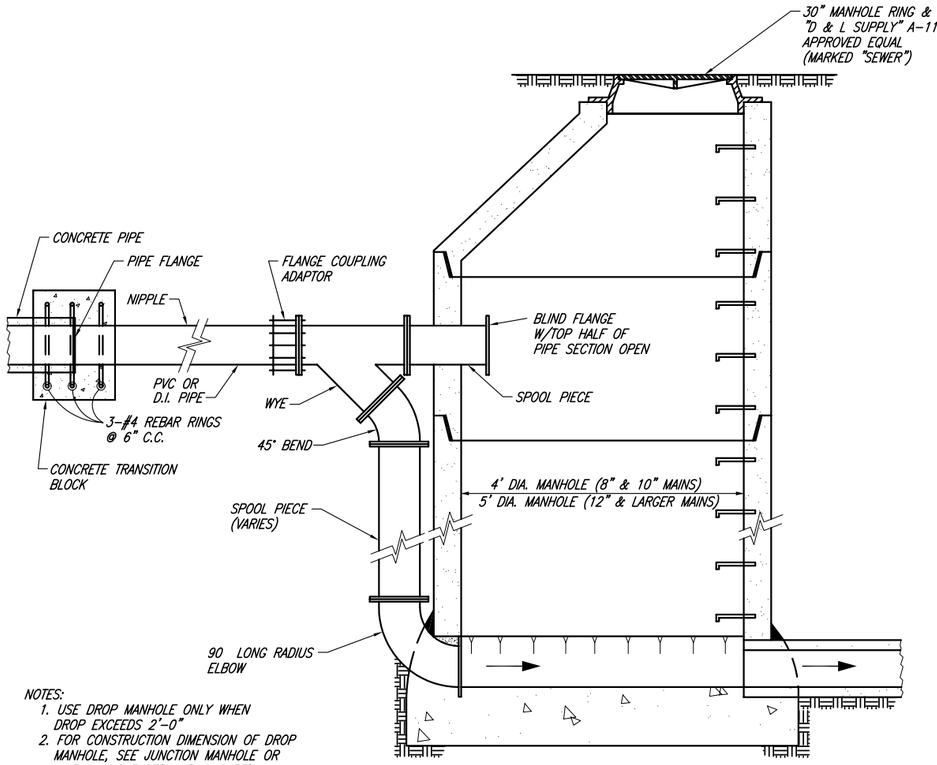
TYPICAL D.I. PIPE TO PVC PIPE CONNECTION



PLAN



PLAN



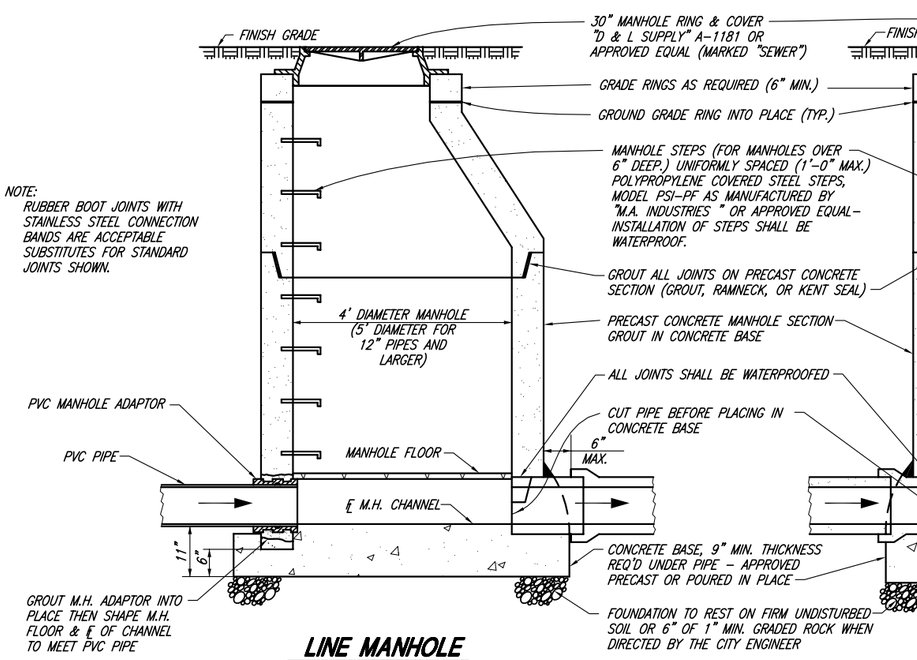
NOTES:
1. USE DROP MANHOLE ONLY WHEN DROP EXCEEDS 2'–0"
2. FOR CONSTRUCTION DIMENSION OF DROP MANHOLE, SEE JUNCTION MANHOLE OR LINE MANHOLE DETAIL THIS SHEET.
3. ALL PIPE FOR DROP MANHOLE TO BE FLANGED DUCTILE IRON PIPE, OR ALTERNATE SCH. 40 PVC.

DROP MANHOLE

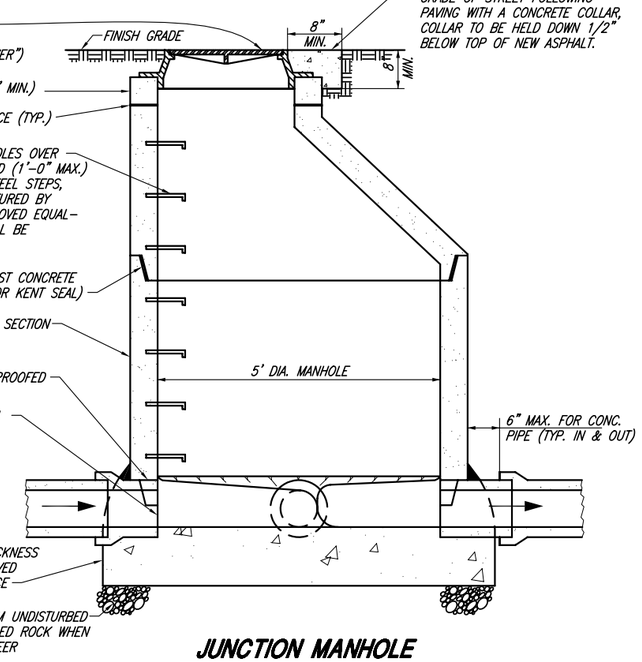
TYPICAL D.I. PIPE TO CONCRETE PIPE CONNECTION

NOTE:
SECURE INVERTS IN ALL MANHOLES DURING CONSTRUCTION SO AS TO PREVENT GRAVEL AND OTHER DEBRIS FROM COLLECTING INSIDE.

NOTE:
RUBBER BOOT JOINTS WITH STAINLESS STEEL CONNECTION BANDS ARE ACCEPTABLE SUBSTITUTES FOR STANDARD JOINTS SHOWN.



LINE MANHOLE



JUNCTION MANHOLE

REGISTERED PROFESSIONAL ENGINEER
No. 134045
Kent Lessing Jones
STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

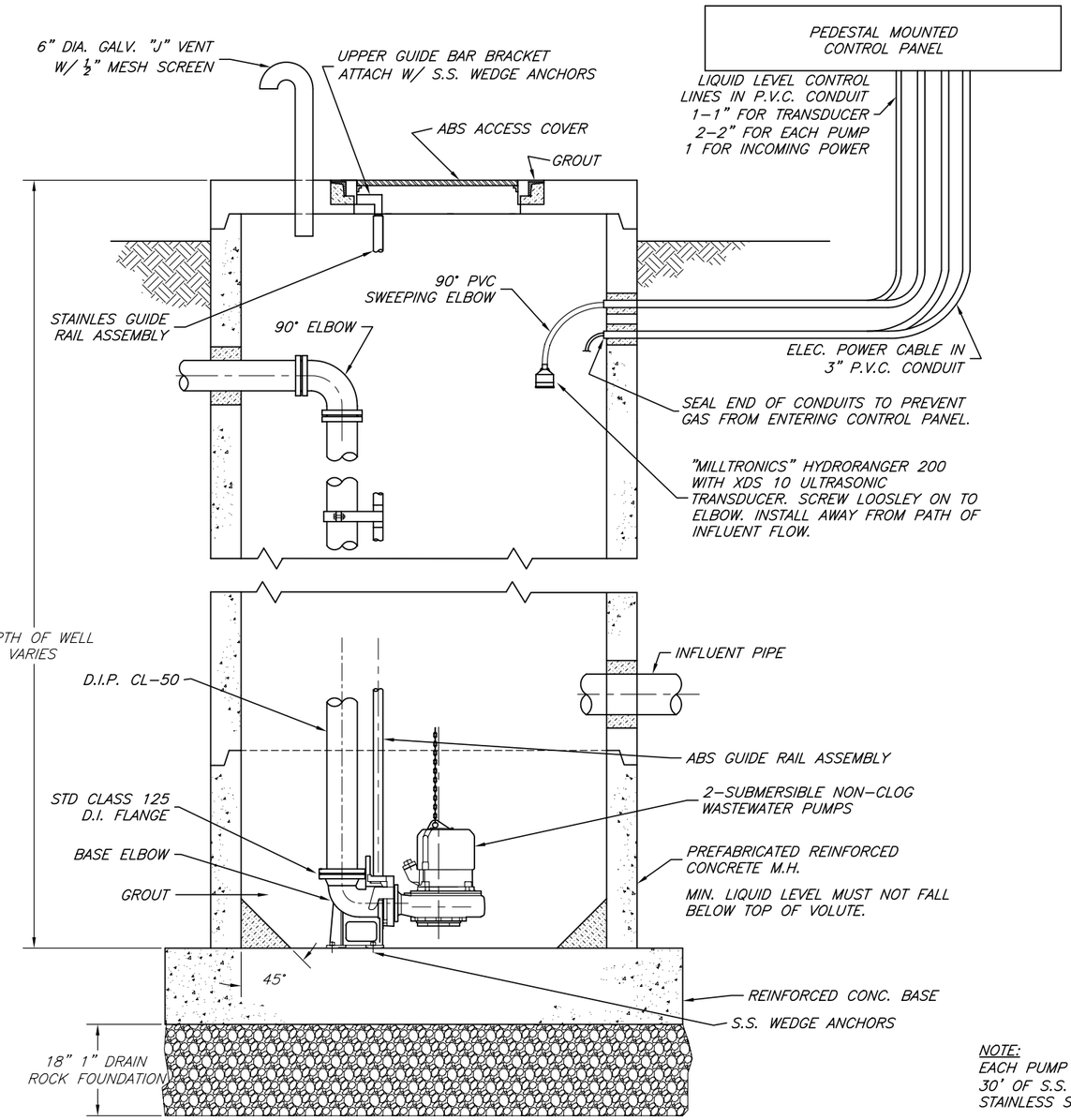
DESIGNED
DRAWN
CHECKED

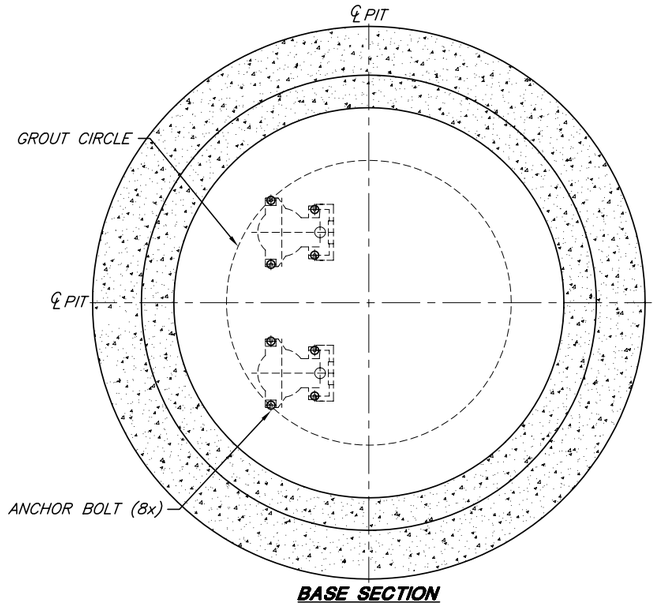
JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476–9767

BRIGHAM CITY PUBLIC WORKS

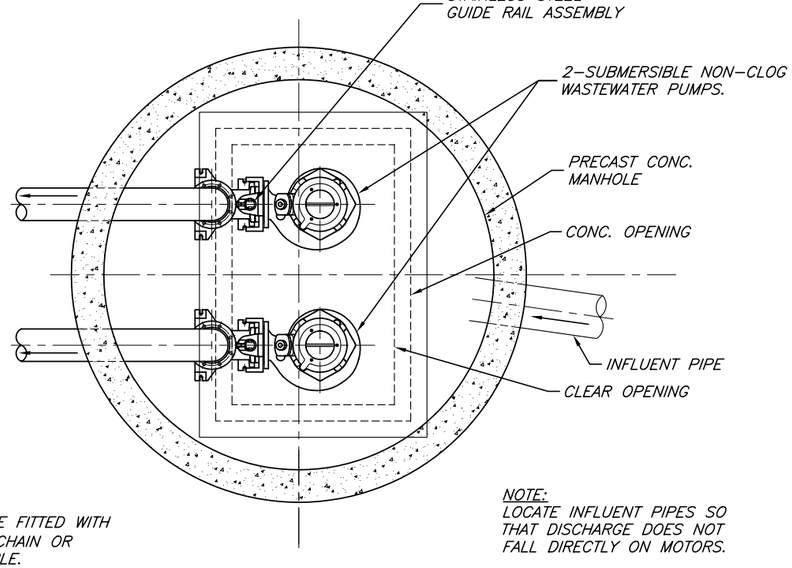
BRIGHAM CITY
PUBLIC WORKS STANDARDS
SANITARY SEWER MANHOLE DETAILS

SHEET: CS-10 OF 16 SHEETS





BASE SECTION



NOTE:
EACH PUMP SHALL BE FITTED WITH 30' OF S.S. LIFTING CHAIN OR STAINLESS STEEL CABLE.

NOTE:
LOCATE INFLUENT PIPES SO THAT DISCHARGE DOES NOT FALL DIRECTLY ON MOTORS.

TOP VIEW

REGISTERED PROFESSIONAL ENGINEER
No. 134045
Kent Lessing Jones
STATE OF UTAH

Kent L. Jones
CITY ENGINEER
July 1, 2005
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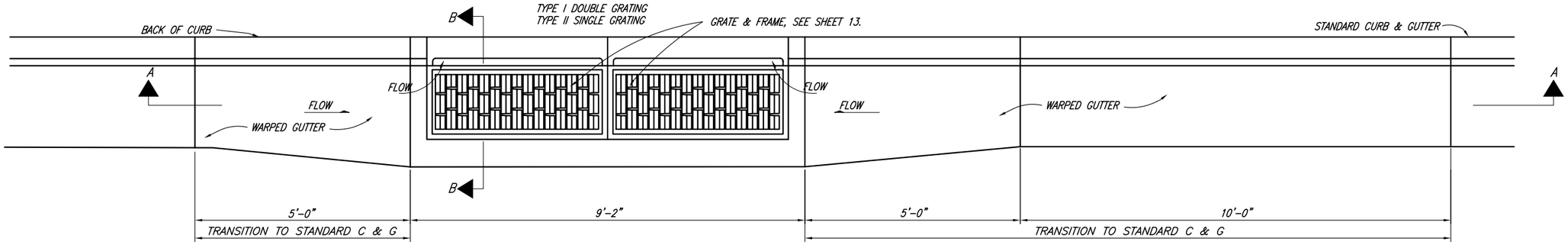
BRIGHAM CITY PUBLIC WORKS

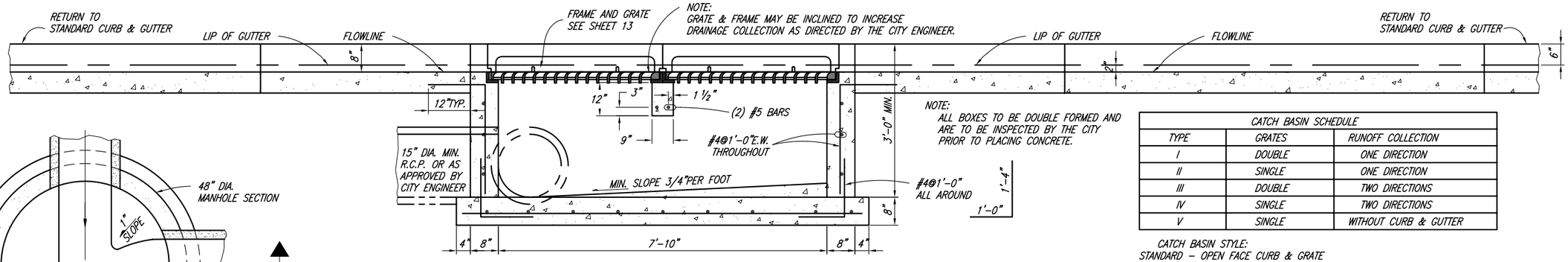
BRIGHAM CITY
PUBLIC WORKS STANDARDS

TYPICAL SEWER LIFT STATION

SHEET: CS-11 OF 16 SHEETS



PLAN



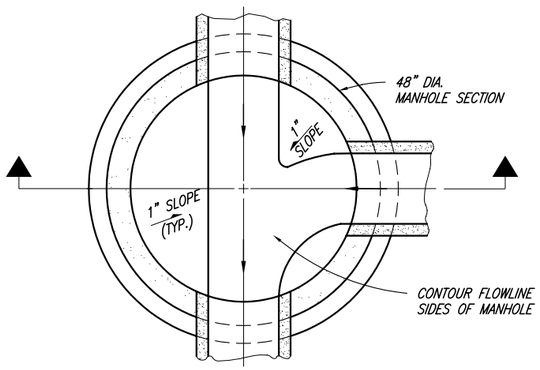
NOTE:
ALL BOXES TO BE DOUBLE FORMED AND ARE TO BE INSPECTED BY THE CITY PRIOR TO PLACING CONCRETE.

CATCH BASIN SCHEDULE		
TYPE	GRATES	RUNOFF COLLECTION
I	DOUBLE	ONE DIRECTION
II	SINGLE	ONE DIRECTION
III	DOUBLE	TWO DIRECTIONS
IV	SINGLE	TWO DIRECTIONS
V	SINGLE	WITHOUT CURB & GUTTER

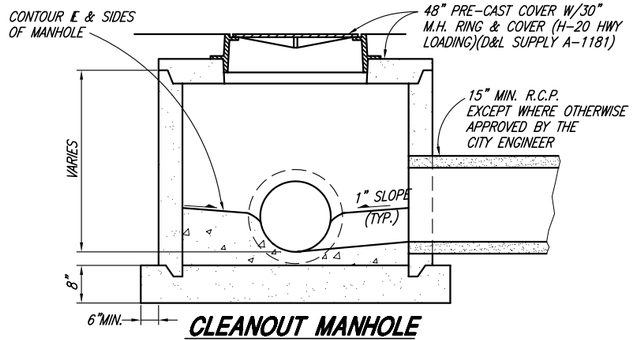
CATCH BASIN STYLE:
STANDARD – OPEN FACE CURB & GRATE
ALTERNATE 1 – STD. CURB & GRATE
ALTERNATE 2 – PVC CATCH BASIN

SECTION A-A

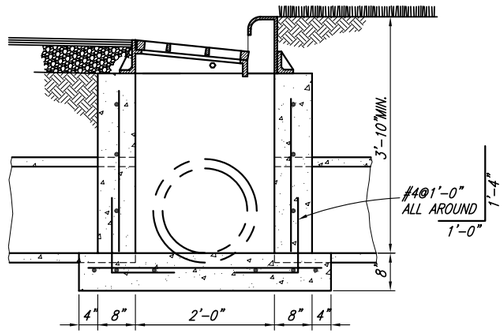
TYPE I CATCH BASIN



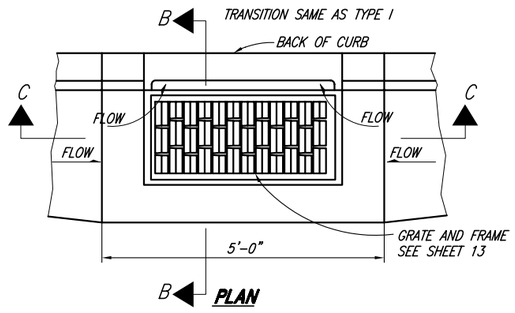
PLAN



CLEANOUT MANHOLE

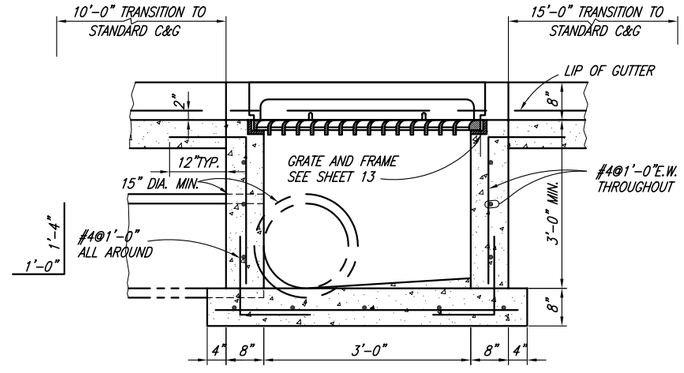


SECTION B-B



PLAN

TYPE II CATCH BASIN



SECTION C-C

REGISTERED PROFESSIONAL ENGINEER
No. 134045
Kent Lessing Jones
STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
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SCALE: N.T.S.

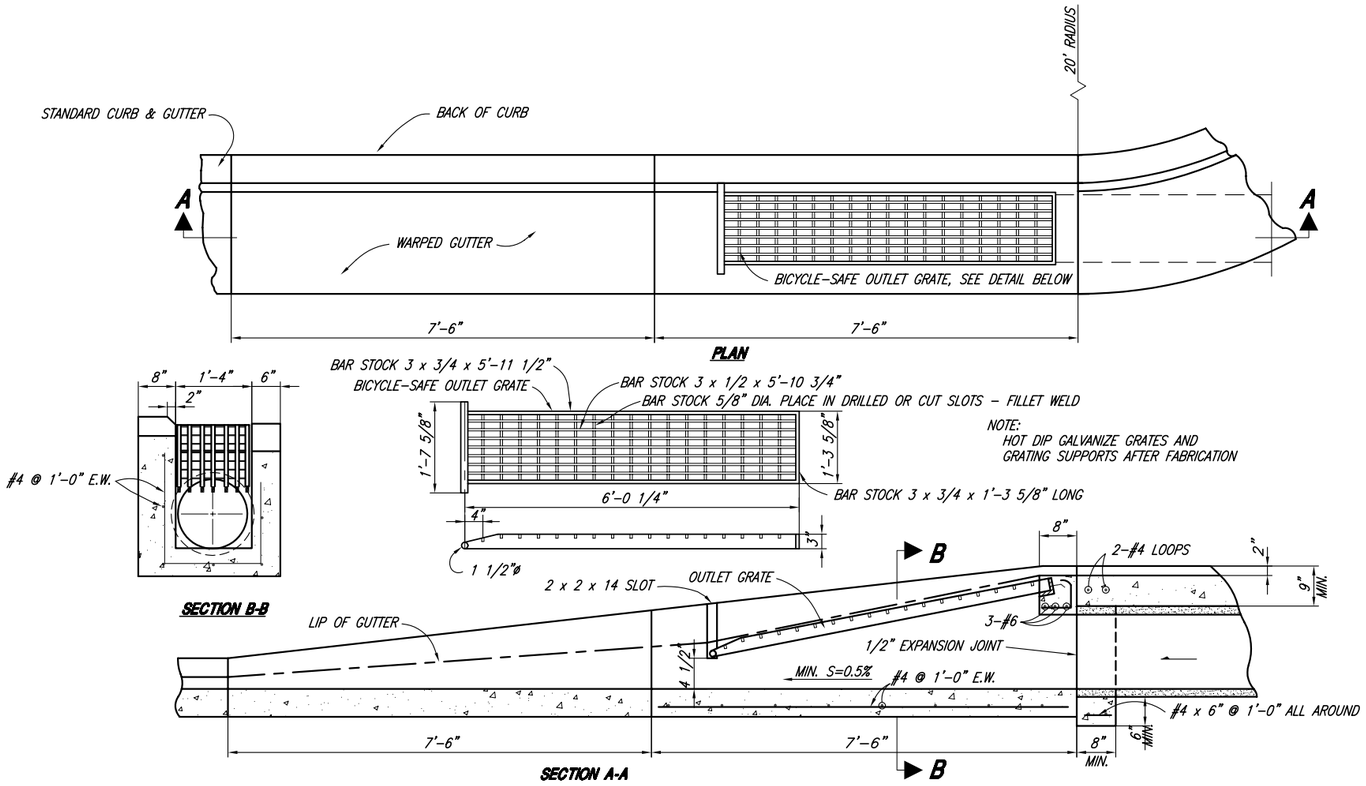
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

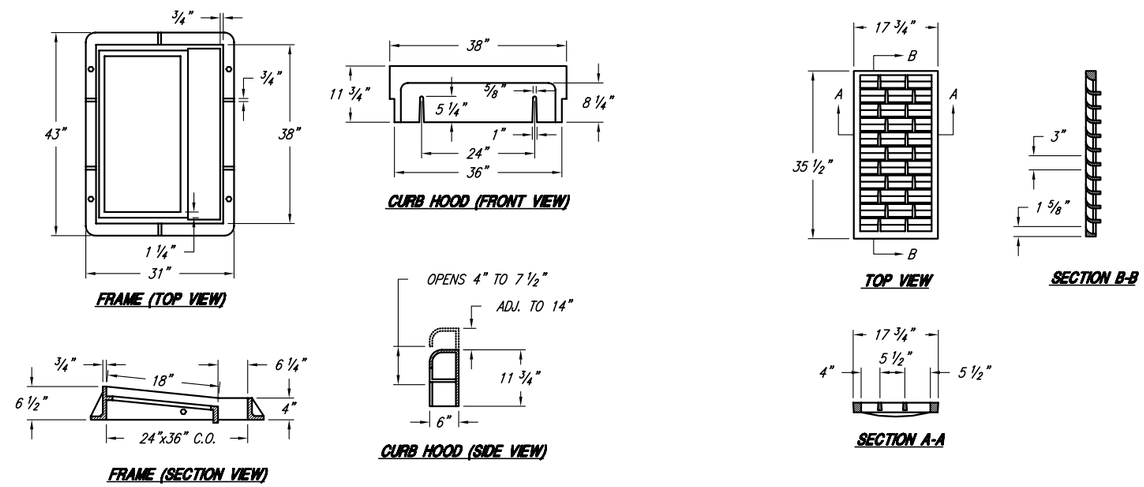
BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
TYPE I THROUGH TYPE IV CATCH BASINS & CLEANOUT MANHOLE

SHEET: CS-12
OF 16 SHEETS



OUTLET DIPSTONE



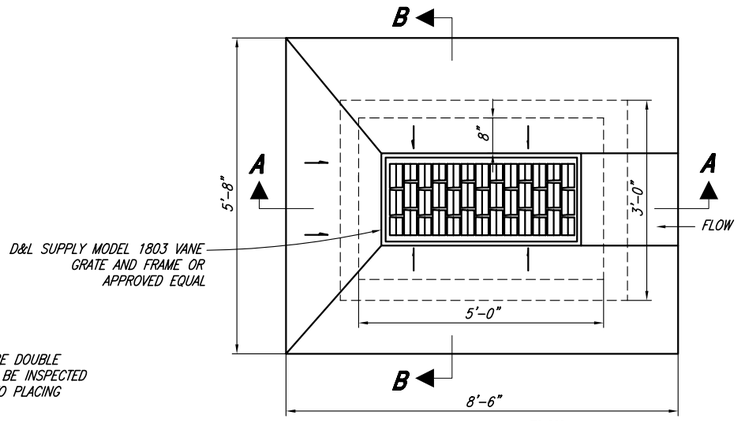
FRAME AND REINFORCED CURB HOOD

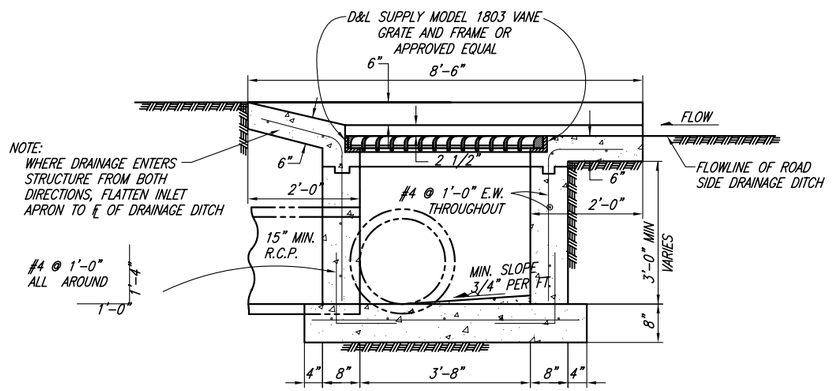
D&L SUPPLY I-3516-R2 AND I-3516-06

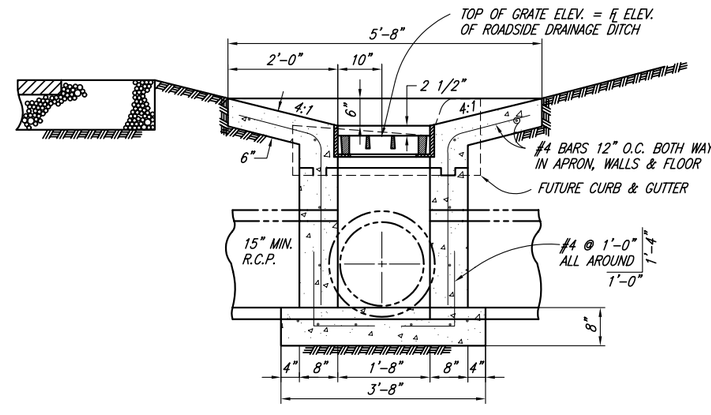
TYPE "L" GRATE (STD.)

D&L SUPPLY I-3517-02

NOTES:
ALL BOXES ARE TO BE DOUBLE FORMED AND ARE TO BE INSPECTED BY THE CITY PRIOR TO PLACING CONCRETE.







TYPE V CATCH BASIN

REGISTERED PROFESSIONAL ENGINEER — No. 134045 — Kent Lessing Jones — STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

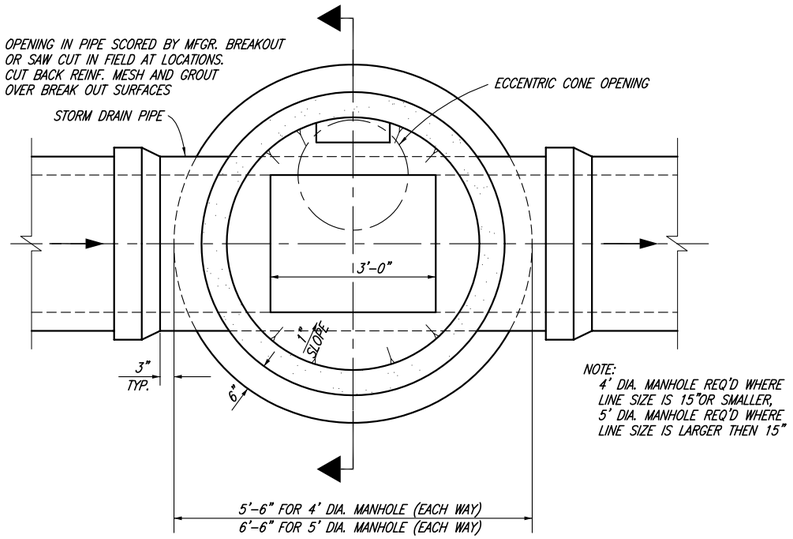
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

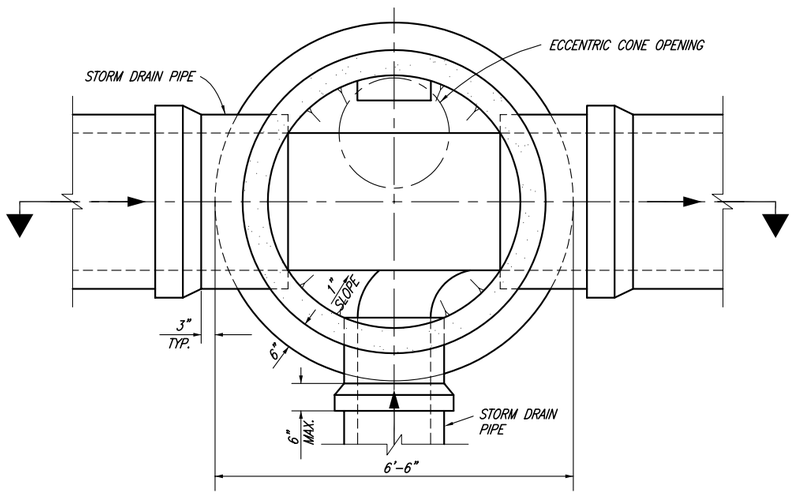
BRIGHAM CITY
PUBLIC WORKS STANDARDS
TYPE V CATCH BASIN & OUTLET DIPSTONE DETAILS

SHEET: CS-13 OF 16 SHEETS

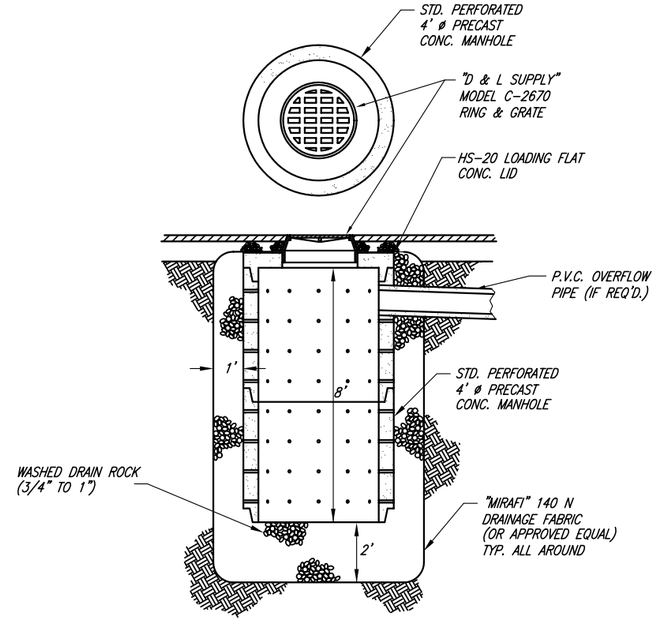


NOTE:
4' DIA. MANHOLE REQ'D WHERE LINE SIZE IS 15"OR SMALLER,
5' DIA. MANHOLE REQ'D WHERE LINE SIZE IS LARGER THEN 15"

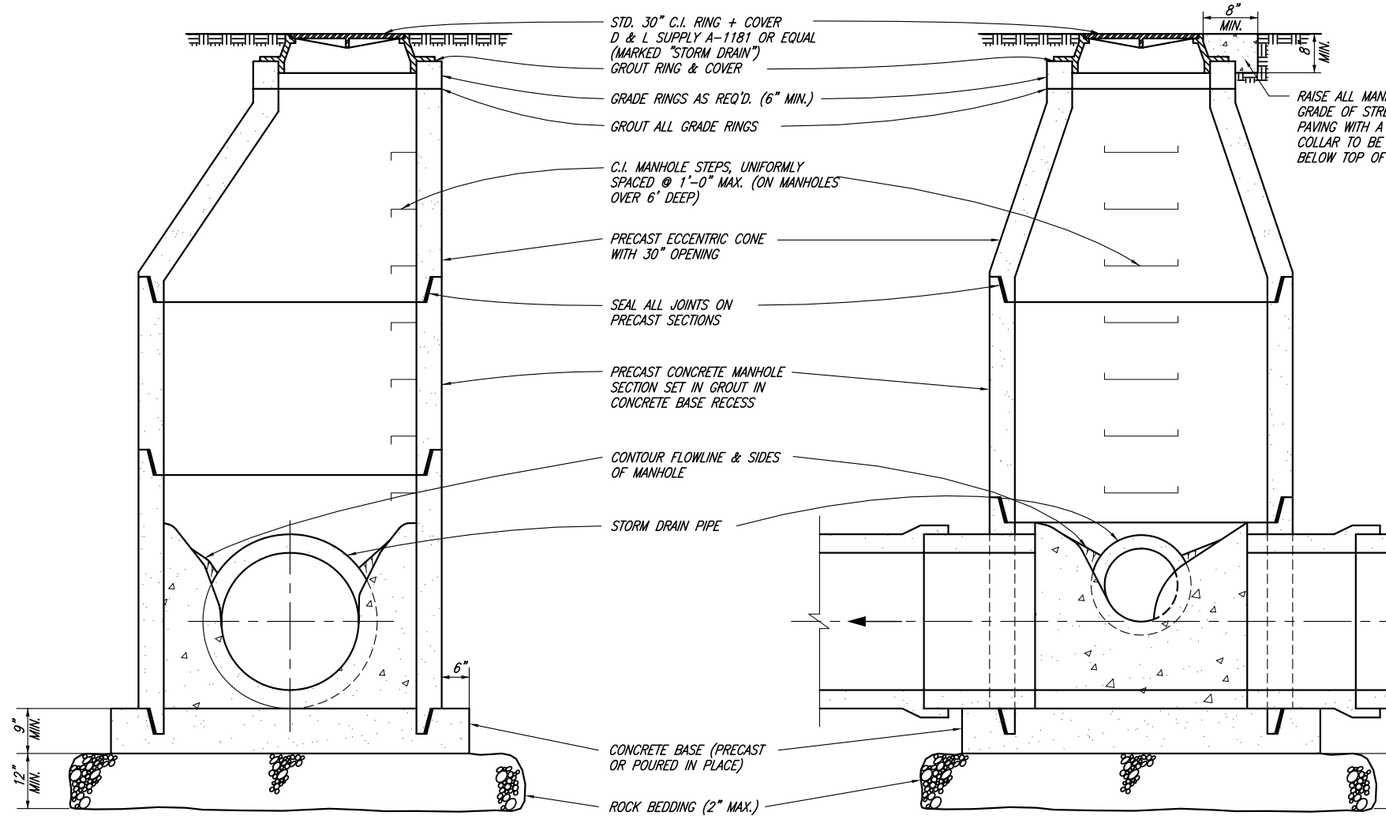
TYPICAL LINE MANHOLE

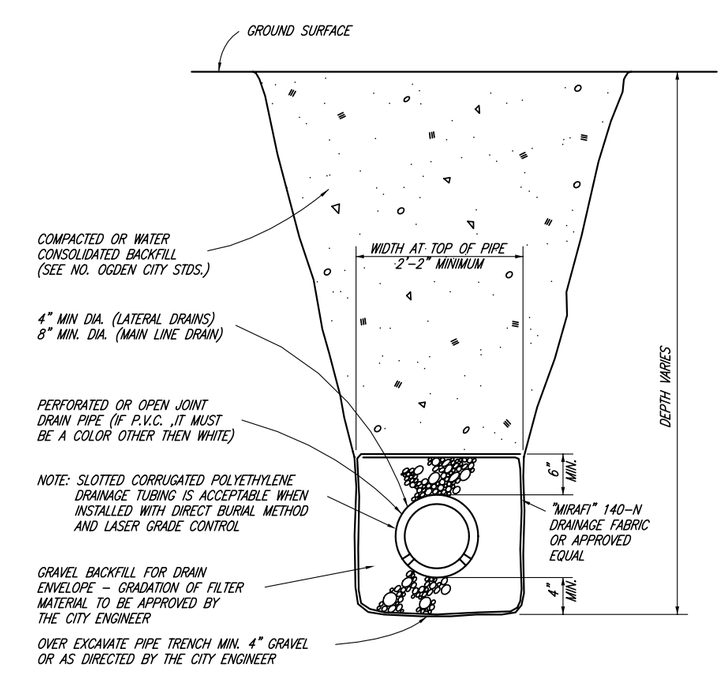


TYPICAL JUNCTION MANHOLE



TYPICAL SUMP DETAIL





REGISTERED PROFESSIONAL ENGINEER
No. 134045
Kent Lessing Jones
STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
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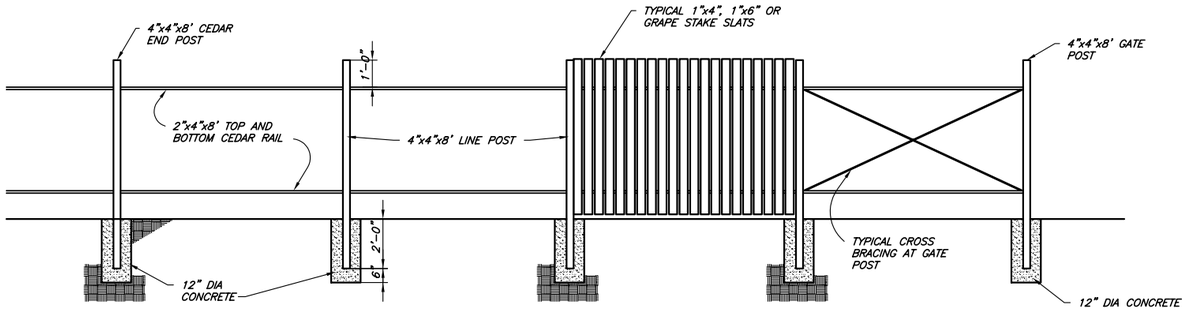
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

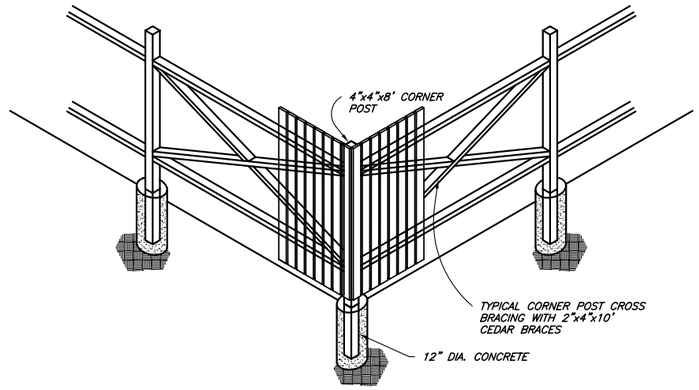
BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
STORM DRAIN MANHOLE & SUBSURFACE DRAINAGE DETAILS

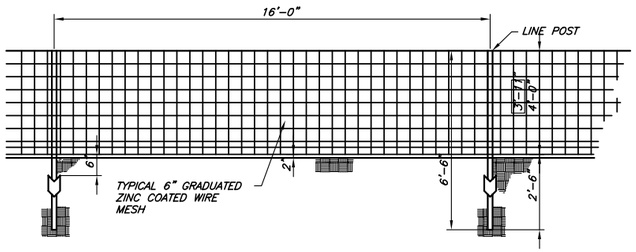
SHEET:
CS-14
OF 16 SHEETS



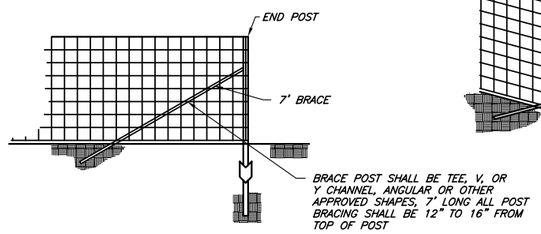
TYPICAL WOOD FENCE



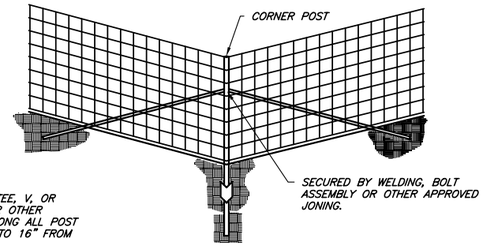
CORNER POST DETAIL



TYPICAL WIRE FENCE



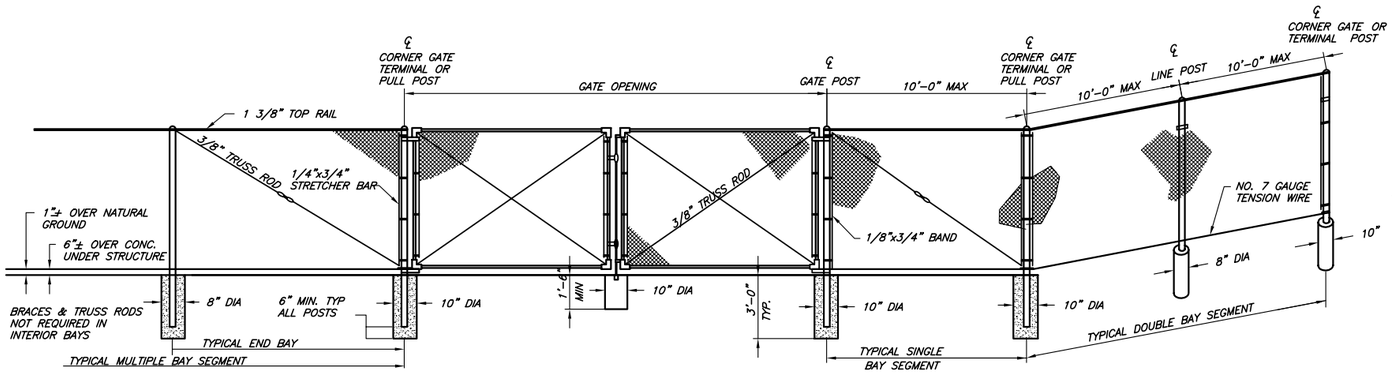
END POST BRACING DETAIL



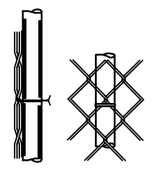
CORNER POST DETAIL

NOTE:
THIS SHEET SPECIFIES VARIOUS FENCING TYPES TO BE CONSTRUCTED WHEN CALLED FOR BY THE CITY ENGINEER.

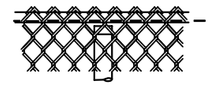
GATES			
GATE POST AND GATE FRAMES			
HEIGHT	GATE OPENING	GATE POST	GATE FRAME
6 FEET AND OVER	SINGLE TO 6' OR DOUBLE TO 12'	2 5/8"	1 1/2"
	SINGLE OVER 6' TO 13' OR DOUBLE OVER 12' TO 24'	3 1/2"	
	SINGLE OVER 13' TO 18' OR DOUBLE OVER 24' TO 36'	6"	
	SINGLE TO 18' OR DOUBLE OVER 36'	8"	



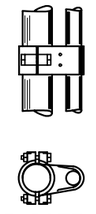
TYPICAL CHAIN LINK FENCE



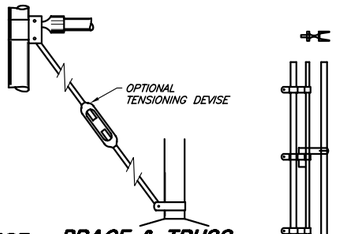
TYPICAL TIE DETAIL



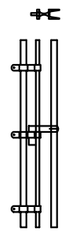
KNUCKLED SELVAGE



TOP GATE HINGE



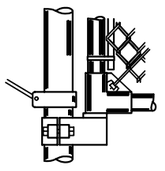
BRACE & TRUSS CONNECTIONS



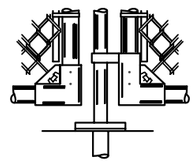
DROP ROD ASSEMBLY

NOTE

1. ALL FABRIC SHALL BE 6' HIGH CHAIN LINK OF 2" GALVANIZED MESH OF 9 GAUGE.
2. ALL STEEL PIPE MEMBERS SHALL CONFORM TO THE REQUIREMENTS OF A.S.T.M. DESIGNATION A-120,SCHEDULE 40, HOT DIPPED ZINC COATED STEEL PIPE.
3. ALL POST SHALL BE SET IN CONCRETE AND SHALL BE TOPPED WITH BALL TYPE OR OTHER APPROVED ORNAMENT.
4. ALL END, CORNER OR PULL POST SHALL BE 9 FEET IN LENGTH WITH A MINIMUM DIAMETER OF 2 7/8 INCHES: ALL LINE POST SHALL BE 8 FEET 8 INCHES IN LENGTH WITH A MINIMUM DIAMETER OF 1 7/8 INCHES.



BOTTOM GATE HINGE



CENTER GATE STOP

REGISTERED PROFESSIONAL ENGINEER
No. 134045
Kent Lessing Jones
STATE OF UTAH

Kent L Jones
CITY ENGINEER
July 1, 2005
DATE

APPROVED
PUBLIC WORKS DIRECTOR
July 1, 2005
DATE

SCALE: N.T.S.

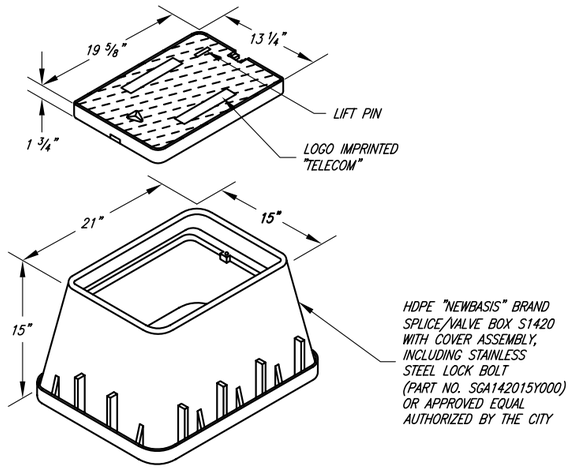
DESIGNED
DRAWN
CHECKED

JA JONES & ASSOCIATES
CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403 (801) 476-9767

BRIGHAM CITY PUBLIC WORKS

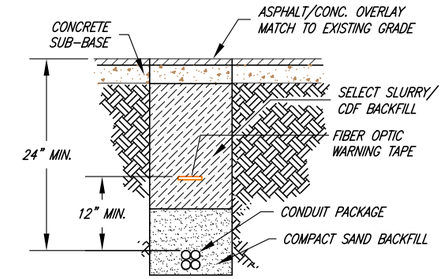
BRIGHAM CITY
PUBLIC WORKS STANDARDS
FENCING STANDARDS

SHEET: CS-15
OF 16 SHEETS

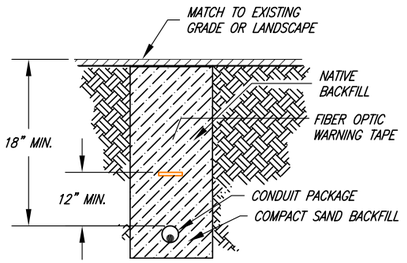


BASE OUTER DIMENSIONS: 20" X 26"
LOAD: STATIC, 2,500 LBS

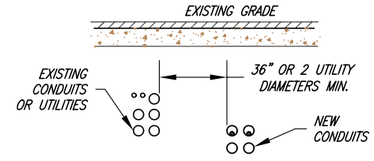
TYPICAL FIBER OPTIC SERVICE BOX



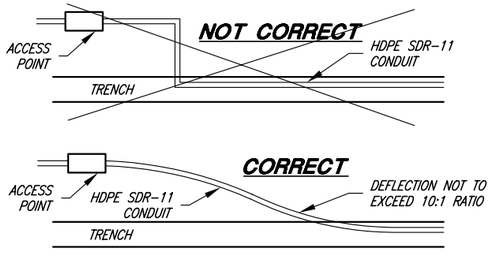
TYPICAL FIBER OPTIC TRENCH



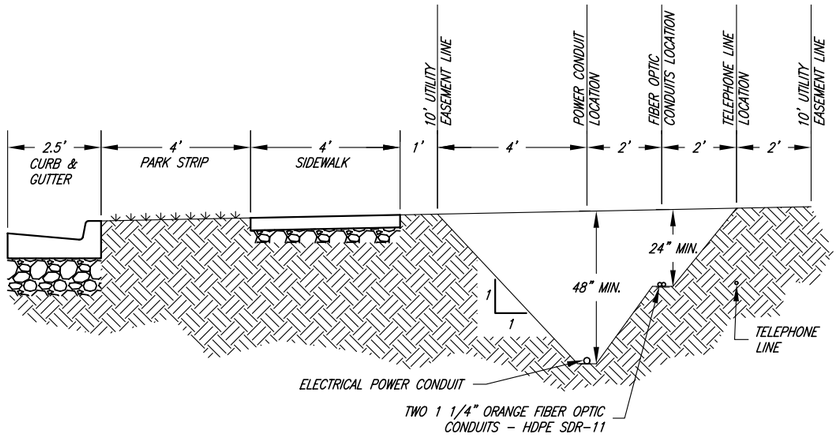
TYPICAL BUILDING/ SUBSCRIBER LATERAL



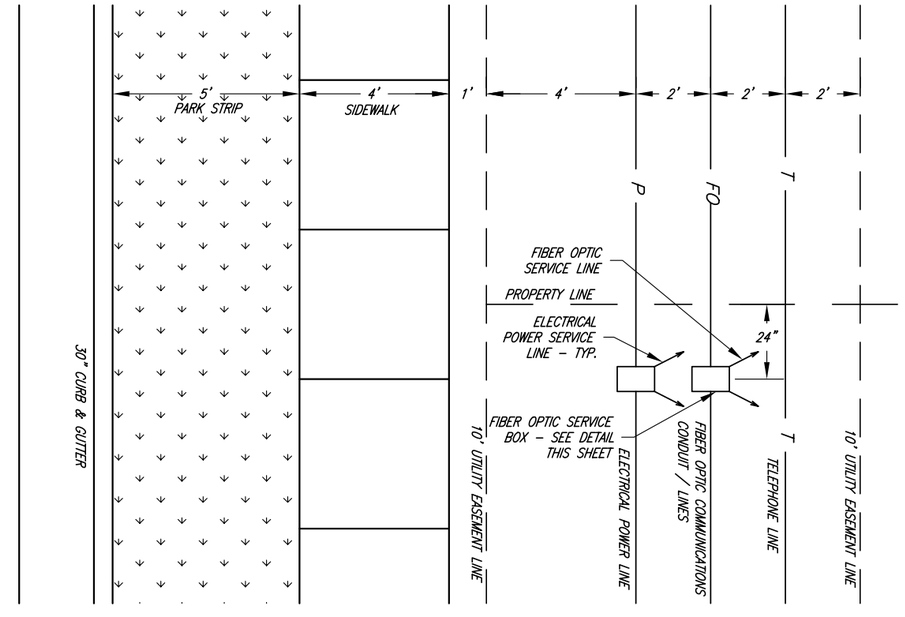
TYPICAL CONDUIT LOCATION NEAR EXISTING UTILITIES



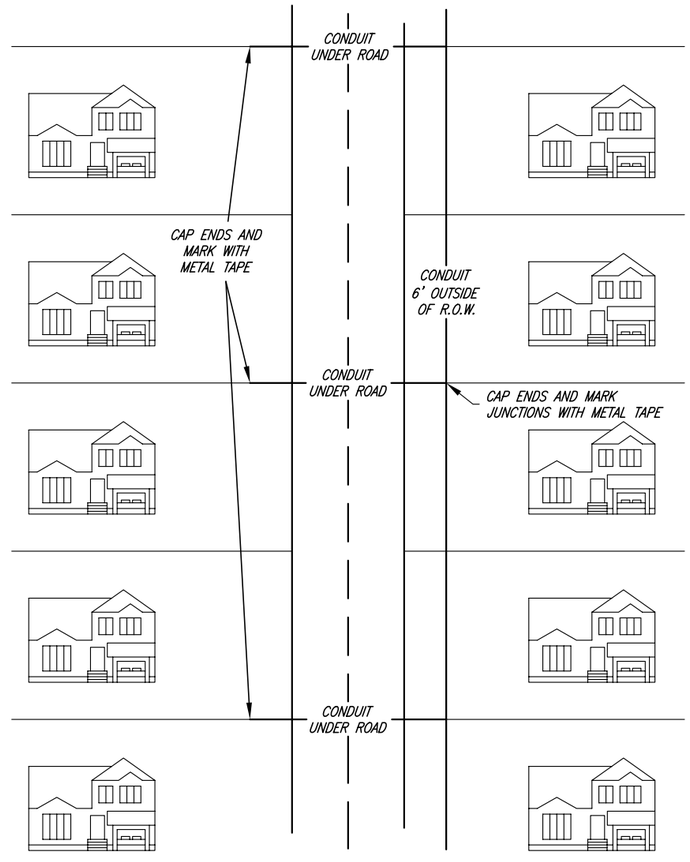
CONDUIT BENDS



TYPICAL NEW UTILITY LOCATION TRENCH SECTION



TYPICAL FIBER OPTIC LINE LOCATION DETAIL



TYPICAL STREET LAYOUT FOR CONDUIT PLACEMENT

REGISTERED PROFESSIONAL ENGINEER
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Kent Lessing Jones
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BRIGHAM CITY PUBLIC WORKS

BRIGHAM CITY
PUBLIC WORKS STANDARDS
STANDARD FIBER OPTIC COMMUNICATION LINE DETAILS

SHEET: CS-16 OF 16 SHEETS