

# FARR WEST CITY

## *Public Works Standards*



*Prepared by*

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**Public Works Standards and Technical Specifications**  
**Farr West City, Utah**

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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. 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 Technical Review Meeting:**

Prior to engaging in the subdivision process the subdivider shall notify the City and schedule for a Technical Review Meeting. One purpose of the Technical Review Meeting shall be to gather preliminary information from City officials and utility providers. Another purpose of the Technical Review Meeting is to help clarify the development requirements. This meeting is intended to help the subdivider begin the subdivision process in a cooperative manner with city officials. Information exchanged in the meeting is intended to expedite the subdivision process.

### **1.3 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.

### **1.4 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 Farr West City Standards.
- G.** Separate drawings of elements of the Farr West City Standards shall not be required to be redrawn and submitted with the construction drawings unless specific deviations from the standards are requested for approval, however, the construction drawings shall refer to the specific items of the Standards that are to be incorporated into the work.

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. In addition to the mylar construction plans, the developer's engineer shall provide the City Engineer with electronic files of the final plat and improvement plans in "AutoCAD" or other City Engineer approved format. 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.

## **1.5 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; (c) Subdivision or Project Engineer; (d) all Contractors and Subcontractors involved with installing the subdivision or project improvements; (e) representatives of affected Farr West City Departments; (f) representatives of local utility companies as may be required by Farr West City. Items pertaining to the construction and inspection of the subdivision or Project improvements will be discussed.

## **1.6 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 or authorized city representative.

### **1.7 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 (1) 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.

### **1.8 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.

### **1.9 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.

### **1.10 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".



### **1.11 Drawings:**

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

### **1.12 Modifications to the Public Works Standards:**

Whenever, in the opinion of the Farr West City Public Work's Director, Chief Building Official, the City Engineer, or the City Administrator, a literal enforcement of these regulations may work an undue hardship or a literal enforcement of the provisions may be unnecessary to meet the goals and standards of Farr West City, Farr West City may modify those standards.

Modifications may be granted when there are practical difficulties involving carrying out the provisions of the Public Works Standards and Technical Specifications and a panel consisting of the City Engineer, Director of Public Works, the Building Official, and the City Administrator determine that granting of a modification for an individual case will meet the goals and requirements of Farr West City without unduly jeopardizing the public and the individual's interest. The City Engineer shall first receive an application for a modification to the standards from any interested party. Upon receipt of the application the panel shall find that a special individual reason makes the strict letter of the standard impractical, and shall find the modification is in conformance with the intent and purpose of the standards and shall find that such modification does not in any way lessen the integrity of the standards. When such findings of fact are made, the panel may grant such modification as it deems appropriate. The details of any action granted as modification by this panel shall be recorded and entered in the files of the Public Works Department, with the specific reasons for the granting of said modification.

## Section 2

### Permit Requirements for Work in the Public Way

#### 2.1 Purpose of Intent:

The purpose of this section is to describe Farr West City's Department of Public Work's policies for issuing permits and to control any excavation and construction operations in the public way in Farr West City. All contractors, sub-contractors, and utility companies proposing to construct, repair or replace any facility within the public way, shall contact the Farr West 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.

#### 2.2 Policies:

- A. Permittee (including all sub-contractors) must be licensed with the State of Utah:** It is the policy of Farr West 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.

	<u>TYPE OF WORK</u>	<u>LICENSE</u>
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 a public utility company (sub-contractors for utility companies shall have a valid contractor's license)

- B. Policy for determining when "permit waivers" can be granted:** Working within the public way without a permit is a violation 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 1-1/2" 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. 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. All projects shall be "Blue Staked" prior to construction.
- 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 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 Permittee.

## **2.4 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.

## 2.5 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.
- D. Vacuum sweeping or hand sweeping shall be required when the Public Works Department determines cleaning equipment is ineffective.
- E. **Storm Water:** The permittee shall comply with all applicable requirements in the Farr West City Storm Water Management Plan including compliance with all applicable "Best Management Practices" (B.M.P.'s).

## 2.6 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 Building 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 Building 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 and against any and all liability, damages, claims, demands, costs and expenses of whatsoever nature, including court costs and legal 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 permittee's execution of the work herein



specified. The permittee, at no expense to the City, shall carry and maintain, from a reputable company or companies, commercial general liability insurance with other appropriate coverages as reasonably determined by the permittee. The policy issued by the insurer for commercial general liability insurance provided for in this section shall be for the benefit of the City and the permittee will designate the City as a named insured or loss payee with minimum limits of \$1,000,000.00 for injury to or death of one person, and \$1,000,000.00 for one accident; and Property Damage Liability Insurance with limits of \$1,000,000.00 for each accident and \$1,000,000.00 aggregate.

## **2.7 Enforcement:**

Violators of these regulations of working within the Public Way shall be subject to the provisions of the applicable Farr West City Ordinances.

## **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 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. 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 3:1.

### **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 85% 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.

## 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. Geotextile Fabric:** A geotextile fabric is required on subgrade for stabilization and / or separation purposes. The fabric shall be “Geotex” 315-ST or a City Engineer approved equal.
- B. Untreated Base Course:** 12-inch minimum compacted thickness of untreated base course on geotextile fabric. When subgrade soils have a C.B.R. (California Bearing Ratio) less than 10, additional gravel base shall be required as dictated by a pavement design approved by the City Engineer.
- C. Bituminous Surface Course:** 3-inch minimum compacted thickness of plant mix bituminous surface course. When a particular roadway has traffic loading in excess of common residential roadways, additional asphalt thickness may be required.
- D. Seal Coat:** UDOT Type A Bituminous Seal Coat, Slag Type A Chip and Seal or Type III Slurry Seal Coat or as directed by the City Engineer.
- E.** Where unsuitable subgrade soils are suspected further soil testing may be required 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:

Sieve Size	<u>1" Gradation</u>	
	Ideal Gradation (% Passing)	Gradation (Tolerance)
1"	100	0
1/2"	85	±6
No. 4	55	±6
No. 16	31	±4
No. 50	19	±2
No. 200	9	±2

Sieve Size	<u>¾" Gradation</u>	
	Ideal Gradation (% Passing)	Gradation (Tolerance)
¾"	100	±0
3/8"	85	±7
No. 4	61	±6
No. 16	33	±5
No. 50	19	±2
No. 200	9	±2

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

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

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:



<u>3/4" Gradation</u>		
Sieve Size	Ideal Gradation (% Passing)	Gradation (Tolerance)
3/4"	100	0
3/8"	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 or an approved City Engineer equal.

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.

- A. 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.
- B. 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 complete asphalt tack coat at a rate 0.08 gal/per square yard. Care shall be exercised to prevent over spraying on finish concrete surfaces.

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

After the mixture has been spread, the surface shall be rolled in a longitudinal direction, commencing at the outside edge or lower side and proceeding to the higher side. Each pass of the roller shall overlap the preceding pass at least one-half the width of the roller. Rolling shall continue until 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.

- C. **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.

#### **4.4 Bituminous Seal Coat (Chip and Seal):**

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

<u>Sieve Size</u>	<u>% Passing</u>	
	<u>Type A</u>	<u>Type C</u>
½ inch	100	100
3/8 inch	85-100	70-90
No. 4	0-20	0-5
No. 8	0-5	0-3
No. 16	--	--
No. 50	--	--
No. 200	0-1	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.
- 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.
- The aggregate shall have a percentage of wear not exceeding 30 when tested in accordance with AASHTO Designation T-96.
- 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.
- 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.
- 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.

- B. 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.

- C. 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.

- 1) Covering Manholes and Valves: 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.
- 2) Starting and Stopping: 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.
- 3) Application Rate: The contractor shall be responsible to furnish and place the required asphalt emulsion at a uniform rate and application coverage of 0.43 gallons per square yard or as directed by the City's project representative.
- 4) Emulsion Type and Application of: 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.
- 5) Emulsion Temperature: 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.

- D. 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.

- 1) Application of Cover Material: 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.
- 2) Rolling: After the cover material has been satisfactorily spread, the surface shall be rolled by pneumatic-tired rollers in a longitudinal direction with a minimum 12 ton pneumatic-tired roller. 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.

- E. Seal Coat Weather and Seasonal Limitations:** Seal coat shall be applied only between June 1 and September 15 and when the air temperature in the shade and the roadbed temperature are above 70° F. Seal coat shall not be applied during rain, fog, or other adverse weather conditions. Seal coat placed after September 15 shall be placed only upon written authorization from the City Engineer, and then only when the air temperature in the shade and the roadbed temperature are above 70° F.

#### **4.5 Bituminous Plant Mix Seal Coat:**

Where determined by the City Engineer that the bituminous surface course is unacceptable due to material or construction defects, the Contractor shall place and compact a bituminous plant mix seal coat over the bituminous surface course. The seal coat shall consist of a mixture of mineral aggregate and bituminous binder.

- A. Aggregate:** Gradation of the aggregate shall conform to the following:

Sieve Size	% Passing	Tolerance
	(Ideal Gradation)	
1/2 inch	100	0
3/8 inch	97	± 4
No. 4	40	± 4
No. 8	17	± 3
No. 200	3	± 1

- B. Bituminous Material:** 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.

- C. Tack Coat:** 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.
- D. Mixing and Installation:** 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.

#### 4.6 Slurry Seal Coat:

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. The contractor shall provide the City with a mixture report to be approved by the City.

- A. 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.

**B. Materials:**

- 1) 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.
- 2) 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	% Passing	
		Type II	Type III
1/2 inch	100	100	100
3/8 inch	100	100	100
#4	90-100	90-100	70-90
#8	90-100	65-90	45-70
#16	65-90	45-70	28-80
#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 potable and free from harmful soluble salts.

D. **Applications:**

- 1) 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 pounds 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.
- 2) Type II: This aggregate blend is used to fill surface voids, correct moderate surface conditions and provide sealing and a 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.
- 3) 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.

E. **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:

- 1) A change of material sources or suppliers.
- 2) A change in the type of slurry used.
- 3) If problems occur on the project regarding material quality.
- 4) At the request of the Engineer.

- F. Construction:** 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.
- G. 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.
- H. Equipment:** All equipment, tools and machines used to perform the work shall be maintained in satisfactory working order at all times.
- I. 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.
- J. 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.
- K. 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.
- L. 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.

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" or "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.

- M. Weather Limitations:** 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 (80% or greater) 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.
- N. 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.

## **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 grade 60 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
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 1/2 to 2 1/2	5 ± 1
3/4 or 1	6 ± 1
3/8 or 1/2	7 ± 1

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

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

## **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 moldings 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 equal to the width of the sidewalk but not to exceed 10 feet or as directed. Joints shall be approximately 3/16" wide and be approximately 1/4 of the total slab thickness. Expansion joint in sidewalk shall be at intervals not to exceed 44 feet and shall extend the full depth of the concrete.
- 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 when constructed by hand methods. Curb and gutter constructed with a lay down machine shall be scribed with joints which shall be approximately 1/16" wide and be approximately 1/4 of the total curb thickness.

## **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 1/2 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.

## **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, cobble rock, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation six inches above the bottom of the pipe after placement in its final position. All additional excavation necessary for preparation of the trench bottom shall be made manually. Excavation shall not be carried below the grade shown on the drawings. Any unauthorized excavation made below grade for any reason shall be backfilled in accordance with these specifications.
- B. Excavation for trenches in ledge rock, cobble rock, stones, mud, or other material unsatisfactory for pipe foundation shall extend to a depth of at least six 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 ½"	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 blasting is permitted the contractor shall obtain a Blasting Permit from the City. 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 Farr West City Standard Drawings and in the Specifications for each pipe type. Backfill around the pipe to the level indicated in the Standard Drawings shall not contain rocks more than three inches in diameter and shall be free from sod, vegetation, and other organic or deleterious materials.

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, and every 2 vertical feet (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 and the City Engineer 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 two feet (10 inch 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 three 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, starting at the lower end, 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, 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 displacement test, if the displacement test is not conclusive then a TV pipe inspection test may be required. If directed by the City Engineer, the contractor shall also conduct one or all of the following tests an infiltration test, an exfiltration test, and a pipe system air 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 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. Exfiltration Test:** In areas where groundwater does not exist, exfiltration tests may be required in lieu of infiltration tests.
  - 1) Each section of the sewer shall be tested between successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers. The pipe and manhole shall be filled with water to a point approximately four feet above the invert of the sewer at the center of the upper manhole.
  - 2) The allowable leakage will be computed by the formula:

$$E=0.25DH^{1/2}$$

Where:

- a) E is the allowable leakage in gallons per minute per 1000 feet of sewer tested.
  - b) D is the internal diameter of the pipe in inches.
  - c) H is the difference in elevation in the water surface in the upper manhole and the invert of the pipe at the lower manhole (feet).
- 3) If the leakage from the sewer, as shown by the test, exceeds that allowed by the formula, the Contractor shall make the necessary corrections to reduce the exfiltration to within permissible limits as determined by additional testing.
  - 4) Where the difference in elevation between inverts of adjacent manholes exceeds 10 feet, no exfiltration leakage tests will be required.
  - 5) House service laterals shall be considered part of the main line sewer to which they are connected and shall be tested with the main line sewer.

**D. 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.

**E. 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 tees. All connections into existing sewer line shall be done with a sewer tapping machine and as shown on the City Standard Drawings. The Contractor shall furnish all materials and perform all labor to tap the existing main and install the required tapping saddle.

## **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 concrete pipe or PVC as approved by the City Engineer.

#### **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 upgrade, starting at the lower end, 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 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 ( $1/2$ ) inch, provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one sixty-fourth ( $1/64$ ) inch per inch of pipe diameter, or one-half ( $1/2$ ) inch maximum.

## **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 TV pipe inspection and pressure test. If directed by the City Engineer, the contractor shall also conduct one or all of the following tests an infiltration test, an exfiltration test, displacement test, and a pipe deflection 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 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. Exfiltration Test:** In areas where groundwater does not exist, exfiltration tests may be required in lieu of infiltration tests.
  - 1) Each section of the sewer shall be tested between successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers. The pipe and manhole shall be filled with water to a point approximately four feet above the invert of the sewer at the center of the upper manhole.
  - 2) The allowable leakage will be computed by the formula:

$$E=0.25DH^{1/2}$$

Where:

- a) E is the allowable leakage in gallons per minute per 1000 feet of sewer tested.
  - b) D is the internal diameter of the pipe in inches.
  - c) H is the difference in elevation in the water surface in the upper manhole and the invert of the pipe at the lower manhole (feet).
- 3) If the leakage from the sewer, as shown by the test, exceeds that allowed by the formula, the Contractor shall make the necessary corrections to reduce the exfiltration to within permissible limits as determined by additional testing.
  - 4) Where the difference in elevation between inverts of adjacent manholes exceeds 10 feet, no exfiltration leakage tests will be required.
  - 5) House service laterals shall be considered part of the main line sewer to which they are connected and shall be tested with the main line sewer.

**D. 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 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.

**E. 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.

- F. 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 tees. All connections into existing sewer line shall be done with a sewer tapping machine and as shown on the City Standard Drawings. The Contractor shall furnish all materials and perform all labor to tap the existing main and install the required tapping saddle.



## Section 9

### Subsurface Drain Pipe

#### 9.1 General:

Buried drain pipe with closed or 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.

#### 9.2 Material:

- A. Closed Joint Subsurface Drain Pipe Systems:** All closed joint subsurface drainage piping shall be PVC plastic sewer pipe and 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.

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.

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.

4" closed joint sewer pipe service laterals to individual residential lots shall be PVC sewer pipe as defined in this section and shall be pipe color other than white.

- B. Open Joint or Perforated Drain Pipe:** 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.

### **9.3 Laying Pipe:**

For open joint or perforated pipe, gravel backfill shall be placed under and 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 10**

### **Manholes**

#### **10.1 General:**

This section covers the requirements for manhole materials and installation.

#### **10.2 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 or larger. All manholes with the mainline size being 12 inch diameter or larger shall be 60 inch inside diameter or larger. All other manholes shall be 48 inch inside diameter.

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

#### **10.3 Wall and Cone Sections:**

All manholes shall be precast, sectional, reinforced concrete pipe of either 48 or 60 inch I.D., or as specified to accommodate larger diameter pipes. 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:

The throat section of the manhole shall be adjustable, by use of grade rings, up to 12 inches or less in height.

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.

The pipe used in the base section shall be furnished in section lengths of 1, 2, 3, and 4 feet as required.

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.

#### **10.4 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.

#### **10.5 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 but shall not 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 width of 12" and a thickness of 8" and shall be held down ½" below the top of the adjacent asphalt pavement.

#### **10.6 Manhole Steps:**

All sanitary sewer and storm drain manholes over three 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 11**

### **Grates and Frames**

#### **11.1 General:**

Grates and grate frames shall be the size and type shown on the drawings. Cast iron grates and frames shall be supplied with an approval paint or coating to retard rusting. All fabricated grates and frames shall be constructed of ASTM A-36 structural steel or an approved equal and the finished fabricated product shall be hot dip galvanized in accordance with ASTM A-123. Frames shall be securely embedded in concrete by use of approved anchors.

#### **11.2 Miscellaneous Components:**

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 12

### Restoration of Surface Improvements

#### 12.1 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.

#### 12.2 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:

Seive Size	% Passing	Tolerance
1"	100	0
1/2"	85	±6
No. 4	55	±6
No. 16	31	±4
No. 200	9	±2

#### 12.3 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 12.2 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.

#### **12.4 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 13

### Fencing Specifications

#### 13.1 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 Farr West City.

#### 13.2 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, 9 gauge.
- 2) Tension wire for bottom only, No. 7 gauge spring coil.
- 3) Top Rail: 1-5/8 inch #40 or sch. 40 tubular rail.
- 4) Corner, Gate, or End Posts: Minimum diameter 2-3/8 inch O.D. #40 or schedule 40 galvanized pipe w/o slats; 2-7/8 inch O.D. #40 or schedule 40 galvanized pipe w/slats.
- 5) Line Posts: Minimum diameter of 1-7/8 inch O.D. #40 or schedule 40 galvanized pipe w/o slats; 2-3/8 inch O.D. #40 or schedule 40 galvanized pipe w/slats.
- 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 5.3 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:

- 1) Tangent sections and curves down to 500 foot radius: not more than 10 feet.
- 2) Curves 500 foot radius to 200 foot radius: not more than 8 feet.
- 3) Curves 200 foot radius to 100 foot radius: not more than 6 feet.
- 4) 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.

### **13.3 Vinyl Fence Specifications:**

#### **A. Material:**

- 1) Height: An 8' tall PVC fence shall be installed when fence is used to separate a residential area from a commercial area. A 6' tall PVC fence shall be used in residential areas.
- 2) Fence Style: Any PVC fence installed shall be a privacy style fence.
- 3) PVC Specification: Posts, rails, pickets, gate uprights, post caps, and accessories shall be of high impact, Ultra Violet (U.V.) resistant, rigid PVC, and shall comply with ASTM D 1784, Class 14344B.
- 4) PVC Thickness: All fence parts made from PVC shall have a minimum thickness of 0.17 in except where specified otherwise.
- 5) Post Caps: Molded, one piece.
  - a) Cross Section: Match post or gate upright cross section.
  - b) Thickness: 0.095" minimum
  - c) Configuration: Flat or four-sided as required for installation to top of posts and gate.
- 6) Accessories: standard gate brace, screw caps, rail end reinforcers, and other accessories as required.

#### **B. Miscellaneous Materials:**

- 1) Stiffener Chemicals: Galvanized steel structural channel. Configure channels for concealed installation within PVC rails with pre-drilled holes for drainage. Aluminum extruded channel available upon request.
- 2) Cross Section: 3.00" x 3.00" x 1.500" hourglass shape to grip picket.
- 3) Thickness: 0.040 Gauge (minimum)
- 4) Fasteners and Anchorage: Stainless Steel. All fasteners are to be concealed or colored heads to match fence color. Provide sizes as recommended by fence manufacturer.
- 5) PVC Cement: As recommended by fence manufacturer.

**C. Gate Hardware and Accessories:** Provide hardware and accessories for each gate according to the following requirements:

- 1) Hinges: Size and material to suit gate size, non lift-off type, self-closing, glass filled nylon with stainless steel adjuster plate, offset to permit 120 degree gate opening. Provide one pair of hinges for each gate.
  - a) Stainless Steel, painted with carbo zinc base.
  - b) Finish: Prepainted, 2 coats "Polane".
  - c) Color: Black Gravity Latch or dual access gravity latch.
- 2) Latch: Manufacturers' standard self-latching, thumb latch, pre-finished steel or stainless steel gravity latch. Provide one latch per gate. Finish should match gate hinge finish.
- 3) Hardware: Stainless Steel. Provide sizes as recommended by fence manufacturer. Finish should match gate hinge finish.

**D. Concrete:** Provide concrete consisting of portland cement per ASTM C 150, aggregates per ASTM C 33, and potable water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2000 psi. Use at least four sacks of cement per cubic yard, 1-inch maximum size aggregate, 3-inch maximum slump. Use ½ inch maximum size aggregate in post where required.

Packages Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C 387 with clean water to obtain a 2 to 3 inch slump.

**E. Reinforcement for Filled Posts:** Steel Reinforcing Bars: ASTM A 615. Grade 60 Deformed (#4 or ½"). Install 2 bars for each corner or gate post as specified in the drawings.

**F. Execution - Installation, General:**

- 1) Install fence in compliance with manufacturer's written instructions. During installation, PVC components shall be carefully handled and stored to avoid contact with abrasive surfaces. Install components in sequence as recommended by fence manufacturer.
  - a) Install fencing as indicated on the drawings provided.
  - b) Variations from the installation indicated must be approved.
  - c) Variations from the fence and gate installation indicated and all costs for removal and replacement will be the responsibility of the contractor.

**G. Fence Installation:**

- 1) Excavation: Drill or hand-excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
  - a) If not indicated on drawings, excavate holes for each post to a minimum diameter of 12 inches.
  - b) Unless otherwise indicated, excavate hole depths not less than 30 inches or to frost line.
- 2) Posts: Install posts in one piece, plumb and in line. Space as noted in the drawings. Enlarge excavation as required to provide clearance indicated between post and side of excavation.
  - a) Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
    - (i) Unless otherwise indicated, terminate top of concrete footings 3 inches below adjacent grade and trowel to a crown to shed water.
    - (ii) Secure posts in position for manufacturers' recommendations until concrete sets.
    - (iii) After installation of rails and unless otherwise indicated, install reinforcing in posts in opposing corners of post as shown and fill end and gate posts with concrete to level as indicated. Concrete fill shall completely cover the reinforcing steel and gate hardware fasteners. Consolidate the concrete by striking the post face with a rubber mallet, carefully tamping around the exposed post bottom.
    - (iv) Install post caps. Use #8 screws, nylon washers and snap caps.
    - (v) Remove concrete splatters from PVC fence materials with care to avoid scratching.

- 3) Top and Bottom Rails: Install rails in one piece into routed hole fabricated into posts to receive top and bottom rails, and middle where necessary. Except at sloping terrain, install rails level.
  - a) Prior to installation of rails into posts, insert concealed steel channel stiffeners in top rail, where necessary. Bottom rails shall include minimum 2-1/4" drainage holes.
  - b) At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with concrete.
- 4) Middle Rails: Where necessary, install middle rails in one piece into routed hole in posts with larger holes facing down. Except at sloping terrain, install middle rails level. Secure mid rail to pickets with 2-#8 x 1-1/2" screws evenly spaced. At posts to receive concrete fill, tape rail ends to prevent seepage when filling post with concrete.
- 5) Pickets: Install pickets in one piece as per manufacturer recommendations. Install pickets plumb.
- 6) Fence Installation at Sloping Terrain: At sloping terrain rails may be racked (sloped) or stepped to comply with manufacturers' recommendations.

#### **H. Gate Installation:**

- 1) Prior to installation of rails into posts, apply PVC cement into sockets per manufacturer's recommendations. Bottom rail shall include minimum 2-1/4" drainage holes.
- 2) Assemble gate prior to fence installation to accurately locate hinge and latch post. Align gate horizontal rails with fence horizontal rails.
- 3) Install gates plumb, level, and secure for full opening without interference according to manufacturer's instructions.
- 4) Gate Latch Installation. Install gate latch according to manufacturer's instructions.
- 5) Allow minimum 72 hours to let concrete set-up before opening gates.

#### **I. Adjusting and Cleaning:** Remove all traces of dirt and soiled areas.

### **13.4 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 both the top and bottom rail.

### 13.5 Construction Fence Specifications - Type "D":

- A. Materials:**
- 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 14**

### **Street Lighting**

#### **14.1 General:**

All new subdivisions shall have street lighting plans as approved by the City Engineer. Street lights shall be provided at all street intersections and along new proposed streets at a maximum street light spacing of 600 feet.

The developer shall be responsible for the construction of all street lights. At the preconstruction conference for each new subdivision, the developer shall make a payment to the City, at the current street light cost, for each new street light required in the development. The City will transfer this payment to Rocky Mountain Power and arrange for the installation of the required street lights.

All street lighting shall be constructed in accordance with the details shown on the Farr West City Public Works Drawings and the applicable requirements of Rocky Mountain Power. Alternate decorative street lights may be installed in new subdivisions provided that the developer obtain prior approval from the Farr West City Council. Alternate decorative lighting must be from the Rocky Mountain Power list of approved street lights.



## **Section 15**

### **Municipal Irrigation**

#### **15.1 General Requirements:**

This specification covers the general construction requirements for sprinkler irrigation systems on grassed areas such as parks and detention basins that will be constructed by development and shall be owned and maintained by the city. Pressurized irrigation systems shall not be permitted to connect to the culinary water system. Standards provided by the secondary water supplier should be followed when connecting to secondary water main lines. Additional standards apply for work in the City right-of-way as established herein. Irrigation sprinkling systems on city property will be constructed according to these specifications.

The sprinkler system shall be constructed using the sprinklers, valves, piping, fittings, wiring, etc. of sizes shown on the drawings in accordance with these specifications.

Sprinkler lines shown on the drawings are essentially schematic in nature. Locations of all sprinkler heads, valves, piping, wiring, etc., may need to be adjusted for field conditions. Changes should be made with the concurrence of the contractor, the owner and the engineer.

#### **15.2 Scope:**

It is the intention of these specifications, together with the accompanying drawings to accomplish the work of installing an irrigation system which will operate in an efficient and satisfactory manner according to the workmanlike standards established for the irrigation industry.

It will be the contractor's responsibility to report to the Engineer any deviations between the drawings, specifications and the site. Failure to do so prior to the installing of equipment, and resulting in replacing, and/or relocating, will be done at the contractor's expense.

#### **15.3 Quality Assurance:**

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary trades and who are completely familiar with the specified requirements and the methods of the work of these specifications.

The basis for accepting or rejecting the installation procedures used on the work will be the manufacturer's recommended installation procedures, these specifications and the direction given to the contractor by the owner or the owner's engineer.

#### **15.4 Pipes and Fittings:**

Pipes shall be installed and backfilled at the depths indicated by the trench detail in the drawing sheets.

- A. Main and Lateral Lines:** Schedule 40 PVC solvent weld pipe and shall meet the requirements of ASTM D-2241, "Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)" with the ratings printed on the pipe. Pipe shall be free from cracks, holes, foreign material, blisters, inside bubbles, wrinkles and dents. Sizes shall be as shown on the drawings.
- B. Joints:** All joints shall be glued as per manufactures recommendations, using both the proper primer and glue. All joints must be allowed to set for a minimum of 24 hours prior to pressure testing.

Fittings on lateral lines and main lines shall be Schedule 80 pressure rated PVC. Do NOT use galvanized fittings.

Fittings on flex swing risers shall be barbed insert ells made of THICK-WALLED POLY FITTINGS. Pipe on flex swing risers shall be THICK-WALLED POLY PIPE. This pipe is to be used only between heads and lateral lines and shall not exceed a distance of 5 feet.

## **15.5 Manual Valves:**

Manual brass ball valves shall be sized to match the electric control valve. Valves shall be installed on the up-stream side of the electric control valve and in the same valve box and shall be operable by a simple above grade sprinkler control key.

## **15.6 Electric Control Valves:**

Use Rainbird PEB-PRS-B automatic sprinkler valves with flow control adjustment. Wire shall be 14 gage or larger as determined by the distance from the controller. Ground or neutral wires shall be white.

Splices in electric control wires shall be made with waterproof connectors. NO EXCEPTIONS. All splices shall be contained in a valve box, preferably in the same box as the electric remote control valve. Do not run short pieces of wire. Consult with the Engineer if any question arises as to length of wire. Failure to do so will result in the replacement of the wire at the contractor's expense.

## **15.7 Valve Boxes:**

Valve boxes shall be of sufficient size to house 1 (one) electric remote-control valve and 1 (one) manual valve of the specified size and still allow room for maintenance without having to excavate or perform similar operations. Boxes shall be as manufactured by Wetco (or approved equal) meeting with ASTM D638 for tensile strength of 4,300 pounds per square inch. Boxes shall be installed such that they are on a fully stable foundation. Boxes shall not rest on pipes leading to or exiting from the valve box.

### **15.8 Quick Coupler:**

All quick couplers shall be a 1" single lug valve installed as per details on the drawings. The quick coupler shall be located directly outside of each valve box on the downstream side of the two valves.

### **15.9 Thrust Blocks:**

All main lines shall have a thrust block of poured concrete installed at each change of direction. The thrust block shall be of sufficient size for the pipe involved and rest on undisturbed ground.

### **15.10 Heads:**

System shall provide separate circuits for park strip and open basin areas where different type heads are used. Sprinkler head design shall provide 100% overlap between heads. Sprinkler heads in the open basin areas shall be "Rain Bird" Model 5000 series or 3500 series rotor heads or city approved equal. Sprinkler heads in narrow areas such as the park strip shall be "Rain Bird" 1800 series spray heads or approved equal.

### **15.11 Drain Valve:**

Grade and lay all piping such that the entire system will drain. Drain valves shall be provided to prevent freezing of water. Pipe shall be laid so that drain valves are located at low points. Drain valves shall be of the size and type as shown on the drawings.

### **15.12 Automatic Controllers:**

All sprinkler valves shall be controlled by an automatic timer enclosed in a weatherproof pedestal mounted box. Use Rainbird ESP-Me sprinkler timer with Rainbird PED-DD16 pedestal or approved equal. Controllers shall be connected to a permanent AC power source or solar panel system. Automatic controllers shall be installed according to the manufacturer's recommendations and as specified on the drawing details. Ground all controllers with an 8 foot grounding rod, using a #6 or larger solid copper wire. The location of the timer shall be determined by the City. Installation shall conform to current electrical codes.

### **15.13 Existing Utilities:**

Before any trenching, excavation or digging below the surface for any reason is begun, the contractor shall have the area "Blue Staked" in order to determine as close as possible the location of all underground utilities. The contractor will conduct his work in such a manner to protect all utilities from damage. It is the responsibility of the contractor to repair or replace any damage incurred by him or his workmen at no expense to the owner.

### **15.14 Trenches:**

Trenches shall be constructed according to the trench detail in the drawing sheets. Trenches for lateral lines shall be dug a minimum of 14" deep and as wide as necessary to properly install pipes.

Where more than one pipe is to be installed in a trench a distance of 6" is to be maintained between each pipe.

All trenches are to be 12" away from all curbs, buildings and sidewalks.

Grade and lay all piping such that the entire system shall drain. Where possible, drain the main line to the valve manifold. All lateral lines beyond the valve manifold should be laid in such a manner as to drain by gravity to a single low point. The lateral lines shall be "blown out" by the use of compressed air. Automatic drains shall not be installed.

### **15.15 Head Location:**

Where shown on drawings, the irrigation heads are shown schematically. It will be the contractor's responsibility to determine the exact location of each irrigation head and valve to accommodate the conditions as found on the site in order to provide COMPLETE coverage of all areas. In no case shall the spacing exceed 95 percent of the spacing recommended by the manufacture for the irrigation heads. Minor adjustments in the system will be permitted to clear existing fixed obstructions subject to the approval of the Engineer. All deviancies from the drawings must be noted on "As-Built" drawings.

All irrigation heads will be set perpendicular to the finished grade unless otherwise designated on the drawings or specified. Rotor heads on hillsides will be adjusted to the downhill side to avoid cutting into the hill with the stream of water causing additional erosion.

### **15.16 Backfilling of Trenches:**

Backfill around and over the pipes in accordance with the details on the drawings. All backfill that is to come in contact with the pipes shall not contain material more than 1/4 inch in diameter. If the native material is not suitable for backfill then material shall be imported as approved by the City. Upon the approval of the Engineer, the existing material on site may be used as backfill material above the pipes.

### **15.17 Flushing and Testing:**

After installation of all new pipes and risers for a given circuit and after completion of all division work and before the installation of any irrigation head, the control valve shall be opened fully and the piping system shall be flushed of all debris. Contractor shall make provisions for temporary blow off flushing connections.

Pressure testing will be performed after completion of each circuit and after completion of the entire system. Pressure test each section of completed line for a 1 hr. period at 125 psi. At this time any necessary repair work will be done at the contractor's expense and the entire system will be in good working order prior to the issuance of the Substantial Completion.

### **15.18 Piping:**

Before any pipes are covered, the City Inspector shall inspect for compliance with specifications and drawings. Any required changes will be made at this time at the expense of the contractor.

### **15.19 System Operation:**

The entire system will be tested in the presence of the Engineer in order to insure COMPLETE coverage of all areas to be watered and the automatic operation of the system using the automatic clock. Any changes required will be made at this time at the contractor's expense.

All heads will be adjusted to their proper coverage and set to the proper depth at this time.

### **15.20 Guarantee:**

All work shall be guaranteed for compliance with the drawings and specifications for a period of one year after the date of substantial completion. The contractor shall make good any deficiencies at the time he is notified of any faults, and place in satisfactory condition any damage to the buildings or grounds, without cost to the owner.

AS-BUILT DRAWINGS shall be furnished to the Engineer at the time of the Systems Inspection before any Substantial Completion Date will be issued.

After the system has been completed, inspected and approved, instruct the Owner's maintenance personnel in the operation and maintenance of the system.

## **Section 16**

### **Topsoil, Grass, and Hydro-Seeding**

#### **16.1 General Requirements:**

This section defines the general requirements for the installation of top soil, grass (sod), and grass turf (by the method of hydro-seeding) for all public works projects or for projects which are built by the developer and granted to the City.

#### **16.2 Description of Work:**

The work covered by this section of the specifications consists in furnishing all seed or sod, labor, materials and equipment and in the performing of all operations in connection with the installation of seed or sod in strict accordance with this section of the specifications.

Landscape work shall be suspended at any time when it may be subject to damage by climatic conditions.

The ground preparation must be approved by the City prior to placing seed or hydro-seed. The seeding or hydro-seeding application must be approved by the City to ensure adequate coverage and quality of seed mixture.

#### **16.3 Quality Assurance:**

- A.** Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary trades and who are completely familiar with the specified requirements, drawings, and the methods of the work of this section.
- B.** Use adequate amounts of equipment to thoroughly demolish and remove from site all materials without damaging the existing buildings, landscape, etc.
- C.** All damage to existing base facilities, including buildings, asphalt surfaces, concrete surfaces, lawn, irrigation system, etc. shall be repaired at no extra cost to the owner.
- D.** All seed furnished by the Contractor shall be true to type or name as specified by the City and shall be tagged in accordance with the standard practice recommended by the Agricultural Code of the State of Utah.
- E.** Topsoil report, as well as literature on fertilizers, mulch, and seed mixes, shall be submitted to and approved by the City.

#### **16.4 Reference Standards:**

- A.** APWA 2007 Standard Specifications Section 329200

- B. FS-O-F-241: Fertilizers, Mixed, Commercial
- C. ANSI/ASTM D422 Methods for Particle-Size Analysis of Soils

## 16.5 Products:

### A. Seed:

- 1) The grass seed shall consist of a mixture of the current year's Kentucky Blue and Rye Grass.

Seed #	Botanical Name	Common Name	% by Weight
1	Poa pratensis	Adlephi	10
2	Poa pratensis	Columbia	30
3	Poa pratensis	Midnight	20
4	Poa pratensis	Ram I	10
5	Poa pratensis	Sydsport	20
6	Perennial Rye	Citation	10

- 2) The seed mixture shall meet the minimum tested requirements of A.N.A. The seed shall be the current year's crop, guaranteed by the supplier as follows:

80% germination rate, 28 pounds per bushel or equiv.

72% purity and 80% pure live seed.

No more than 2% inert matter.

No noxious weeds and no more than 1/10% weed seed.

- 3) The seed shall be applied at a rate of 6 pounds per 1,000 square foot or as recommended.

- B. **Sod:** Healthy and well-rooted nursery grown Kentucky Blue Grass sod and free of weeds that has been machine cut in straight, uniform strips or rolls, cut at a depth between  $\frac{3}{4}$  inch and 1 inch.

All sod shall be two year old Kentucky Blue Grass that has been cut fresh the morning of installation. Only sod that has been grown in a commercial sod farm shall be used. Sod from any other source shall be deemed unacceptable. All sod that has not been laid within 24 hours shall be deemed unacceptable and shall be removed from the site.

- C. **Fertilizer:** Commercial fertilizer shall be a mixed commercial fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on the containers. Apply at a rate of 6 pounds per 1000 square feet.

- D. Mulch (Cellulose Wood Fiber):** Wood fiber mulch shall be a wood material that has been shredded into small fibers. The mulch shall have been processed so that it will have no germination and so that it forms a blotter-like ground cover. The material shall be air dry and contain no more than 15% moisture by weight. Mulch materials shall be "Silva-fiber" as manufactured by Weyerhaeuser Company Silva Products Department, Tacoma, Washington, or equal and applied at rate of 2000 pounds per acre.
- E. Imported Topsoil:** Where imported topsoil is required it shall conform to the following.

Soil Name	pH	Soluble Salts (mmhos/cm)	SAR (Sodium adsorb ratio)	% Organic Matter	% Sand	% Silt	% Clay	Texture Class
Soil Amendments	<8.0	<4.0	NA	NA	NA	NA	NA	NA
Topsoil	5.5 -8.0	<2.0	<3.0	2	<70	-	<30	Sandy loam; Loam; Sandy clay loam; Silt loam

- 1) Topsoil shall consist of natural sandy loam and be of uniform quality, free from subsoil, hard clods, stiff clay, hard-pan, sod, partially disintegrated debris of any other undesirable material. Soil shall be free of plants, roots, or seeds that would be toxic or harmful to growth. Topsoil shall be obtained from naturally drained areas and shall contain at least 4 percent organic material as determined by loss upon ignition of a moisture free sample that has been dried in accordance with current methods of the Association of Official Agricultural Chemists. Acidity range shall be 5.5 to 7.7 inclusive.
- 2) Upon request, the Contractor shall furnish a certified report of an approved analytical chemist showing the analysis of the topsoil proposed for use. Furnish sample of topsoil to the City prior to delivery of topsoil on site.



## 16.6 Execution – Sod Applications:

- A. Preparation of Subgrade: Inspect subgrade for any deleterious material including all rocks, clods and litter that is larger in diameter than specified. The Contractor shall bring to the attention of the City any deficiencies in the subgrade including low spots, unevenness, and poor drainage areas due to improper grading or leveling prior to the installation of topsoil. Subgrade shall be 5-1/2" below finish grade in all cases to insure a uniform depth of 4" for topsoil and 1-1/2" for sod.
- B. Installation of Topsoil:
1. When contract operations have been completed to a point where the areas shall not be disturbed, subgrade shall be cleaned free of waste material of all kinds. Till and pulverize the subgrade to a depth of not less than 4 inches. Tilling shall be completed in all areas that are to receive plant materials whether it shall be sod or shrubs.
  2. Distribute topsoil to a depth of 4 inches over all sodded areas under the contract. Do not place topsoil over subgrade that is frozen or damp.
  3. Distribute composted mulch material over all topsoil areas at the rate of 10 tons per acre.
  4. Till the composted mulch material into the topsoil to a depth of 4"
  5. Upon completion of the tilling process, the surface of the topsoil shall be fine graded. The surface shall be firm and free from footprints, depressions or undulations of any kind. The surface shall be free of all materials larger than 1/2" in diameter. Smooth shall be within 1 inch plus or minus of contours as shown on plans.
  6. The finish grade of the topsoil adjacent to all sidewalks, mowstrips, etc., and prior to the laying of the sod, shall be 1-1/2" below the top surface of the concrete or hard surface. NO EXCEPTIONS
  7. Prior to laying of sod, the entire surface to receive sod shall be uniformly covered with the specified chemical fertilizer at the rate of 5 pounds per 1000 square feet.
  8. Upon completion of the laying operation, an inspection of the area shall be made. All voids and large cracks between individual pieces of sod shall be filled with topsoil, prior to watering.

9. Upon completion of filling all voids in the newly laid sod areas, the sod shall be completely saturated with water.

## **16.7 Execution – Seeding Applications:**

A. General: The contractor may choose from or combine the following seeding methods to seed and turn over to the City a healthy lawn with the quickest results. Seeding methods shall be discussed with and approved by the City.

B. Preparing The Seed Bed:

1. The landscape work shall not begin until all other trades have repaired all areas of settlement, erosion, rutting, etc., and the soils have been re-established, recompact, and refinished to finish grades. The City shall be notified of all areas which prevent the landscape work from being executed.
2. Inspect subgrade for any deleterious material including all rocks, clods and litter that is larger in diameter than specified. Bring to the attention of the City Public Works Department any deficiencies in the subgrade including low spots, unevenness, and poor drainage areas due to improper grading or leveling prior to the installation of topsoil. Subgrade shall be 4-1/2" below finish grade in all cases to insure a uniform depth of 4" for topsoil.
3. Areas requiring grading by the landscaper including adjacent transition areas shall be uniformly level or sloping between finish elevations to within 0.10-ft above or below required finish elevations.
4. The seeding work shall not proceed until after walks, curbs, pavings, edging, and irrigation systems are in place. The contract operations shall be completed to a point where the landscape areas will not be disturbed.
5. During grading inspect surface for any waste materials in the planting areas such as weeds, clods, rock (2 inches and larger), building materials, rubble, wires, cans, glass, lumber, sticks, litter, etc., shall be removed from the site. Weeds shall be dug out by the roots. The surface shall be cleaned free of waste materials of all kinds.
6. Fertilizers, additives, seed, peat, etc. subject to moisture damage shall be kept in a weatherproof storage place in such a manner that they will be kept dry.
7. After removal of waste materials the planting areas shall be scarified and pulverized to a depth of not less than 4 inches and all surface irregularities removed.

8. Finish sub-grade and topsoil placement and grading shall consist of:
- a. Prepare sub-grade by rough grading and removing all irregularities and debris, then till and scarify subsoil to a depth of 4 inches before placing topsoil. Dig sub-grad down as required in shrub beds for the placement of topsoil.
  - b. Place 4 inches of topsoil over all lawn unless shown or specified otherwise on plans. Sub-grade soil shall be in a loosened and rough surface finish before topsoil is placed over sub-grade. (Sub-grade surface shall not be smooth, but a rough surface shall exist for a transition zone of topsoil to subsoil.) If areas of sub-grade become compacted before topsoil is placed, subgrade shall be tilled again before topsoil placement.
  - c. Placing all soil additives and fertilizers.
  - d. Tilling of lawn and planting areas subsoils and topsoil soils that are compacted.
  - e. After tilling, bring areas to uniform grades by floating or hand raking.
  - f. Making minor adjustment fo finish grades as directed by the City.
  - g. Removing waste materials such as stones, roots, or other undesirable foreign material and raking, dishing, dragging, and smoothing soil ready for planting.
  - h. No work to be under taken when soils are wet or frozen.
9. No seeding shall be done when the wind velocities exceed 5 miles per hour.
10. Any unusual subsoil condition that will require special treatment shall be reported to the City.
11. Surface drainage shall be provided as shown by molding the surfaces to facilitate the natural run-off of water. Low spots and pockets shall be filled with topsoil and graded to drain properly.
12. The finish grade of the topsoil adjacent to all sidewalks, mowstrips, etc., and prior to seeding shall be ½" below the top surface of the concrete or hard surface.

13. The contractor shall prepare only enough ground that can be seeded within 24 hours thereafter.

C. Fertilizing

1. The fertilizer specified above shall be spread evenly over the prepared seed bed in the amount specified above and at those times as specified by the manufacturer.

D. Seeding (Drilling Method):

1. This method shall consist of;
  - a. Preparing the seed bed as specified in Section 20.5b.
  - b. Combining the seed mixture specified at 6 pounds per 1000 square feet with the fertilizer specified at the rates per thousand square feet as specified.
  - c. Drilling the seed and fertilizer into the earth with a billion lawn seeder and making two complete passes at 30 degrees apart from one another over the entire area to be seeded as indicated on the plans. Apply hydro-mulch evenly over newly seeded areas at a rate of 50 pounds per 1000 square. All slopes over 30 percent shall be seeded by hydro-mulching. Any slopes having a washing problem shall be mulched with straw, jute, fibre mating, enkamat, curlex blanket, or other erosion control materials as per the manufacturer's specifications. The material to be used shall be submitted by the Contractor for the City to be reviewed and approved.
2. Drilling may be used from May 1 to August 30.

E. One Step Hydro-Seeding

1. This method shall consist of;
  - a. Preparing the seed bed as specified in section 16.7B.
  - b. Combining the fertilizer, seed mixture as specified at a rate of 6 pounds per 1,000 square foot with Silva Fiber Mulch as specified at a rate of 1500 pounds per acre, filling the tanks with water,

agitating these materials into a well-mixed slurry suspension, and spraying the mixture under pressure onto the prepared seed bed.

2. One step hydro-seeding may be used from April 15 to September 15.

F. Two Step Hydro-Seeding

1. This method shall consist of;
  - a. Preparing the seed bed as specified above.
  - b. Applying the fertilizer as specified.
  - c. Sowing the seed mixture at a rate of 6 pounds per 1,000 square foot in two directions with an approved mechanical seeder.
  - d. Spraying a mixture of water and Silva Fiber under pressure at a rate of 1500 pounds per acre onto the prepared seed bed.
2. Two step seeding may be used from April 15 to September 15.

G. Lawn Repair and Seeding

1. Small area lawn repair and seeding shall consist of:
  - a. Preparing the seed bed as specified.
  - b. Applying the fertilizer as specified.
  - c. Sowing the lawn seed mixture as specified.
  - d. Raking the seed and fertilizer into the soil. Top dress seed bed with two 4 cu. ft. bales of sphagnum peat moss applied evenly per 1000 square feet of area.
2. Lawn area repairs may be sodded in place of seeding to have a healthy lawn acceptable and ready to turn over to the City.

## **16.8 Lawn Establishment:**

- A. The contractor shall establish the lawn by watering; mowing; protecting; repairing eroded areas; re-seeding; and mulching or re-sodding turf as necessary;

keeping the sprinkler irrigation system operational and maintained by cleaning and replacing parts, heads, etc.; fertilizing; and keeping the area clean.

- B. Mowing of Lawn Areas: Cut grass first time when it reaches a height of 4 ½" and maintain to minimum height of 3". Do not cut more than 1/3 of blade at any one mowing. Remove clippings. After first mowing, water to moisten soil from 3 inches to 5 inches deep. Allow a minimum of 5 days between mowing. Contractor shall mow the lawn until the end of the date of Substantial Completion. The number of mowing to be provided by the contractor shall be determined by the growth pattern of the lawn. There shall be no minimum number of mowing set forth, only that the health and vitality of the lawn shall be maintained. At no time shall the height of the lawn exceed 4 ½".
- C. All lawns shall be fertilized after third mowing with 6 pounds of 16-16-8 commercial fertilizer per 1000 sq. ft.
- D. Protection: Protection of the newly seeded or sodded areas shall be the complete responsibility of the contractor. Provide adequate acceptable visual barriers by the means of temporary fences, or barricades set at appropriate distances and strings or tapes between the barriers as an indication of new work. Restore any damages areas caused by others, trespassing, erosion, or vehicular traffic until such a time as the lawn is accepted by the City.

## **16.9 Watering:**

- A. The entire sod or seeded area shall be watered with a completely operational sprinkler irrigation system at time of seeding.
- B. Watering of the sod or seeded areas shall be the complete responsibility of the contractor by whatever means necessary to establish the seed in an acceptable manner prior to acceptance of the City. An irrigation system shall be in place on the site, but if for whatever reason, water is not available in the system, it is the full responsibility of the contractor to water the seeded areas by whatever means, until the area is accepted by the City.
- C. The seed bed shall be kept moist at all times without creating washing or puddling of the lawn area. Erosion caused by over watering shall be repaired immediately and re-seeded according to these specifications.
- D. Areas that continually experience erosion shall be sodded at no extra cost to the City.

### **16.10 Time Period:**

- A. The establishment period for the seeded lawn shall be a minimum of 90 days from the time the lawn seeding operations are completed.

### **16.11 Clean-up:**

- A. The contractor shall keep the site free from accumulation of waste material. Upon completion of all seeding operations, the portion of the project site used for a work or storage area by the CONTRACTOR shall be cleaned of all debris, superfluous materials, and equipment. All walks or pavement areas must be swept or washed clean and all rubbish removed to the satisfaction of the City Engineer or Public Works Inspector.

### **16.12 Final Inspection:**

- A. Inspection work of lawns will be made at conclusion of maintenance.
- B. Within 10 days of the end of the establishment period written notice requesting an inspection shall be submitted to the City by the Contractor. All areas designated for grass or lawn on the plans shall be covered with reasonable stand of grass and acceptable to the City. All areas found not be acceptable shall be re-seeded or re-sodded in accordance with the above specifications. Such areas shall be maintained and guaranteed as stated above. The City will not accept the grass surface if it is unhealthy, patchy, or shows sign of uneven growth. The sloped areas will need to be stabilized and free from scars and washout from erosion.
- C. Final acceptance of the WORK prior to guarantee period of the contract will be accepted upon written approval by the City, on the satisfactory completion of all work, including maintenance, but exclusive of the replacement of plant material.
- D. Any delay in the completion of any item of work in the seeding operation which extends the seeding into more than one season shall extend the maintenance in accordance with the date of completion.
- E. The Contractor shall re-seed or sod, as soon as weather conditions permit, all bare areas or areas where the lawn is thin or not healthy.
- F. All work done under this contract shall be left in good order to the satisfaction of the City and the Contractor shall, without additional expense to the Owner.

### **16.13 Final Acceptance:**

- A. Lawn maintenance by the Contractor shall cease upon his receipt of written notice from the City indicating final acceptance of the lawn.

### **16.14 Guarantee:**

The contractor shall be responsible for the protection, watering, weed control, mowing and replacement of any damaged sod or seeded areas until acceptance by the owner. This guarantee shall include re-seeding of any areas, filling of any voids between sod pieces, removal and replacement of any deficient sod, repairing of any eroded or damaged areas and maintaining the sod or seeded areas by watering, mowing and controlling of insects and weeds, as well as advising the owner of any maintenance or watering procedures necessary to care for and promote plant life. All sod or seeded areas shall be in satisfactory condition at the time of the final inspection and shall be no longer than 4 ½" at that time.



## **Section 17**

### **Sewer Lift Stations**

#### **17.1 Scope:**

Furnish and install at least two submersible non-clog wastewater pump(s) at sewer lift station, a minimum of three pumps shall be provided for stations handling flows greater than 1 million gallons per day. The stations shall conform to the following performance specifications:

#### **17.2 Pump Design:**

The pump(s) shall be capable of handling raw, unscreened wastewater. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump(s) shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter pump well. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft. One single waste water pump shall be sized to handle the maximum peak flows into the sewer lift station including any expected infiltration.

#### **17.3 Wet Well Design:**

The wet well shall be sized and level control settings shall be appropriate to avoid heat buildup in the motor due to frequent starting (short cycling), and to also prevent septic conditions due to excessive detention time.

#### **17.4 Site Tests:**

The pump shall be tested at start-up. Voltage, current, and other significant parameters shall be recorded. The Manufacturer shall provide a formal test procedure and forms for recording data.

#### **17.5 Pump Test:**

The pump manufacturer shall perform the following inspections and tests on each pump before shipment from the factory:

- A. Impeller, motor rating and electrical connections shall be checked for compliance to the customer's purchase order.
- B. A motor and cable insulation test for moisture content or insulation defects shall be made.
- C. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

- D. The pump shall be run submerged a minimum of six (6) ft. under water.
- E. After operational test No. 4, the insulation test (No. 2) shall be performed again.

A written report stating the foregoing steps have been done may be supplied with each pump at the time of shipment (upon request).

### **17.6 Local Pump Service Facility:**

At the time of bidding, there shall be a fully accredited service facility within 100 miles of the project site having factory trained technicians and a full stock of repair parts for a complete overhaul of the proposed pumps.

### **17.7 Pump Warranty:**

The pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and material for a minimum period of five (5) years or 10,000 hours under the Municipal Wastewater-Permanent Installation Warranty Policy under normal use, operation and service. The warranty shall be in printed form and apply to all similar units.

### **17.8 Documentation:**

The manufacturer, if requested, shall supply a minimum of five (5) sets of standard Drawing Submittals, Operating and Maintenance Instruction Manuals and Parts Lists. Additional sets of Drawings, Parts Lists, Manual etc. or modification to the manufacturer's standard submittals shall be at an additional charge. Aperture Cards, photo or microfilming sets, if required, shall be at an additional charge per set.

Standard submittals shall consist of:

1. Pump Outline Drawing
2. Control Data
3. Access Frame
4. Typical Installation Guides
5. Technical Manuals
6. Parts List

### **17.9 Experience Clause:**

The pump manufacturer shall have a minimum of 1,000 units of similar type pumps, installed and operating for no less than five (5) years in the United States.

### **17.10 Controls:**

“ABS” QCII control panel with option package “B”. For each pump motor, there shall be included: a combination circuit breaker/overload with manual reset for protection against current overloads, short-circuit protection, and disconnect for all phases; across-the-line magnetic contact; hand/off/automatic pump operations selector switch; intrinsically safe solid state duplex pump controller with an automatic solid state alternator for two pumps (providing alternating operation of pumps under normal conditions, or in case of high level, allowing both pumps to operate simultaneously) and high level alarm function.

The following additional options shall be included with the panel:

1. NEMA 4X Gasketed, lockable enclosure.
2. High Level Alarm light - panel mounted.
3. Condensation heater.
4. Running time meter(s).
5. Pump run light(s).
6. Secondary Lightning arrester.
7. 3 Phase Power Monitor Phase protection.
8. Automatic Telephone Dialer, Raco Verbatim 8-channel:
  - a. Pump called for but fails to run alarm output
  - b. Power Failure
  - c. High wet well level
  - d. Loss of echo failure
  - e. Low level alarm
9. Manual Emergency/Normal Power Transfer Switch with Generator Receptacle

### **17.11 Liquid Level Sensors:**

Milltronics Hydoranger 200 with an XPS-10 Ultrasonic Transducer or approved equal. Sensor to monitor the water elevations for the high level alarm, lag pump turn on, lead pump turn on and pump off.

Also, one (1) High Level Alarm Redundancy Anchor Scientific P20NO liquid level sensor with 20 feet of electrical cable, each with mounting bracket to 1" pipe. Level sensors shall be a non-floating, displacement type. Level sensors shall be rated for operation at milliwatt levels.

### **17.12 Back-Up Generator:**

An auxiliary power generator is required in an open-air enclosure adjacent to the pump station control building (See Standard Details). An adequate generator size shall be based on the size

and design of the lift pumps and the sewer lift station complete. Each site shall be a case by case design as reviewed by the City Engineer.

**General Generator Requirements:**

1. Natural Gas Operation
2. Weather Proof Enclosure
3. Automatic Start/Automatic Power Transfer Switches
4. Exercise Timers - shall be connected to the control panel and run/load the unit 15-30 minutes each week or as determined by the City Engineer.
5. Startup and Training
6. Engine Cooler/Heater
7. All applicable connections and part

Submit all applicable manufacturer information to City for review and approval.

**17.13 Typical Lift Station Building & Site Plan:**

See City Standards Details

**17.14 Substitutions:**

- A. After execution of the contract, should the contractor desire to substitute equipment other than that specified in the contract, such substitution must be superior in construction and efficiency to that specified in the contract, and higher quality has been demonstrated by service in a similar installation.
- B. In the event the contractor obtains engineer's approval of equipment other than that for which the station was originally laid out, the contractor shall, at his own expense, make any changes in the structures, buildings or piping necessary to accommodate the equipment, and shall provide as-built drawings to the engineer. It shall be assumed that the cost to the contractor of the equipment proposed to be substituted is less than that of the equipment specified in the contract and if substitution is approved, the contract price shall be reduced by an amount equal to the savings.

## Section 18

### Storm Drain Design, Construction Standards, and Policies

#### 18.1 General:

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

All detention basin designs and calculations shall be reviewed and approved by the City Engineer. It is the Developer's responsibility to submit all information relevant to the design of the basin the City Engineer for review and approval. If omission of relevant information effects a change in design, it will be the Developer's responsibility to make any necessary modifications to the basin design.

#### 18.2 Definitions:

- A. **"Basin"** means a structure used either as a detention basin or retention basin as determined by the City Engineer.
- B. **"Detention basin"** means a structure designed to detain or slow down storm water runoff until downstream storm sewer resources are less heavily taxed. A detention basin contains an inlet and an outlet, allows debris to settle out, and regulates water flow.
- C. **"Development"** means any man-made change to improved or unimproved real estate, including but not limited to site preparation, filling, grading, paving, excavation, and construction of buildings or other structures.
- D. **"Disturb"** means to alter the physical condition, natural terrain or vegetation of land by clearing, grubbing, grading, excavating, filling, building or other construction activity.
- E. **"Drain inlet"** means a point of entry into a sump, detention basin, or storm drain system.
- F. **"Drinking water source protection zone"** means zones determined by Geo-Hydrology designed to protect groundwater aquifers of a well in a Culinary Water System.
- G. **"Percolation"** means the ability of a soil to absorb water. Typically measured by a Standard Percolation Test in units of minute per inch.
- H. **"Regional or regional basin"** means a storm water detention or retention basin that services more than one property, or a service area as designed by the city.
- I. **"Retention basin"** means a structure or cavity designed to retain or hold back all storm water runoff from flowing downstream. A retention basin contains an inlet with no outlet other than percolation or evaporation. A retention basin allows debris to settle out.

- J. “Storm drain system”** means a system for the collection and conveyance of storm water that is owned and operated either publically or privately, and including run-off from sidewalks, roads with drainage systems, streets, catch basins, detention basins, curbs, gutters, non-irrigation ditches, man-made non-irrigation channels, sumps, and storm drains.

### 18.3 Rainfall Hydrology:

- A. Policy:** All storm drain detention basin systems shall be designed to carry the 100-year storm, unless otherwise stated.
- B. Storm specifications:** Local storm drain piping shall be designed for the 10-year storm where the road or other above ground conveyance will carry the difference to the 100-year storm. All basins regardless of local or regional, or retention or detention shall be designed to accommodate a 100-year storm event. The intensity used for the sizing of basins shall be based upon the worst case scenario and not the time of concentration.
- C. Intensity-duration-frequency (IDF):** For the use of the Rational Method, an IDF curve shall be obtained from the NOAA Atlas 14 for the project location.
- D. Calculation basis:** For single site plans and minor lot subdivisions the rational equation may be used. For larger sites a City Engineer-approved computer model shall be used.
- E. Rainfall pattern:** For the use of computer models one of the following rainfall pattern shall be used.
- 1) **Farmer Fletcher Storm:** This pattern is based upon the Farmer-Fletcher Distribution. This pattern is for a 1" storm and must be modified for storms of other magnitudes.

1	0	11	0.004	21	0.033	31	0.052	41	0.012	51	0.005
2	0	12	0.005	22	0.034	32	0.045	42	0.011	52	0.005
3	0.002	13	0.008	23	0.035	33	0.04	43	0.01	53	0.004
4	0.002	14	0.009	24	0.038	34	0.035	44	0.009	54	0.004
5	0.002	15	0.009	25	0.039	35	0.03	45	0.009	55	0.004
6	0.002	16	0.013	26	0.045	36	0.022	46	0.008	56	0.003
7	0.002	17	0.017	27	0.052	37	0.02	47	0.006	57	0.003
8	0.002	18	0.02	28	0.054	38	0.018	48	0.006	58	0.002
9	0.003	19	0.024	29	0.054	39	0.016	49	0.005	59	0.002
10	0.003	20	0.029	30	0.054	40	0.014	50	0.005	60	0.001

- 2) SCS – Type II Storm

- F. Rainfall Total:** For the use of the above rainfall patterns, a rainfall total from the NOAA Atlas 14 for the site must be obtained. For the Farmer Fletcher storm, the total shall be based upon the storm duration that produces the highest flow or basin size. The SCS storm uses a 24 hour rain total.
- G. Time of Concentration Calculation:** The time of concentration must be calculated using one or a combination of the following: (1) TR-55 equations for overland flow, (2) FHWA equations for overland flow, (3) Manning's equation for open channel flow, or (4) Hazen-Williams equation for open channel flow.
- The sheet flow distance may not exceed one hundred (100) feet. After one hundred (100) feet, sheet flow is to be considered shallow concentrated flow or open channel flow depending on the topography.
- H. Directly Connected Impervious Area:** The storm water modeling method used must account for areas directly connected to the storm drainage system independently from landscaped or unimproved areas.

#### **18.4 Storm Drain System:**

- A. Policy:** It is the policy of the city that:
- 1) Storm waters not be carried in irrigation ditches, nor that irrigation water be conveyed in storm drain systems.
  - 2) Local pipes may be sized at a minimum 10-year storm event where the road and other above ground conveyance will carry the difference to the 100 year storm event.
- B. Piping:** Storm drain lines shall be concrete pipe (NRCP or RCP) or corrugated high density polyethylene pipe of appropriate class. Minimum size for storm drain mains shall be 15-inch diameter, 8-inch for land drain systems and 4-inch for land drain laterals. Pipe specifications are included in the Public Works Standards. Where determined by the City Engineer, larger storm drain lines shall be installed to accommodate future development. The cost to provide adequate storm drainage to a development shall be paid for by the Developer.
- C. Access:** Storm drain lines shall have clean-out boxes, inlets or manholes installed at all changes in grade or alignment, with a maximum distance of 400-feet between accesses. Structures shall be installed in accordance with the standard drawings.
- D. Ground Water:** Where adverse groundwater conditions exist, the City may choose to allow the installation of a subsurface land drain. Laterals may be installed to each lot for clear groundwater only (no surface water permitted). Subsurface lines shall be installed with a slope adequate for proper drainage.

Some type of backflow control may be required at the confluence of the land drain pipe and storm drain system as determined by the City Engineer.

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

## **18.5 Basins:**

- A. Policy:** It is the policy of the City to require storm drainage basins for all development (site plans or subdivisions). Exception may be allowed where there is sufficient downstream storm drain capacity or where additional local storm drainage control is not needed as determined by the City Engineer.
- B. Basin Size and Location:** Storm water detention design is critical for developments that are in close proximity to a Stream or River or within Drinking Water Source Protection Zones one or two as defined by the State Division of Drinking Water Rules. All detention basin designs and calculations shall be reviewed by the City Engineer for approval.
- C. Certain Development Requirement:** On-site detention is required for all commercial, manufacturing, industrial, or similar development in the city.
- D. Ownership:**
  - 1) Private Basins: Where the development will have a Home Owners Association or in commercial applications, local detention basins shall be owned and maintained by the owner, or an owning association.
  - 2) Local Public or Private Basins: In subdivisions, local detention basin shall be constructed by the developer. Following acceptance of the construction, the ownership, operation and maintenance may either be conveyed and maintained by the City or owned and maintained by an adjacent property owner as determined by the City Engineer.
  - 3) Regional Detention Basins: Regional basins shall be owned and maintained by the City and constructed according to the criteria set forth herein and approved by the City Engineer. Actual ownership and responsibility shall be specifically defined in the Owners Dedication Certificates or Development Agreements or by Deed.
- E. Basin Access and Setback:** Basin access shall be as follows:
  - 1) Public Basins: The developer shall provide the city a construction, service and maintenance, ingress, egress, and repair easement for any public basin.
  - 2) Private Basin: The owner or owning association shall be provided a construction, service and maintenance, ingress, egress, and repair



easement for any private basin. The city shall be provided an emergency easement for emergency access, service, and repair for a private basin.

- 3) **Setback:** Each basin shall be constructed with a flat rim circling the basin which shall be setback from a property line, adjoining property, and from any structure an appropriate distance determined by the city engineer to prevent erosion and to allow for a backhoe and dump truck to circle the rim for maintenance and repair.

**F. Percolation:** No reduction due to percolation for detention basin volume shall be permitted in design, due to the nature of basins silting in over time and also possible frost conditions during a storm.

**G. Basin construction:** Basins shall be constructed as follows:

- 1) **Policy:** Basins must be constructed to enhance safety, health and aesthetics of the area.
- 2) **Engineering:** Basins, whether detention or retention, must be designed and stamped by a Licensed Civil Engineer.
- 3) **Location:** Detention basins shall be located with convenient access for maintenance and repair by maintenance personnel. This generally means that the basin property has frontage along a public roadway. Volume in ditches or roadside swales shall not be considered in the volume calculation.
- 4) **Fencing:** If unfenced and open to general public, the maximum depth of water should generally not exceed three (3) feet. If a fence is required, six foot chain link fencing is desired and in accordance with these Public Works Standards and conform to City Zoning Requirements.
- 5) **Side Slopes:** Side slopes should not exceed 3:1 (horizontal to vertical) (4.5:1 is desirable) for ease of mowing and access.
- 6) **Bottom Slope:** The basin floor shall be designed so as to prevent the permanent ponding of water. The slope of the floor of the basin shall not be less than 1% to provide drainage of water to the outlet grate and prevent prolonged wet, soggy or unstable soil conditions. The preferred minimum slope is 2%.
- 7) **Freeboard:** There should be at least one foot of freeboard (berm above the high water mark).
- 8) **Spillways:** Spillways must be considered and a path with a maintained swale and drainage easement to a safe location. Attention should be given to the design of the spillway to avoid erosion. Overflow spillways are

intended to introduce flows back into the main pipe and are typically downstream of the outlet control. Emergency Spillways are intended to carry flows beyond the capacity of the overflow spillway to a safe downstream location. All spillways shall be designed to protect adjacent embankments, nearby structures and surrounding properties.

- 9) Outlet Control: Small, local, private detention basins may be allowed to have calculated fixed orifice plates mounted on the outlet of the basin. Large, regional, public detention basins shall have movable screw-type head gates (Waterman C-10 O.A.E.) set at a calculated opening height for the discharge and with a chain to fix the position.
- 10) Grates: All inlet boxes of any size and all outlet boxes over 15" shall have grates. All grates where there may be pedestrian or bicycle traffic shall be designed accordingly to accommodate such traffic. All grates on inlets and outlets must be hot dipped galvanized (not painted) with bars at spacing to prohibit feet from falling in and yet avoid clogging with debris. Generally bar spacing should never exceed 3" spacing.
- 11) Low Flow Piping: The inlet and outlet structures may be located in different areas of the basin, requiring a buried pipe to convey any base flows that enter and exit the basin (Rather than a cross gutter or surface flow) The minimum pipe size for the low flow shall be 12" diameter or as approved by the City Engineer.
- 12) Ground Covers: The surface area of the basin may either be seeded, sodded, or covered with fabric and cobbles, as specified by the City. If seeded, measures shall be taken to eliminate erosion until grasses are established. A minimum of 4" of top soil must be installed prior to sod or seed placement. Cobble sizes shall be 4" or greater in size overlying a city-approved weed barrier. Cobble rock may be permitted if the basin is fenced and no other alternative purpose is proposed for the land. Grass or hydro-seeding on all basins shall be installed in accordance with the Public Works Standards. The basin shall be provided with an automated sprinkler irrigation system previously approved by the City Engineer. Landscape shall be in accordance with Section 15 and Section 16.
- 13) Embankment (fill) Construction: If a raised embankment is constructed for a basin (constructed with granular materials), it shall be provided with a minimum of 6" of City approved clay cover on the inside of the berm to prevent water passage through the soil.
- 14) Excavation (cut) Construction: If the basin is constructed primarily by excavation, then it may be necessary to provide an impermeable liner and land drain system when constructed in the proximity of basements or other below grade structures as determined by a Geotechnical evaluation.

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

**H. Detention Volume:** Detention basins shall be sized based upon the criteria set forth in Section 18.3. Detention Basins are designed to allow a pre-determined amount of flow to discharge during and after a storm event as discussed above. Detention Basins are preferred over Retention Basins. Above-grade detention basins are preferred over below-grade basins, yet both are allowable.

**I. Retention Basins:** The following applies to retention basins.

- 1) Policy: Regional Retention basins shall not be permitted by the City. It is the policy of the City to prohibit local or private retention basins for developments, unless certain criteria are met.
- 2) Retention Basins Are Strongly Discouraged: Any retention basin must be specifically approved by the City Engineer. Retention basins shall not be permitted within a zone 3 of any Drinking Water Source Protection Zone of any drinking water source. Due to silting potential, no percolation rate may be used in the calculation of volume unless an approved oil/sand separator is installed upstream. The volume must be based upon the 100-year, 3-hour storm.
- 3) Retention Basin Criteria: Retention Basins (basins which hold all water coming to them) shall not be permitted for developments unless all of the following conditions are met:
  - a) The Basin is greater than 500 feet or 50 feet times the number of lots in the entire development (whichever is greater) from the City Storm Drain System or water way, and is topographically capable of draining to the City System, and
  - b) The Basin is not located within a Hazardous Area (such as a steep slope) or some other fragile area (such as a Drinking Water Source Protection Zone), and
  - c) The Basin is temporary in nature, meaning that a master planned storm drain pipe is eminent (within the next few years) and a funding vehicle, Special Improvement District (SID), Impact Fees, or Pioneering Agreement is in place, and

- d) Local storm retention basins shall be designed for the 100-year, 3-hour storm, based upon the Intensity-Duration-Frequency (IDF) Curve for the area as approved by the City Engineer. (Local basins are typically private in ownership and maintenance and serve only one or two specified subdivisions or sites as may be approved.)
- 4) Percolation Rate for Retention Basins: The percolation rate of the ambient soils may be permitted in the calculations only if an oil/sand separator is installed upstream and only 10% of the percolation rate is used due to eventual silting-in of the basin.
- 5) Standing Water: The following regulations apply to standing water:
  - a) It is the policy of the City to eliminate standing water wherever possible as an effort to minimize a mosquito problem and associated viruses, except where wetland protection is enforced.
  - b) Basins should completely drain within 48 hours of the primary storm event.
  - c) Low flow bypass pipes may be required.

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

- 1) Cobble Rock: Cobble rock may be permitted and no other alternative purpose is proposed for the land. The cobble size shall be sufficient (eight (8) inch minimum) to eliminate erosion. Permeable weed barrier fabric shall be placed under the rock. Fencing may be required around cobble rock basins.
- 2) Grass, Sod, Top Soil and Hydro seeding: All grass or hydro-seeding on all basins shall be installed in accordance with the Public Works Standards. The basin shall be provided with an automated sprinkler irrigation system previously approved by the City Engineer. Drought tolerant grass may be used in lieu of Public Works Standard upon approval.
- 3) Pasture Grass: If approved by the City, pasture grass or native seed mix may be used as a ground surface for detention basins. Fencing may be required around pasture grass basins. Fencing material will be determined by the City.

## 18.6 Discharge:

- A. Policy:** It is the policy of the City to control storm water at the source and minimize the potential for flooding downstream.
- B. Requirements:** The following requirements apply
- 1) Storm Drainage leaving a site or subdivision shall not exceed, as much as practicable, the pre-developed quantities and qualities at a maximum rate as follows:
    - a) Allowable Discharge: The allowable discharge from any non-regional basin shall:
      - (i) Not exceed the pre-hard surfacing discharge for the entire site for the 100-year storm event.
      - (ii) Not exceed the maximum discharge rate set by the City Engineer depending on the proposal, the facts and circumstances of the basin and historical flow, and the drainage within surrounding area. If no maximum discharge rate is established then the standard discharge rate is 0.1 cubic feet per second.
      - (iii) Controlled discharge may be established through an orifice or adjustable gate as approved by the City Engineer.
    - b) Flow Concentration: By the very nature of development, flows are concentrated to one or more locations where historically, sheet flow in lower concentrations may have left the site. Attempts shall be made to minimize the runoff concentrated quantity to the flows stated above by use of detention basins, down stream piping to safe areas or other methods as deemed necessary by the City Engineer.
  - 2) Water quality: Best Management Practices (BMP's) shall be used to maintain, to the maximum practicable extent, the quality of the water to the pre-developed condition. BMPs are included in the Storm Water Management Plan for the City and must be approved by the City Engineer.
  - 3) Discharge to Irrigation Ditches: No discharge shall be permitted to irrigation ditches.
  - 4) Sump Drains (underground injection wells) and Underground Storage: Sump drains are not allowed, nor is any underground storm drain storage facility. All storm drain facilities shall be open and at surface for visible inspection, and to ensure adequate size, functionality, and proper upkeep is maintained.

- 5) Parking Lots: No parking lot area, including sidewalks and all other hard surfaces, shall be used for ground water storage of any kind, above or below surface.
- 6) Basin Overflows: Attention shall be given to overflow locations and pathways to safe locations downstream as discussed above. Easement shall be obtained and pipes or swales sized to handle the 100 year flow.

## **18.7 Permits and Practices:**

### **A. Policy:** The following policies apply

- 1) It shall be the policy of the City to comply with the requirements of the Clean Water Act phase II, and all other city, state and federal requirements. This is to include applications, permits, plans and implementation.
- 2) It is the policy of the City to require a Storm Water Activity Permit for all construction sites within the City. (See City Ordinance #349 - 15.24.020).

### **B. Permits:**

- 1) City Storm Water Activity and/or Connection Permit: A city permit for all construction activities is required and can be obtained as outlined in City Ordinance Section 15.24.030.
  - a) This permit must be obtained before connecting to any existing storm drain system (ditches, pipes, catch basins, boxes, manholes, or similar facility).
  - b) As part of this permit all fees must be paid, and all detention basins shall be calculated, designed, and stamped by a Licensed Professional Engineer.
- 2) Utah Pollutant Discharge Elimination System (UPDES) Permit: A storm water general permit for construction activities is required for all sites or development project affecting 1-acre or more, including any area used for staging, stockpiling, or any other temporary construction activity. This permit is filed with the Utah Division of Water Quality, Department of Environmental Quality. The permit can be obtained on-line as follows:
  - a) [www.waterquality.utah.gov/UPDES/stormwatercon.htm](http://www.waterquality.utah.gov/UPDES/stormwatercon.htm).
  - b) Click on "Online Application Process Notice of Intent".
  - c) The appropriate fee must be paid to the state.
  - d) A Storm Water Pollution Prevention Plan (SWPPP) must be prepared and on site for this application. As a minimum, The BMPs discussed herein must be addressed.

- 3) Stream Alteration Permit: A Stream Alteration Permit is filed with the State Department of Natural Resources, Division of Water Rights.
  - a) This permit overlaps the 404 wetlands permit, discussed below, because it is applicable to the area equal to the stream plus two times the bank full width (up to 30 feet).
  - b) Any modifications to the stream or banks within this area must comply with the Stream Alteration Permit.
- 4) EPA 404 Wetlands Permit: This permit is filed with the US Army Corp of Engineers and is applicable for all wetland areas in a development.
  - a) This permit applies to all wetlands regardless of standing water, soils type, and vegetation.
  - b) As part of this permit a Wetlands Delineation Report is required.
  - c) The scope of this permit applies to all jurisdictional waters of the United States up to and including the normal high water mark.
  - d) No fee is typically required for this permit.
  - e) A letter of non-regulated wetlands may also be applicable.
  - f) Any mitigation that may be required, must be done prior to recording a Final Plat.

**C. Best Management Practices (BMPs):** The Storm Water Management Plan (SWMP) of the city contains a listing of BMPs that can be used on a site.

- 1) BMPs Typically Fall into the Following Categories:
  - a) Perimeter control,
  - b) Erosion controls,
  - c) Sediment control,
  - d) Materials handling and spill prevention,
  - e) Waste management, and
  - f) Good housekeeping.
- 2) The Application of Some BMPs are Discussed Below: They include, but are not limited to:
  - a) Oil separators,
  - b) Inlet protection,
  - c) Tracking pads,
  - d) Street sweeping,
  - e) Concrete washout, and
  - f) Silt fences.
- 3) Oil Separators (OWS): Oil separators shall be required on all sites greater than 10 acres, or smaller sites anticipating oily discharges from mechanic shops, car washes, or associated parking lots. Oil separators must be

capable of removing particulates down to 150 microns. Possible products include, but are not limited to: BaySaver, Storm Cerptor, and Vortechnic.

- a) Where oil separators are required, sizing and design of Oil Separators must be reviewed by the City Engineer prior to installation. Consideration must be given to frequency and ease of maintenance of the structure. Private basins shall have contracts in place with a local sewer company to periodically clean the Separator (at least annually).
  - b) Manufacturers recommendations for sizing must be followed with calculations submitted to the City. The separator may either be installed upstream or downstream of the basin keeping in mind that flows on the outlet of the basin would be smaller.
- 4) Inlet Protection (IP): The Storm Water Management Plan of the city will permit straw bails, silt fences or curb snakes (after asphalt is placed). Filter fabric under the grate shall not be permitted since drainage is greatly inhibited.
  - 5) Tracking Pads (CR): Sites must have a tracking pad to eliminate mud from being tracked onto the adjacent street. If mud is tracked, the contractor shall be responsible to sweep the streets as necessary.
  - 6) Street Sweeping (SC): If mud is tracked onto the street, the developer or owner shall be responsible for sweeping the street.
  - 7) Concrete Washout (CWM): A place must be located within the subdivision or on the site for concrete washout. No washout will be permitted on the street which would then continue to the Storm Drain. The washout area may need to be maintained and temporarily excavated until the building foundations and driveways are constructed, or some other arrangement made.
  - 8) Silt fences (SF): Silt fences must be installed to prohibit the flow of sediments off of the site in accordance with manufacturers recommendations and the city's Storm Water Management Plan.

**D. Notice Sign:** All subdivisions, except minor lot subdivisions, are required to install one large notice sign that is clearly visible at the entryway of the subdivision indicating that the Storm Water Pollution Prevention Plan must be obtained and followed. Said sign shall be maintained by the original subdivision applicant until conditional acceptance of the subdivision. The specific wording on the sign relating to storm water and other related development requirement may be prescribed and modified by the administration as needed to meet the challenges created by development and to give notice to requirements of law.



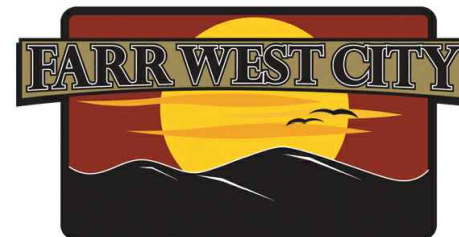
# FARR WEST CITY CORPORATION

## PUBLIC WORKS STANDARD DRAWINGS

### SUBMITTED & RECOMMENDED

*Dean D. Ayala*  
DEAN D. AYALA P.E.  
FARR WEST CITY ENGINEER

JUNE 30, 2014  
DATE



1896 NORTH 1800 WEST  
FARR WEST CITY, UT 84404  
801-731-4187

### APPROVAL

*Lee Dickmore*  
LEE DICKMORE  
FARR WEST CITY MAYOR

JUNE 30, 2014  
DATE

*David Bunderson*  
DAVID BUNDERSON  
FARR WEST CITY PUBLIC WORKS DIRECTOR

JUNE 30, 2014  
DATE

*Sean Lambert*  
SEAN LAMBERT  
FARR WEST CITY BUILDING OFFICIAL

JUNE 30, 2014  
DATE

*Lindsay Stratford Afu'ai*  
LINDSAY STRATFORD AFU'AI  
ATTEST, FARR WEST CITY RECORDER

JUNE 30, 2014  
DATE

### Index of Drawings

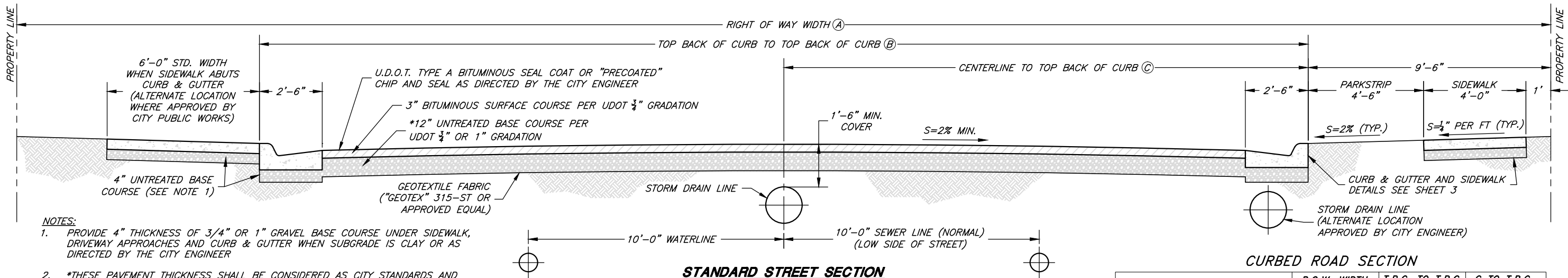
- CS-01.....TITLE PAGE & INDEX OF DRAWINGS
- CS-02.....PUBLIC ROADS - TYPICAL STREET SECTION & DRIVE APPROACH DETAILS
- CS-03.....PUBLIC ROADS - TYPICAL INTERSECTION DETAILS
- CS-04.....PUBLIC ROADS - TYPICAL ADA RAMP & DEFECTIVE CONCRETE REPLACEMENT DETAILS
- CS-05.....PUBLIC ROADS - CUL-DE-SAC & TEMP. TURNAROUND DETAILS
- CS-06.....SANITARY SEWER - LATERAL & CONNECTION DETAILS
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- CS-13.....STORM DRAIN - SINGLE AND DOUBLE CATCH BASIN DETAILS
- CS-14.....STORM DRAIN - DRAINAGE DITCH INLET BOX, GENERAL GRATE AND FRAME DETAILS & LAND DRAIN DETAILS
- CS-15.....STORM DRAIN - MANHOLE AND CLEANOUT DETAILS
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- CS-17.....GENERAL - WOOD FENCE, WIRE FENCE & TRAIL DETAILS
- CS-18.....GENERAL - STREET LIGHTING STANDARDS

**JUNE 2014**



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South Ogden, Utah 84403 (801) 476-9767

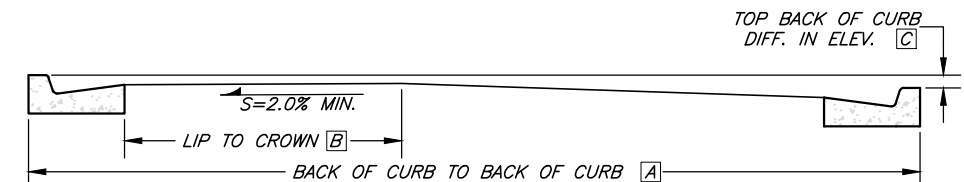
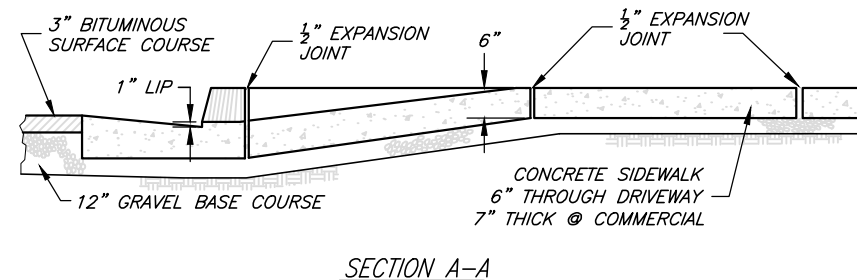
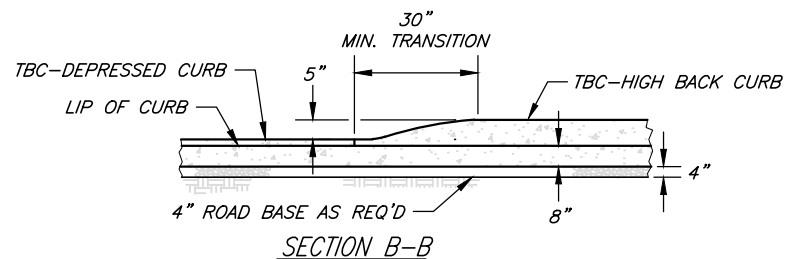


- NOTES:**
1. PROVIDE 4" THICKNESS OF 3/4" OR 1" GRAVEL BASE COURSE UNDER SIDEWALK, DRIVEWAY APPROACHES AND CURB & GUTTER WHEN SUBGRADE IS CLAY OR AS DIRECTED BY THE CITY ENGINEER
  2. \*THESE PAVEMENT THICKNESS SHALL BE CONSIDERED AS CITY STANDARDS AND MAY BE INCREASED BY THE CITY ENGINEER WHEN A GREATER 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 THAN 3" AND GRAVEL BASE COURSE LESS THAN 4" THICK.
  3. ALL ROAD CUTS SHALL BE PATCHED WITH 12" UNTREATED ROAD BASE AND 3" OF BITUMINOUS SURFACE COURSE AND MUST MEET THE MINIMUM COMPACTION REQUIREMENTS.
  4. SIDEWALKS, CURB & GUTTER, AND CROSS DRAINS SHALL BE CONSTRUCTED IN COMPLIANCE WITH FARR WEST CITY TECHNICAL SPECIFICATIONS.

**CURBED ROAD SECTION**

STREET DESIGNATION	R.O.W. WIDTH A	T.B.C. TO T.B.C. B	CL TO T.B.C. C
MINOR (STANDARD RESIDENTIAL)	60'	41'	20.5'
COLLECTOR	66'	47'	23.5'
MINOR ARTERIAL	84'	65'	32.5'
MAJOR ARTERIAL	100'	81'	40.5'

**NOTE:**  
ROAD SECTION USED AS DETERMINED BY THE CITY ENGINEER & PLANNING COMMISSION BASED UPON ZONING, GENERAL PLAN, SIZE OF DEVELOPMENT, ESTIMATED TRAFFIC VOLUME, & AMOUNT OF DEVELOPMENT PROPOSED. DEVELOPMENTS PROXIMATE TO HIGH VOLUME ROADS OR ARTERIALS SHALL BE APPROVED BY THE CITY ENGINEER



**CROWN NOTES:**

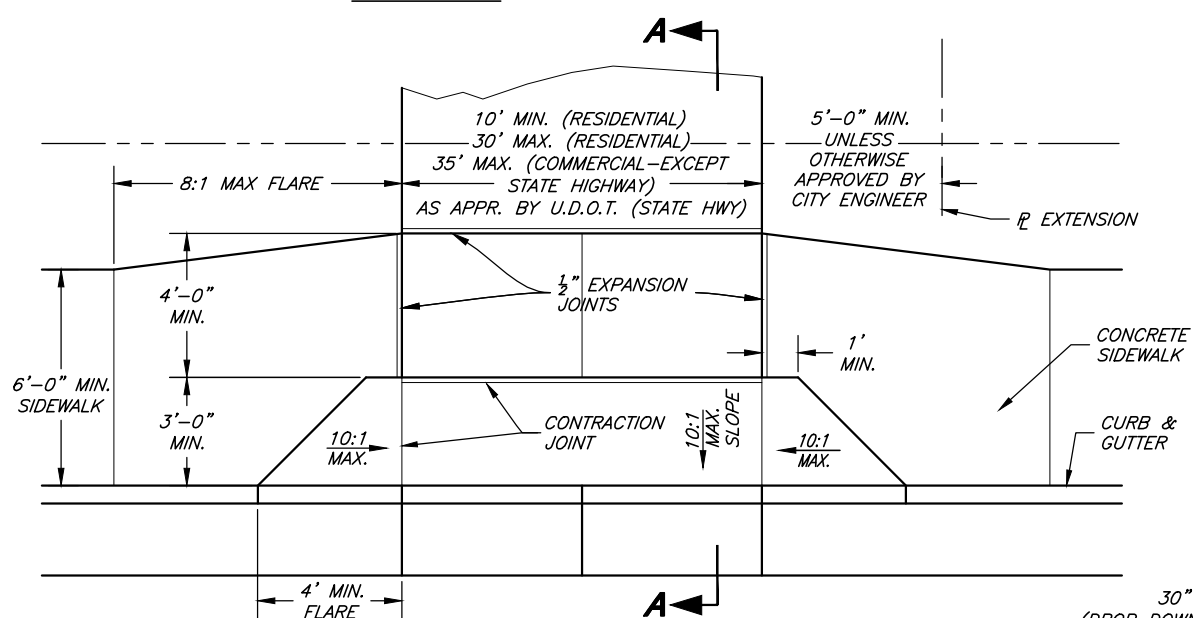
1. MAXIMUM DIFFERENCE IN ELEVATION BETWEEN CURBS ON OPPOSITE SIDES OF THE STREET SHALL NOT EXCEED THOSE SHOWN IN DETAIL AND TABLE.
2. ON ARTERIAL STREETS AND CERTAIN STREETS APPROVED BY THE CITY COUNCIL, THE CITY ENGINEER WILL PROVIDE A PAVEMENT DESIGN. LOCATION OF SIDEWALK AND CURB & GUTTER MAY VARY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

CROWN LOCATION TABLE		
A	B	C
41'-0"	20'-6"	0'-0"
41'-0"	12'-0"	0'-6"
41'-0"	10'-0"	1'-0"
47'-0"	23'-6"	0'-0"
47'-0"	10'-6"	0'-6"
47'-0"	10'-6"	1'-0"

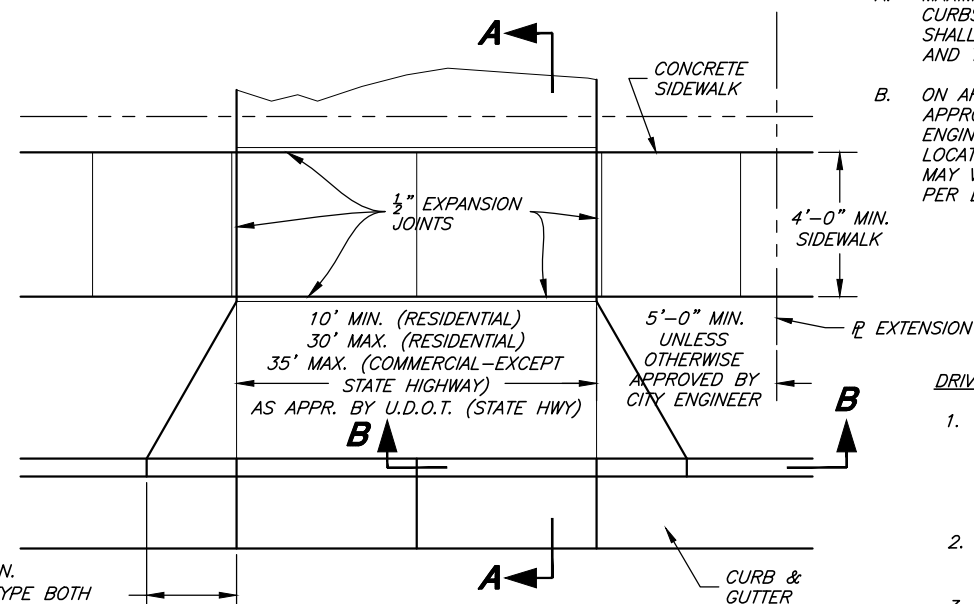
**CROWN LOCATION FOR VARIOUS CROSS SLOPES**

**DRIVEWAY APPROACH NOTES:**

1. 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.
2. SIDEWALK ADJACENT TO THESE SAW CUTS MUST BE 6" MIN. THICKNESS THROUGH THE DRIVEWAY WIDTH.
3. SCORE SIDEWALK 1/2" OF SIDEWALK THICKNESS @ EACH 4'-0" EXPANSION JOINTS @ EACH 32'-0" PROVIDE ADDITIONAL CONTRACTION JOINTS ON OVERSIZE DRIVEWAYS AT 5'-0" MAX. SPACING



30" MIN.  
(DROP DOWN TYPE BOTH SIDES-SEE DETAIL THIS SHEET)



DROP DOWN STYLE (CITY STANDARD)

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:  
N. T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA



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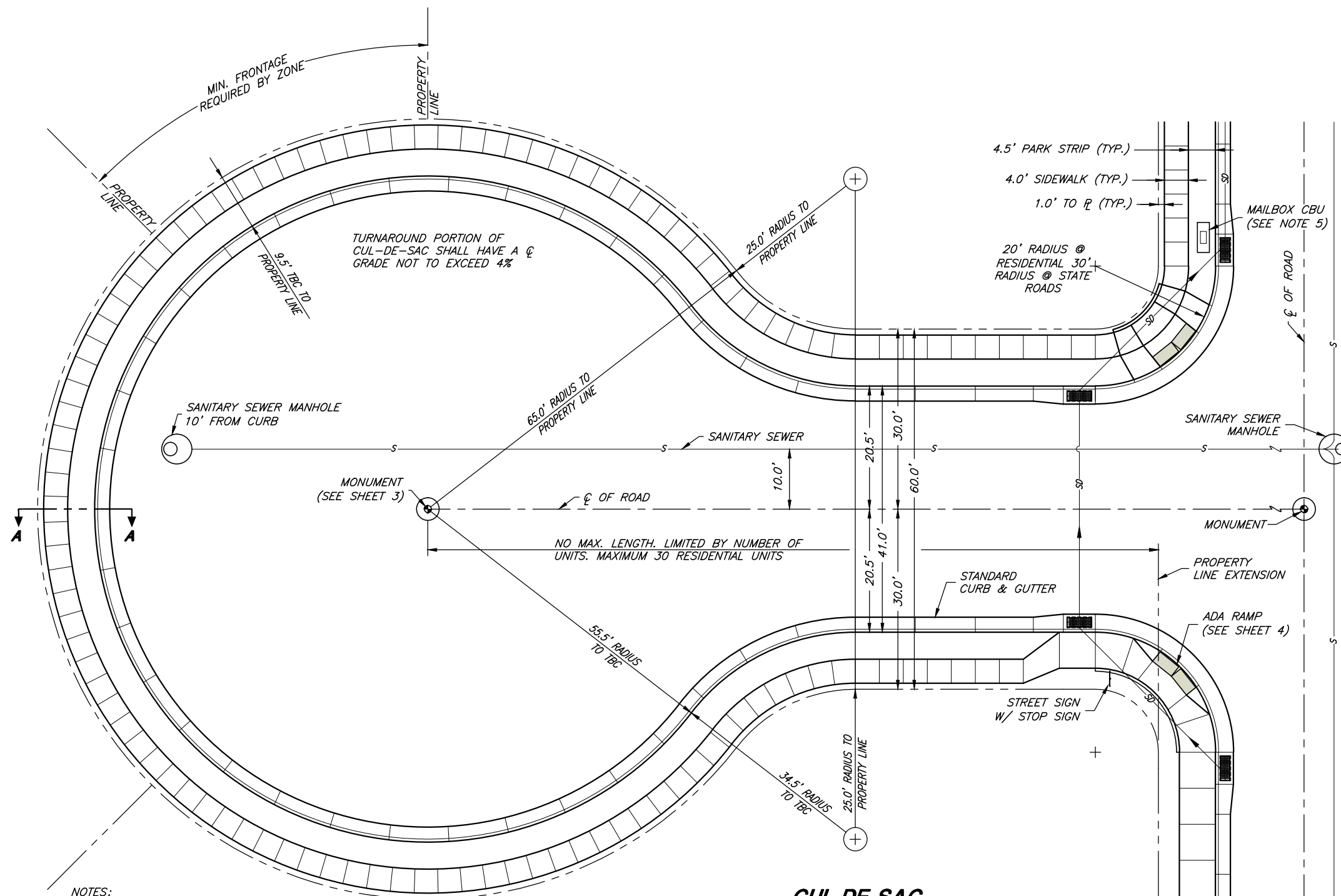
**FARR WEST CITY CORPORATION**  
**PUBLIC WORKS STANDARD DRAWINGS**  
**PUBLIC ROADS - TYPICAL STREET SECTION**  
**& DRIVE APPROACH DETAILS**

SHEET:  
**CS-02**  
OF 18 SHEETS  
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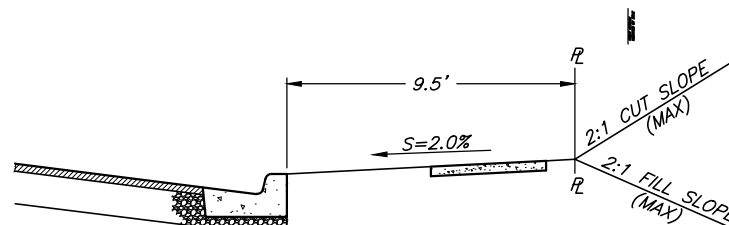




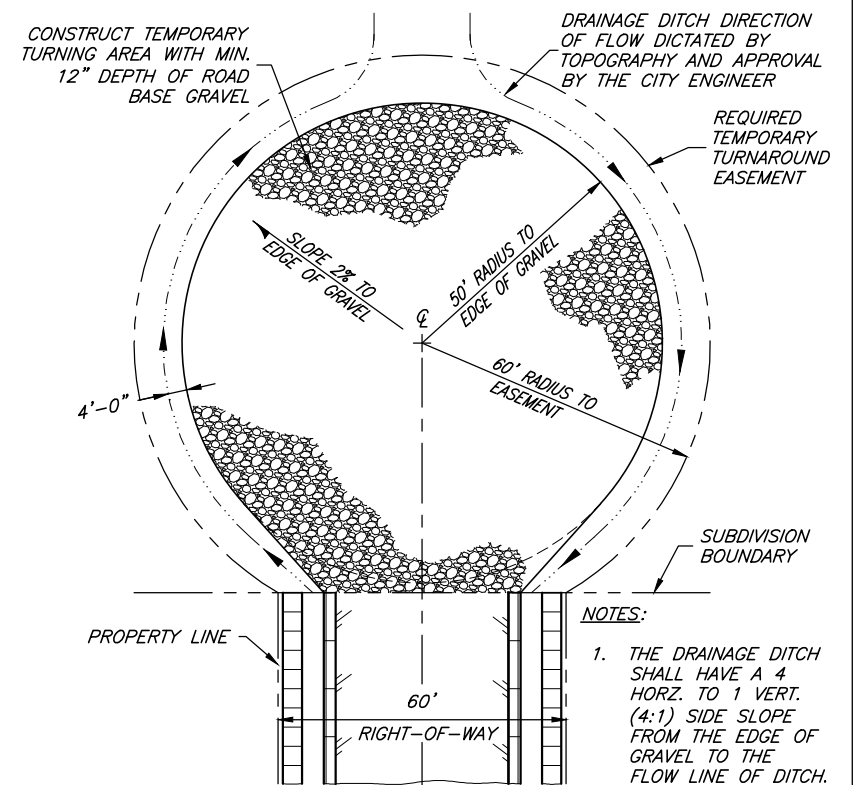
- NOTES:**
1. THE CIRCULAR CUL-DE-SAC LAYOUT ON THIS SHEET IS TO BE CONSIDERED AS THE CITY STANDARD DESIGN. OTHER ALTERNATE DESIGNS MAY BE CONSIDERED AS APPROVED BY THE CITY ENGINEER.
  2. DEVELOPER SHALL PROVIDE AN AIR RELIEF OR BLOW-OFF AS DETERMINED BY THE SECONDARY WATER PROVIDER AND IN ACCORDANCE WITH THEIR STANDARDS AND APPROVED BY THE CITY ENGINEER.
  3. ALL TERMINATING SEWER MAINS SHALL END WITH A CITY STANDARD MANHOLE.
  4. SERVICE LATERAL CONNECTIONS SHALL NOT BE ALLOWED IN SEWER MANHOLES.
  5. INDIVIDUAL MAILBOXES MAY BE ALLOWED IN CUL-DE-SACS. IF NOT ALLOWED A MAILBOX COMBINATION BOX UNIT (CBU) MUST BE INSTALLED ON THE MAIN ROAD AS THE MAIL DELIVERY LOCATION FOR HOMES WITHIN THE CUL-DE-SAC. IF SIDEWALK IS INSTALLED AGAINST THE BACK OF CURB, A CBU WILL BE REQUIRED BEHIND THE SIDEWALK.
  6. MODIFIED CUL-DE-SACS (KNUCKLE, EYEBROW, BULB, OR HALF CUL-DE-SACS) ARE NOT PERMITTED.

### CUL-DE-SAC

60' RIGHT-OF-WAY

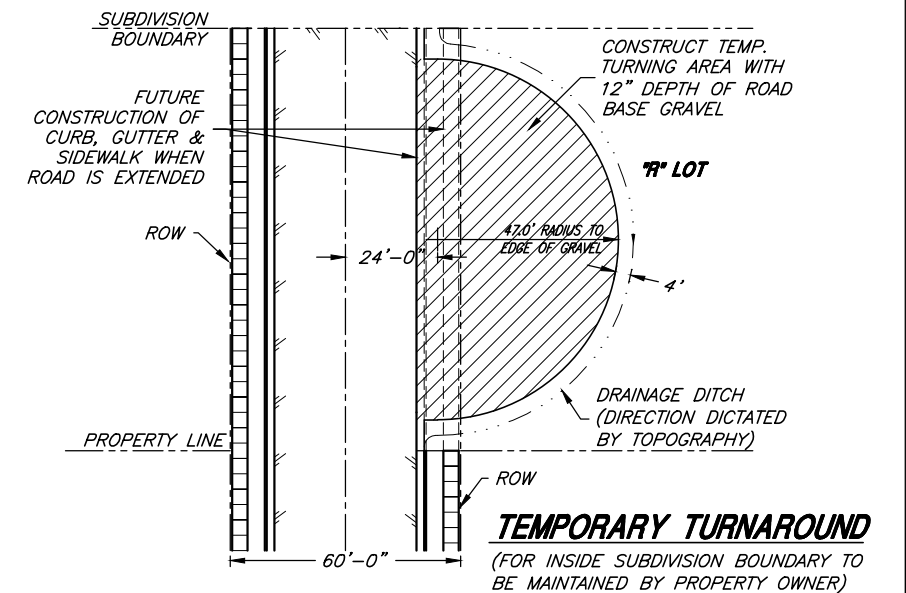


**SECTION A-A**  
REQUIRED GRADING BETWEEN TBC AND PROPERTY LINE



### TEMPORARY TURNAROUND

(FOR OUTSIDE OF SUBDIVISION BOUNDARY AND TO BE MAINTAINED BY PROPERTY OWNER)



- TEMP. TURNAROUND NOTES:**
- A. 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.
  - B. DRAINAGE ONTO ADJACENT PROPERTY MUST BE BY WRITTEN APPROVAL OF ADJACENT PROPERTY OWNER.
  - C. THE LOT ON WHICH THE TURN AROUND IS CONSTRUCTED SHALL BE RESTRICTED AS FOLLOWS:
    1. PLATTED AS AN "R" "RESTRICTED" LOT.
    2. THIS LOT CANNOT BE SOLD OR BUILDING PERMITS ISSUED UNTIL THE ROAD IS EXTENDED BEYOND THE SUBDIVISION BOUNDARY COMPLETE WITH CURB & GUTTER AND SIDEWALK.

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:  
N. T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA

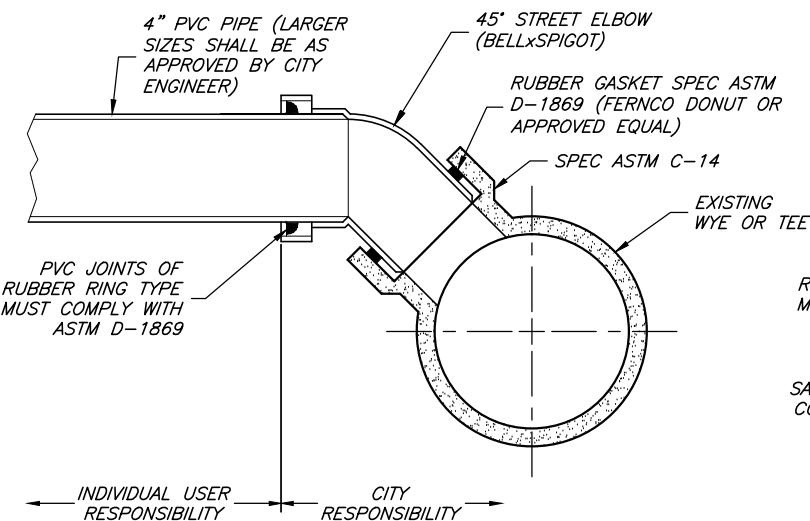


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**PUBLIC WORKS STANDARD DRAWINGS**  
**PUBLIC ROADS - CUL-DE-SAC & TEMP. TURNAROUND DETAILS**

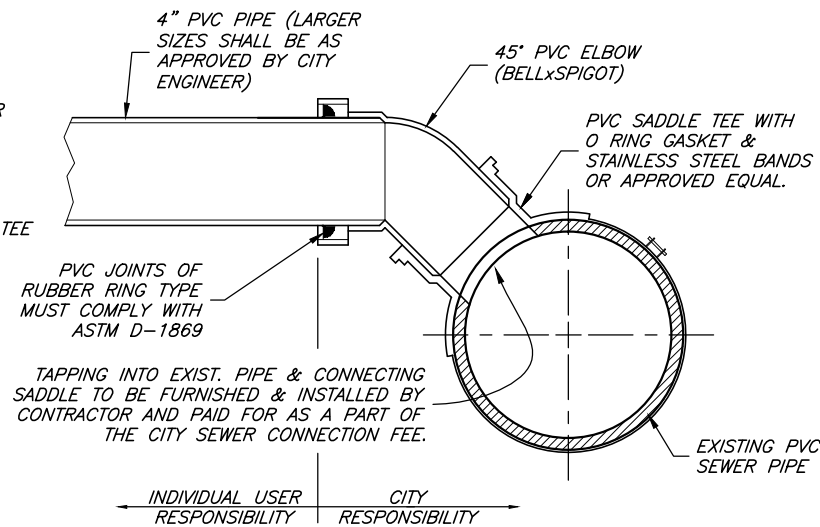
SHEET:  
**CS-05**  
OF 18 SHEETS  
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NOTE:  
PVC PIPE FITTINGS ASTM D-3034  
WITH A S.D.R. 35



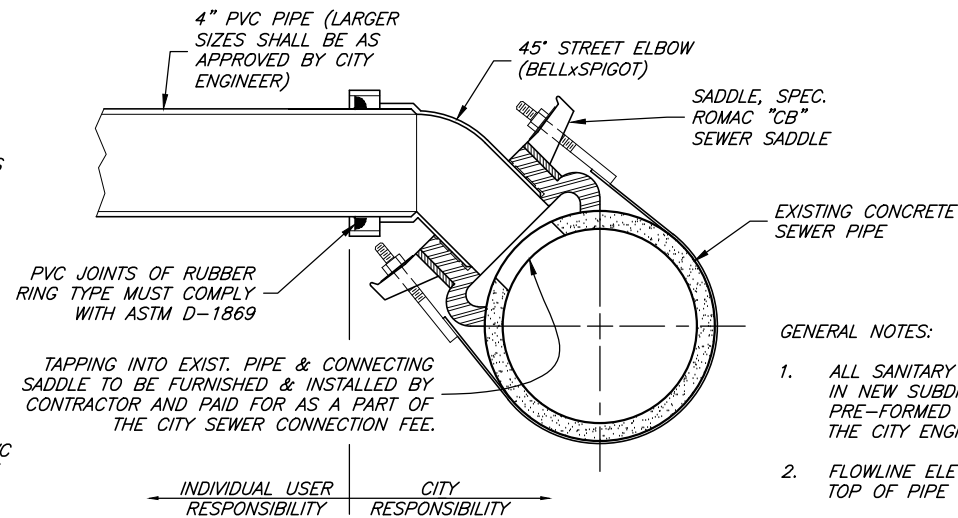
**CONNECTING INTO EXISTING WYE OR TEE**

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



**TAPPING INTO EXISTING PVC PIPE**

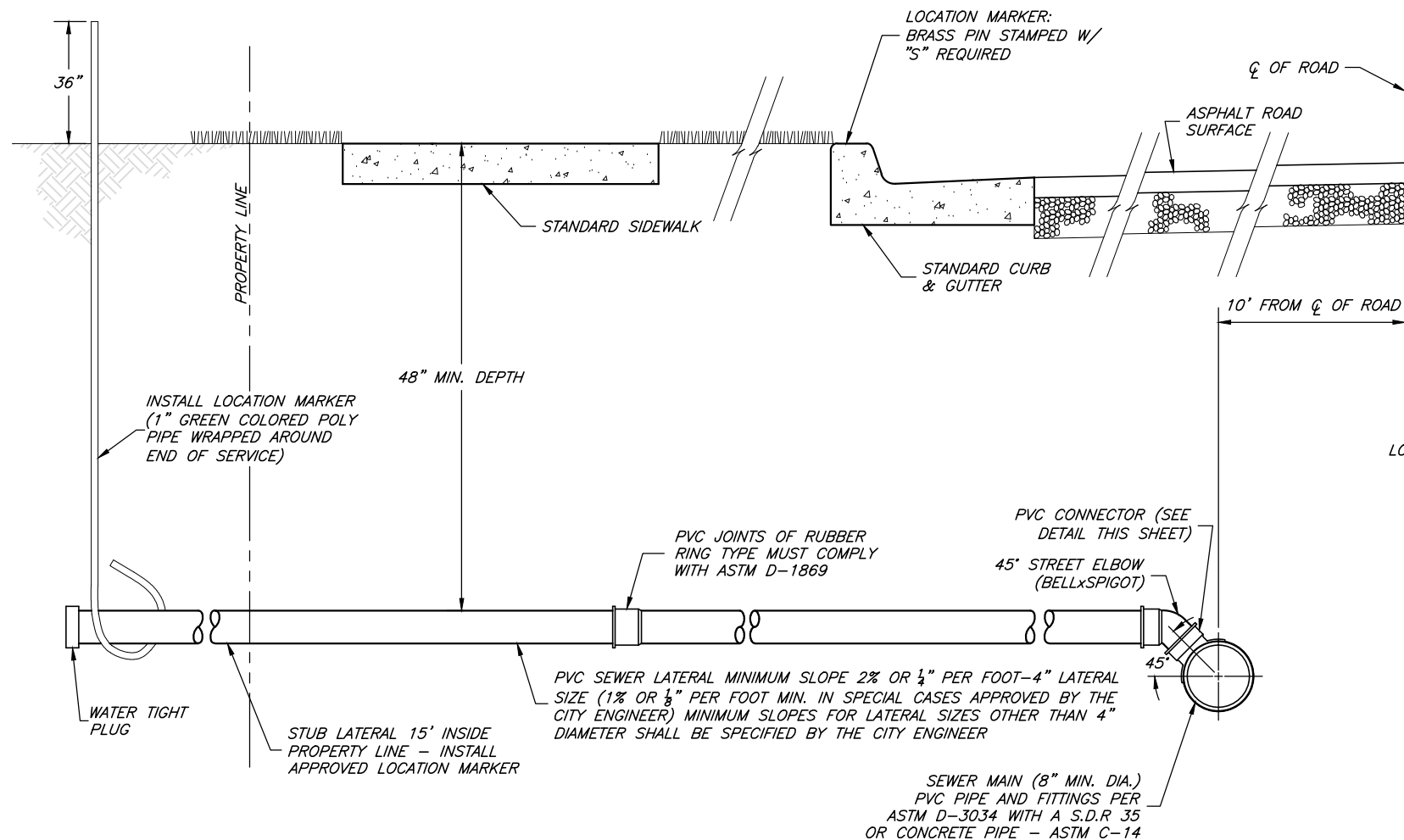
NOTE:  
PVC PIPE FITTINGS ASTM D-3034  
WITH A S.D.R. 35



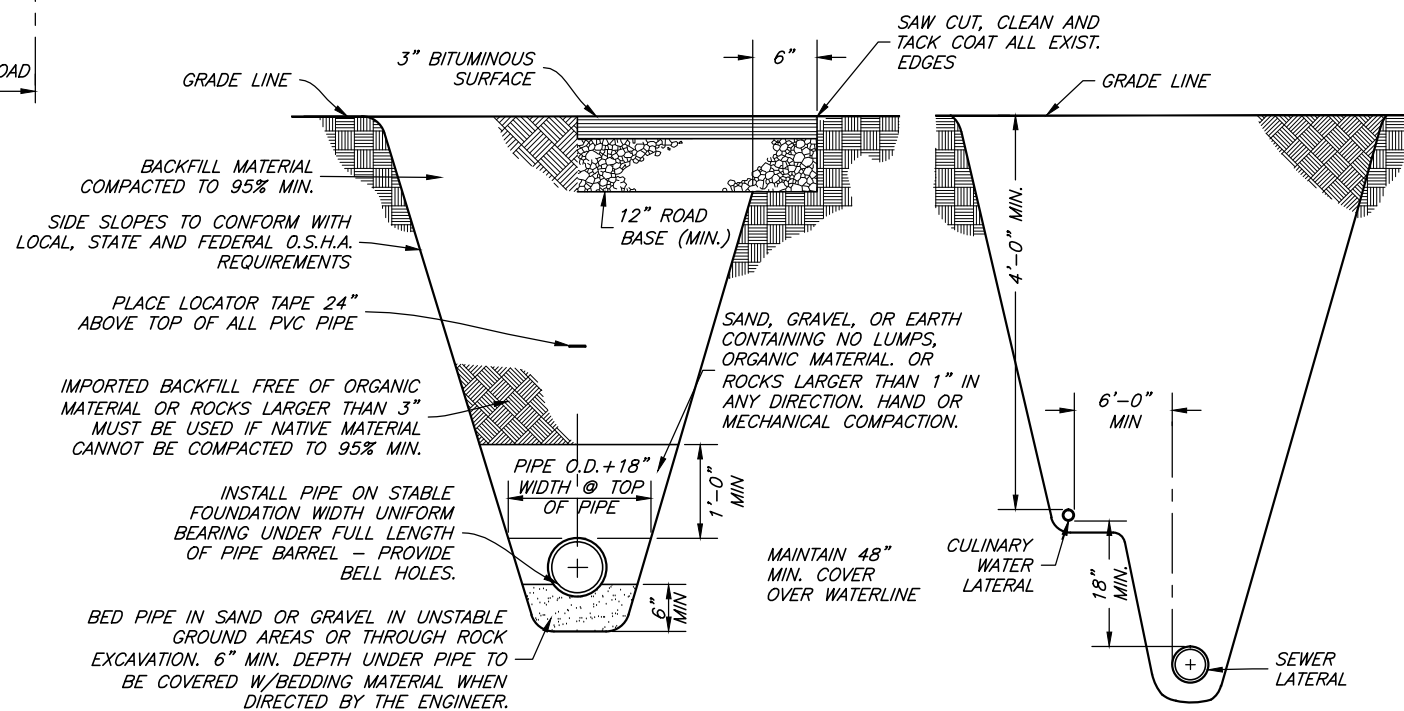
**TAPPING INTO EXISTING CONCRETE PIPE**

**GENERAL 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 SERVICE LATERAL CONNECTIONS SHALL NOT BE ALLOWED IN SEWER MANHOLES.
4. SANITARY SEWER PIPES SHALL BE "GREEN" IN COLOR SUB-SURFACE DRAIN LINES SHALL "WHITE" IN COLOR
5. ALL SANITARY SEWER LINES SHALL BE AIR TESTED AND INSPECTED BY MEANS OF VIDEO CAMERA WHEN CONSTRUCTED.
6. INSERTA TEE PRODUCT IS NOT APPROVED BY THE CITY
7. ALL CLEANOUTS SHALL BE MARKED AND FITTED WITH A METAL LID FOR LOCATION PURPOSES
8. ALL CULINARY WATER MAINS AND SERVICES MUST MAINTAIN A MINIMUM SEPARATION FROM ALL SEWER MAINS AND LATERALS OF 10'-0" HORIZONTAL AND 18" VERTICAL IN ACCORDANCE WITH THE STATE OF UTAH DIVISION OF DRINKING WATER RULES SECTION R309-550-7



**TYPICAL SEWER LATERALS CONNECTION**



**TYPICAL TRENCH SECTION**

**COMBINED WATER & SEWER SECTION**

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:

N.T.S.

DESIGNED BEB  
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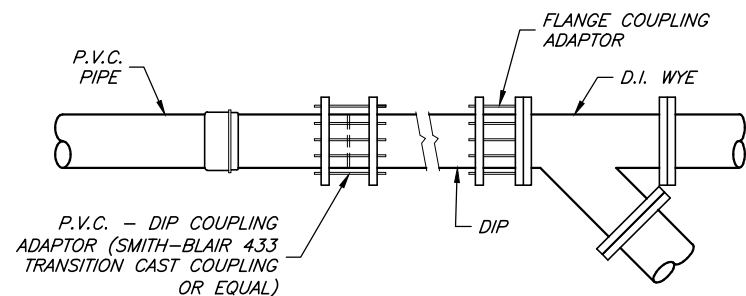
FARR WEST CITY CORPORATION  
PUBLIC WORKS STANDARD DRAWINGS

**SANITARY SEWER - LATERAL & CONNECTION DETAILS**

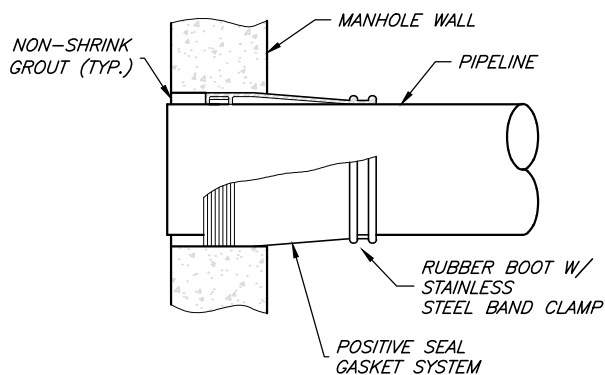
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**CS-06**

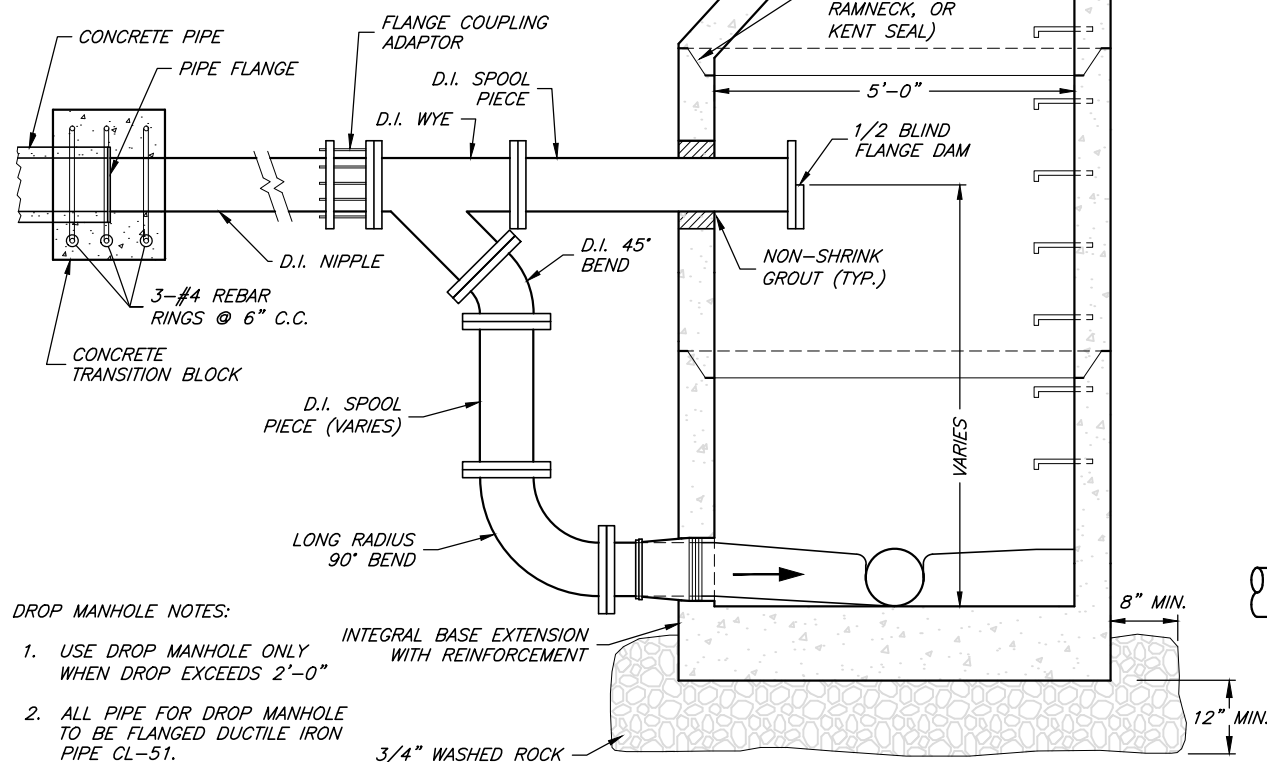
OF 18 SHEETS  
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**TYPICAL CONNECTION**  
DUCTILE IRON TO PVC PIPE



**RUBBER BOOT DETAIL**

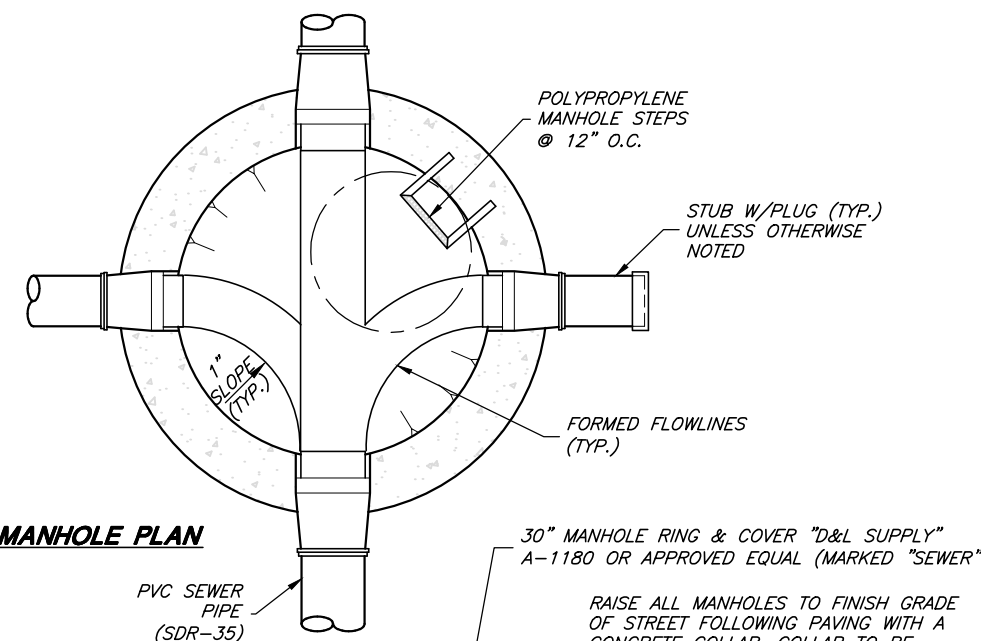


**DROP MANHOLE NOTES:**

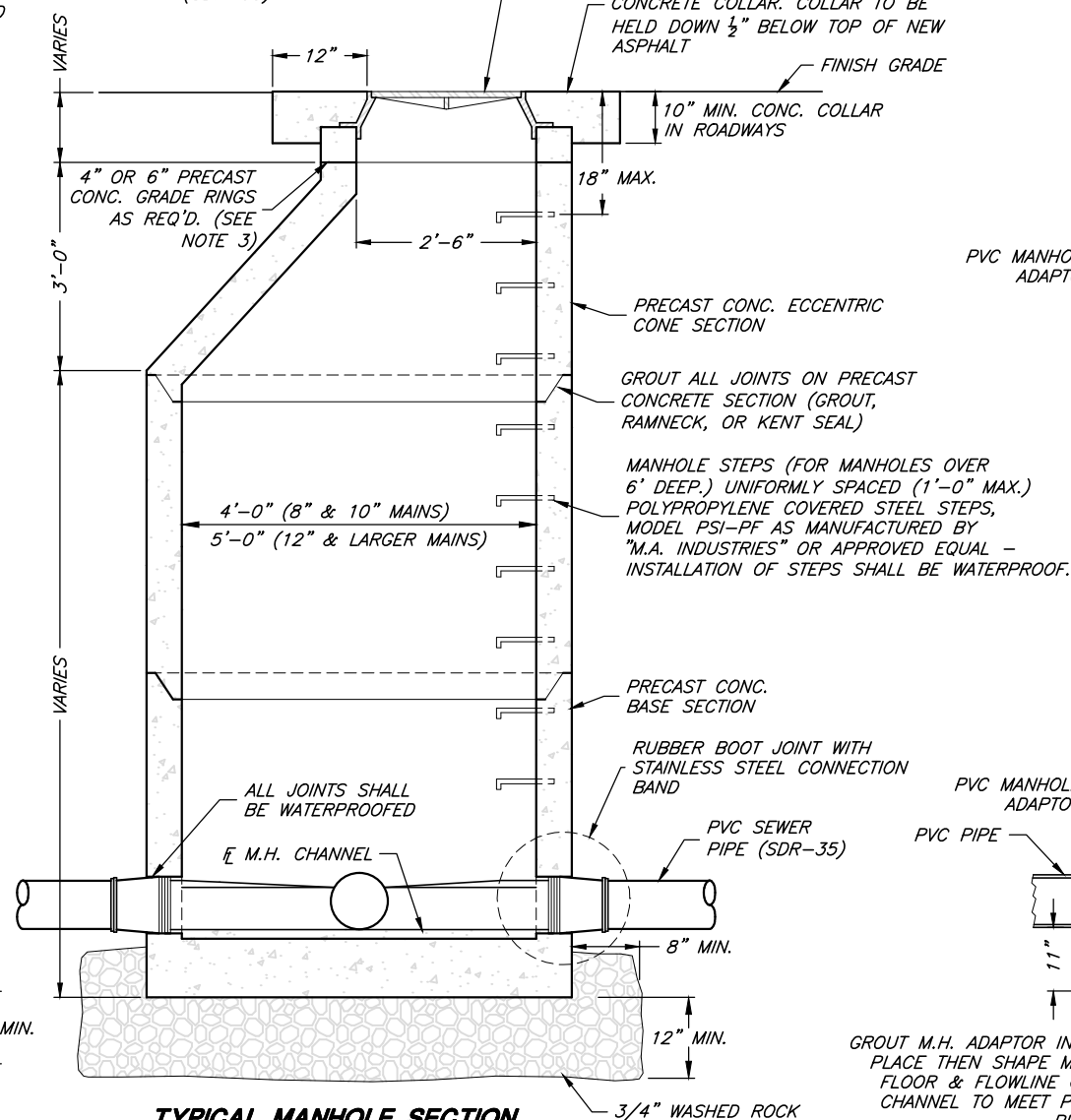
1. USE DROP MANHOLE ONLY WHEN DROP EXCEEDS 2'-0"
2. ALL PIPE FOR DROP MANHOLE TO BE FLANGED DUCTILE IRON PIPE CL-51.

**TYPICAL DROP MANHOLE SECTION**

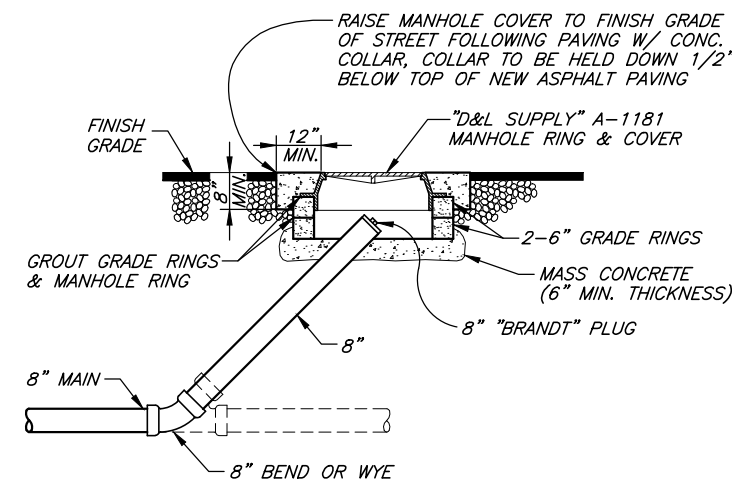
- GENERAL NOTES:**
1. SECURE INVERTS IN ALL MANHOLES DURING CONSTRUCTION SO AS TO PREVENT GRAVEL AND OTHER DEBRIS FROM COLLECTING INSIDE.
  2. A LARGER DIAMETER MANHOLE MAY BE REQUIRED BY THE DESIGN ENGINEER AFTER EVALUATION OF THE NUMBER, SIZE, AND ANGLE OF THE PIPES THAT CONNECT TO THE MANHOLE.
  3. NO MORE THAN 12" OF GRADE RINGS TO BE ALLOWED ON ANY MANHOLE.
  4. ALL TERMINATING SEWER MAINS SHALL END WITH A CITY STANDARD MANHOLE.
  5. SERVICE LATERAL CONNECTIONS SHALL NOT BE ALLOWED IN SEWER MANHOLES.
  6. ALL SANITARY SEWER LINES SHALL BE INSPECTED BY MEANS OF VIDEO CAMERA AND AIR TESTED WHEN CONSTRUCTED.



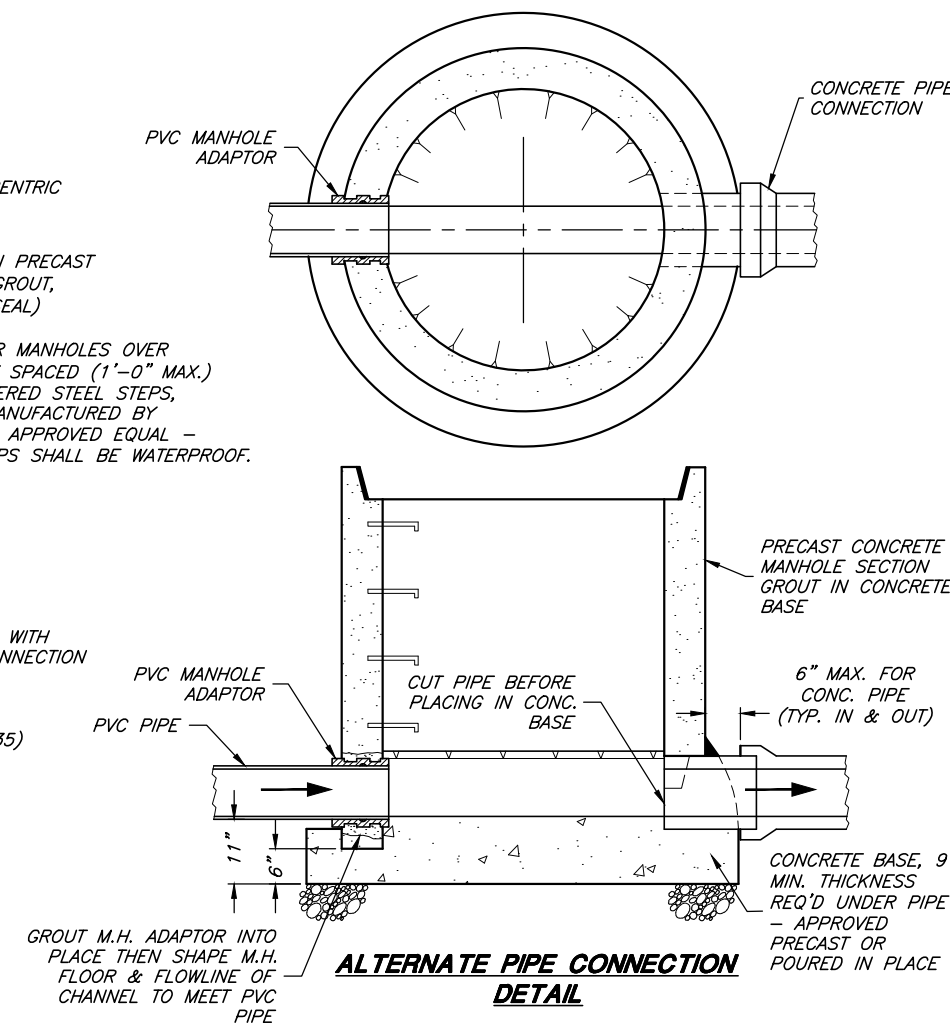
**MANHOLE PLAN**



**TYPICAL MANHOLE SECTION**



**DRAIN/SEWER MAINLINE CLEANOUT**



**ALTERNATE PIPE CONNECTION DETAIL**

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:

N. T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA



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FARR WEST CITY CORPORATION  
PUBLIC WORKS STANDARD DRAWINGS

**SANITARY SEWER - TYPICAL MANHOLE DETAILS**

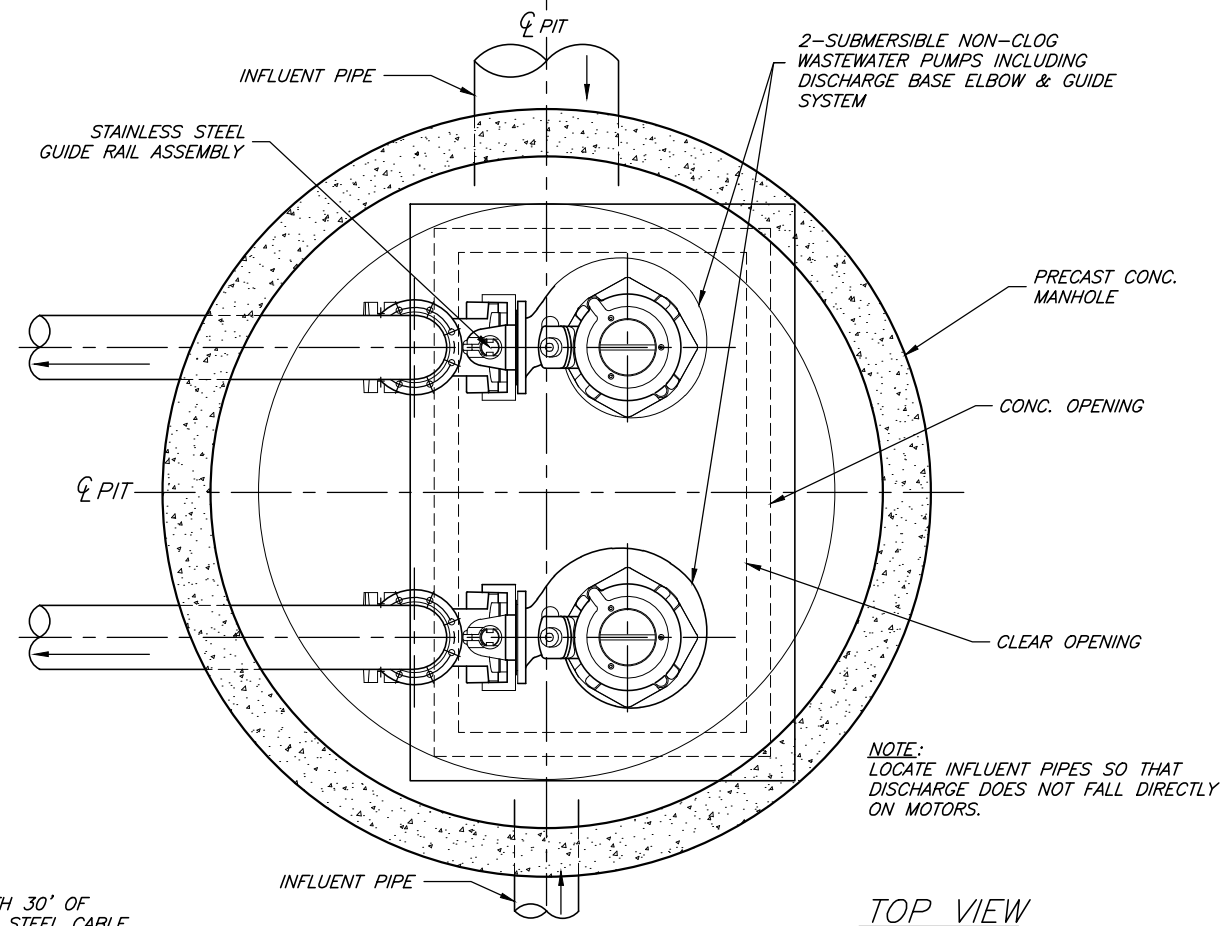
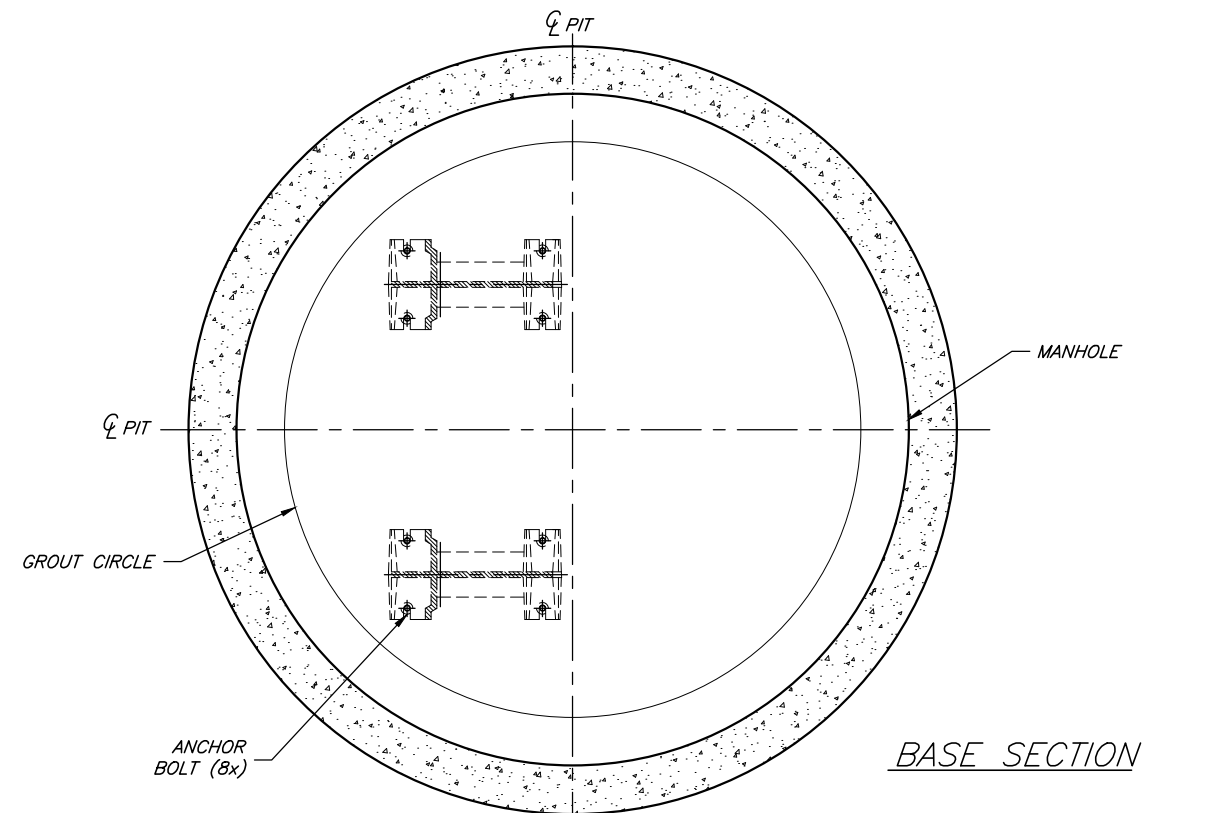
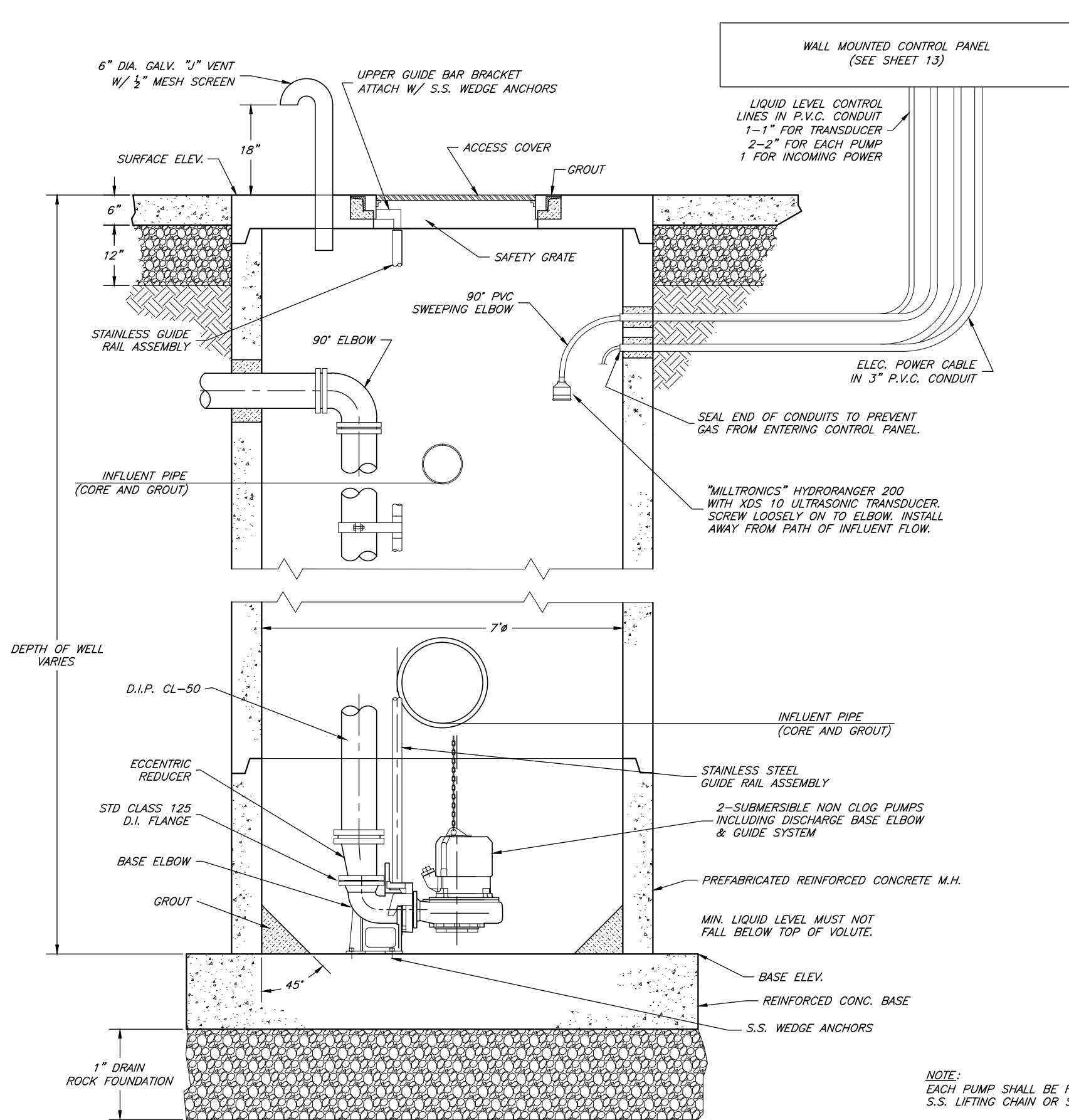
SHEET:

**CS-07**

OF 18 SHEETS

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

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:  
N.T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA

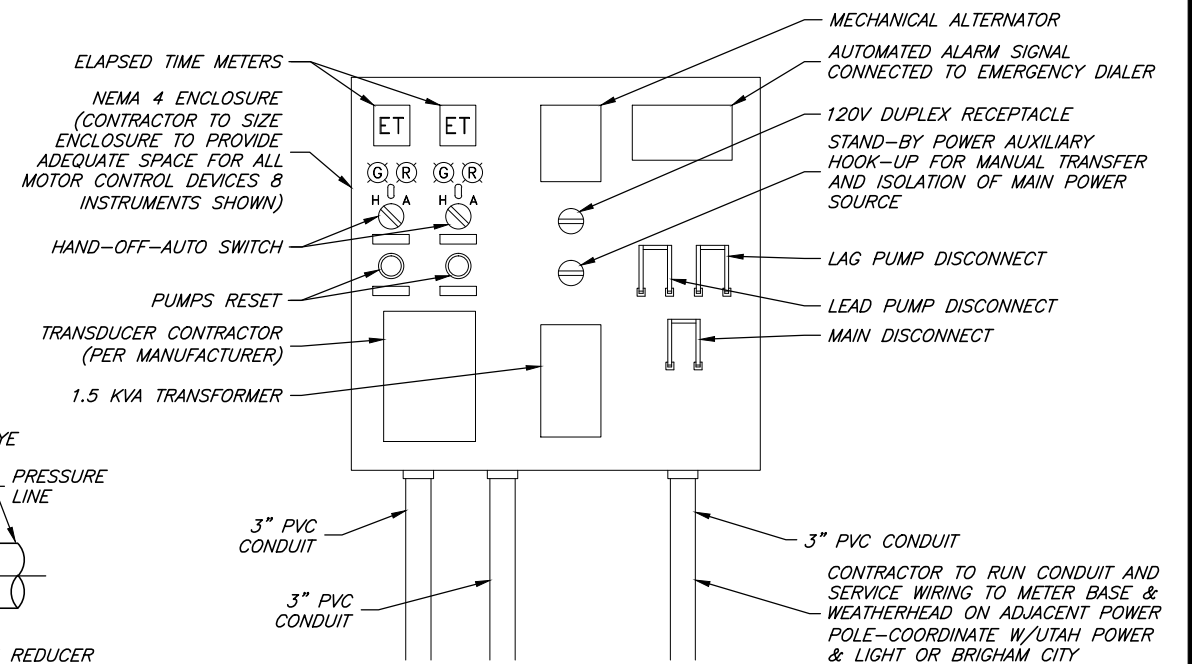
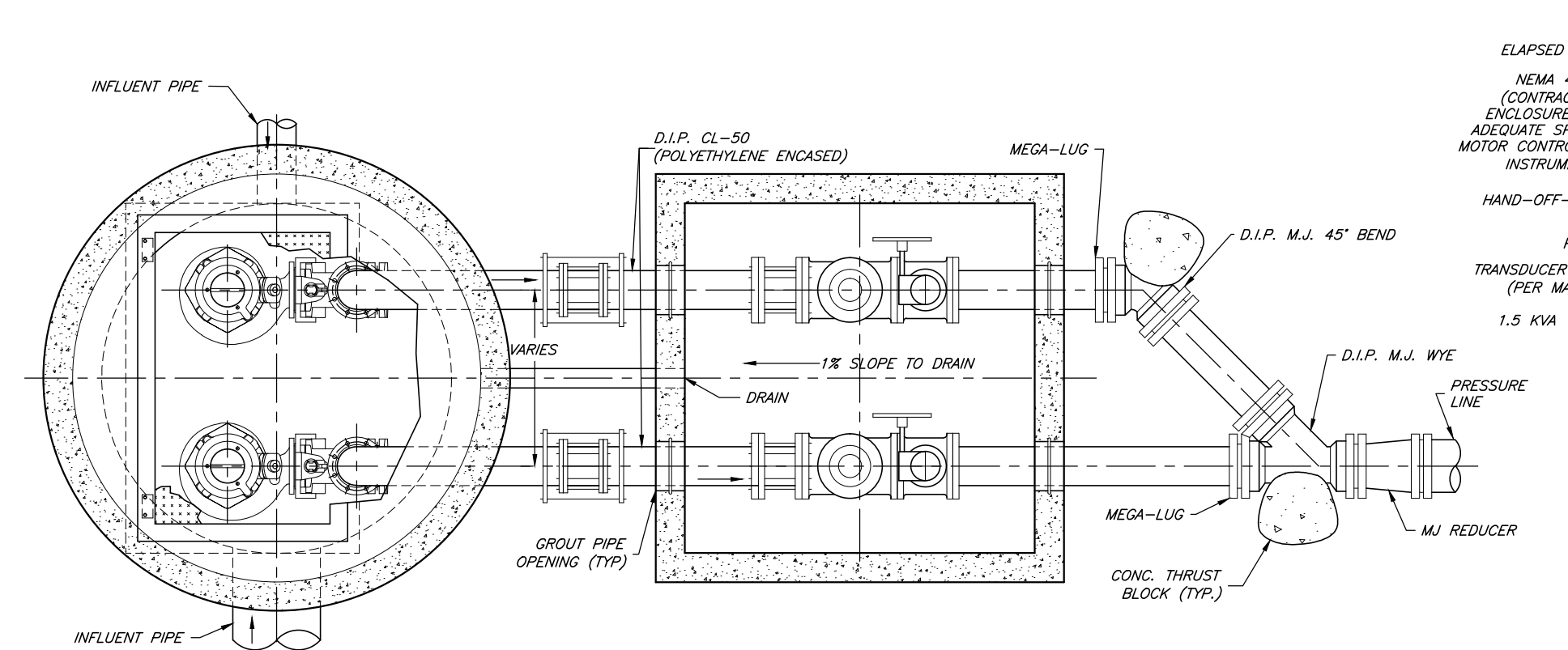


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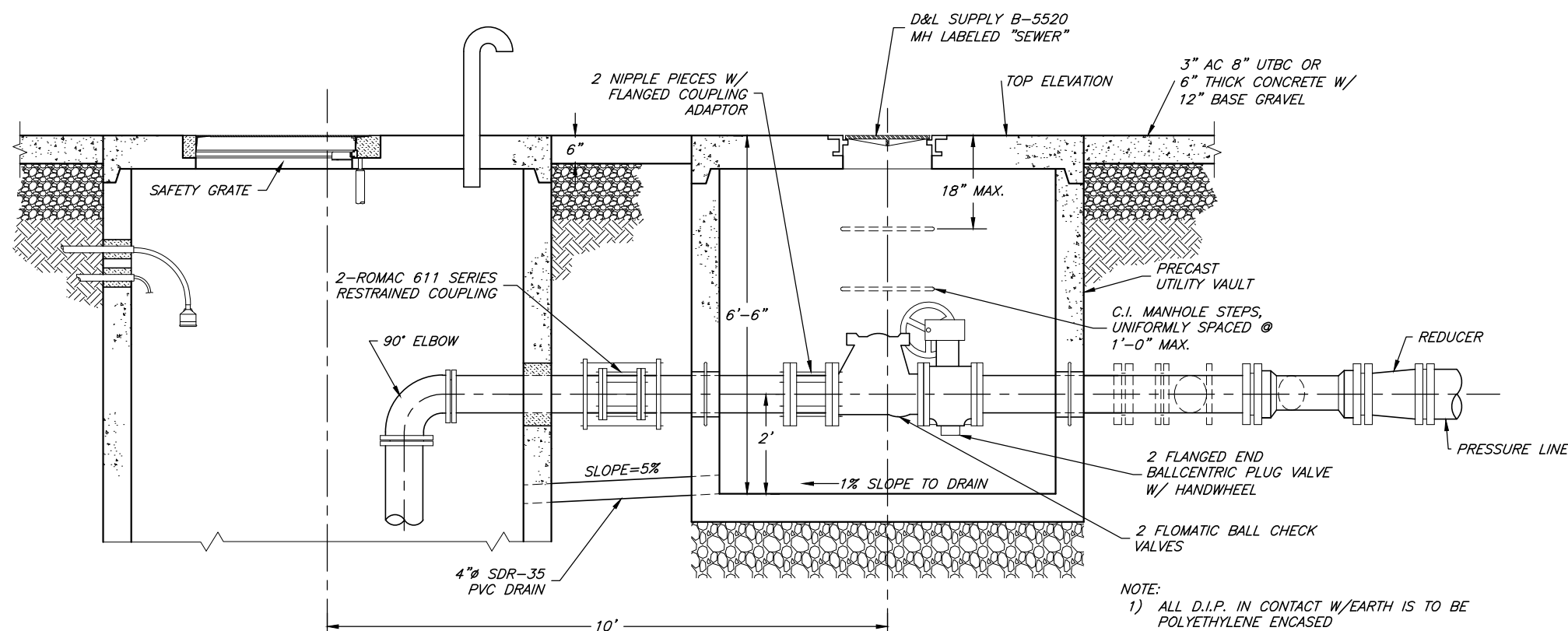
FARR WET CITY CORPORATION  
PUBLIC WORKS STANDARD DRAWINGS  
**SANITARY SEWER - TYPICAL SEWER LIFT STATION**

SHEET:  
**CS-08**  
OF 18 SHEETS  
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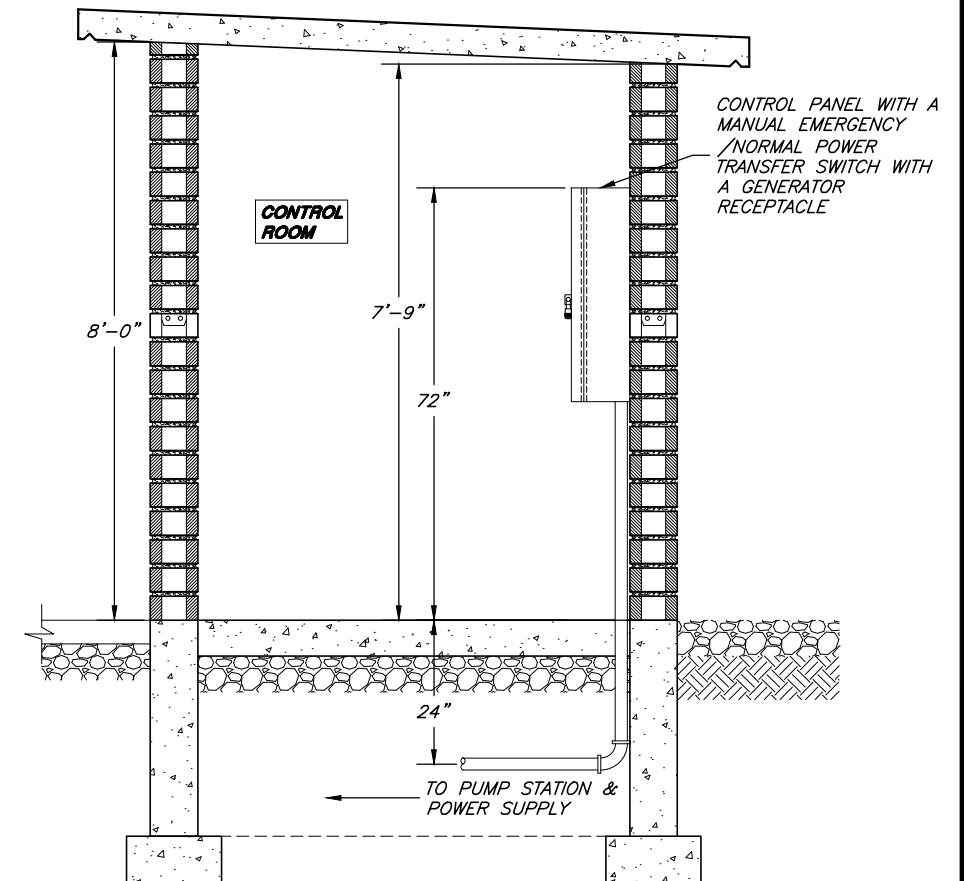


**PUMP CONTROL PANEL**



**CHECK VALVE STATION**

- NOTE:
- 1) ALL D.I.P. IN CONTACT W/EARTH IS TO BE POLYETHYLENE ENCASED
  - 2) 14 GAUGE TRACER WIRE REQUIRED ON PRESSURE LINE EVERY 400-500 FT W/ ACCESS BOX INSTALLED



**PANEL WALL**

CONTRACTOR SHALL PROVIDE 3/4" BARE COPPER GROUNDING ROD 8 1/0 BARE COPPER GROUNDING CONDUCTOR FOR CONTINUOUS GROUND.

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:  
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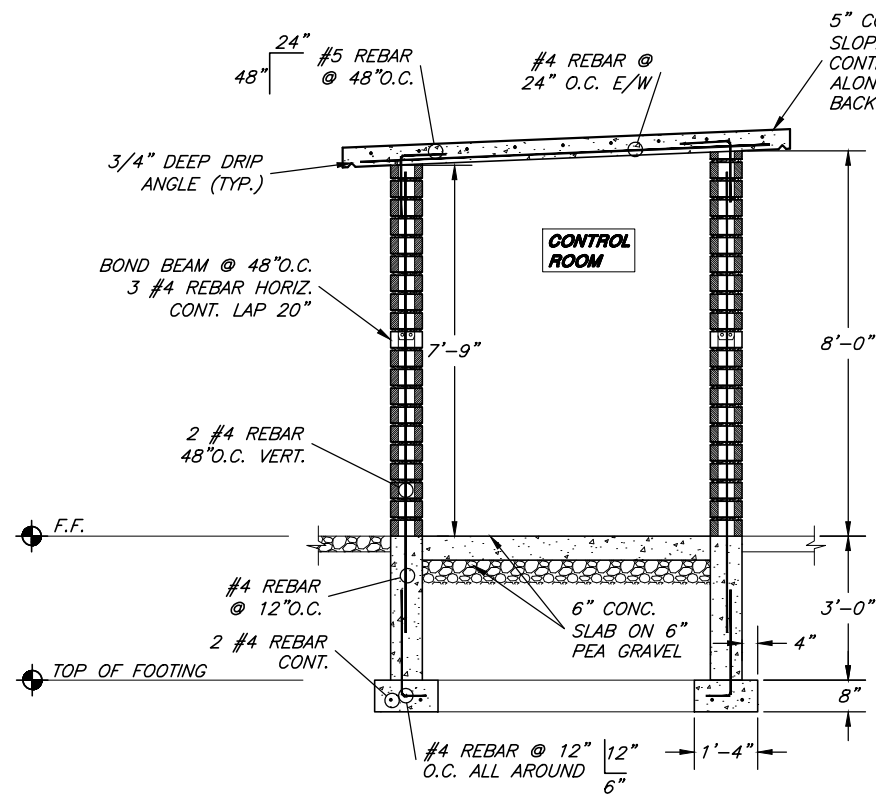
DESIGNED BEB  
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FARR WEST CITY CORPORATION  
PUBLIC WORKS STANDARD DRAWINGS  
**SANITARY SEWER - LIFT STATION CHECK VALVE & CONTROL PANEL**

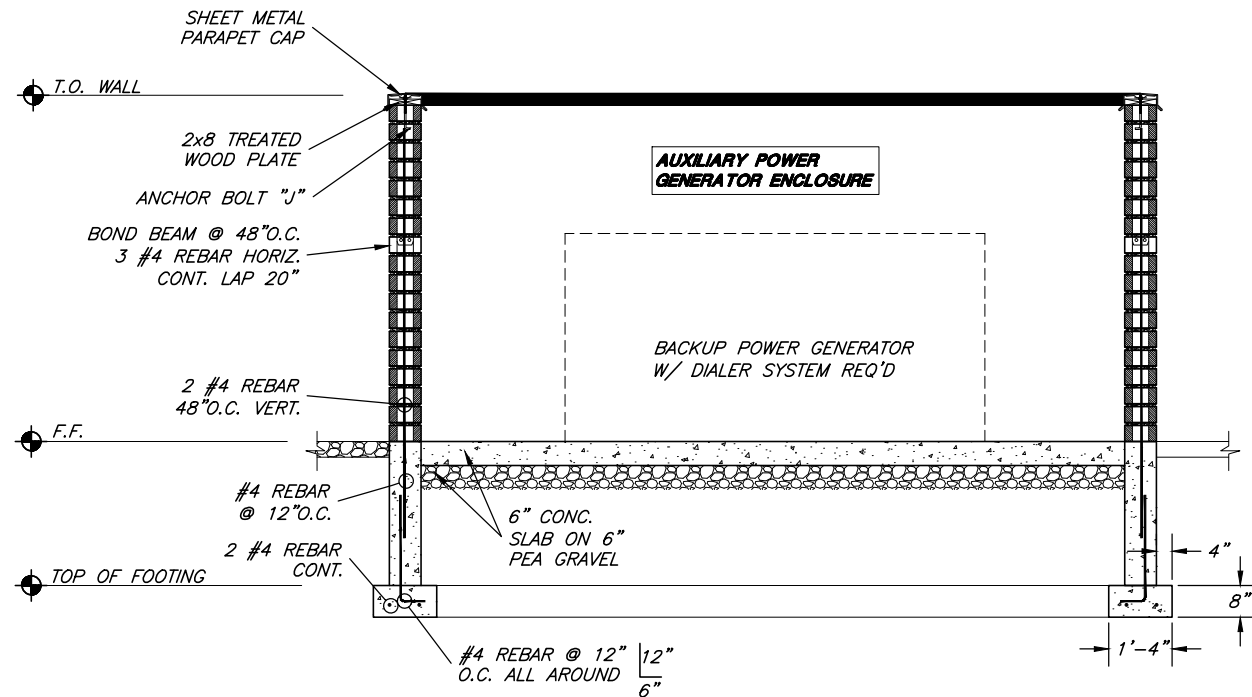
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OF 18 SHEETS  
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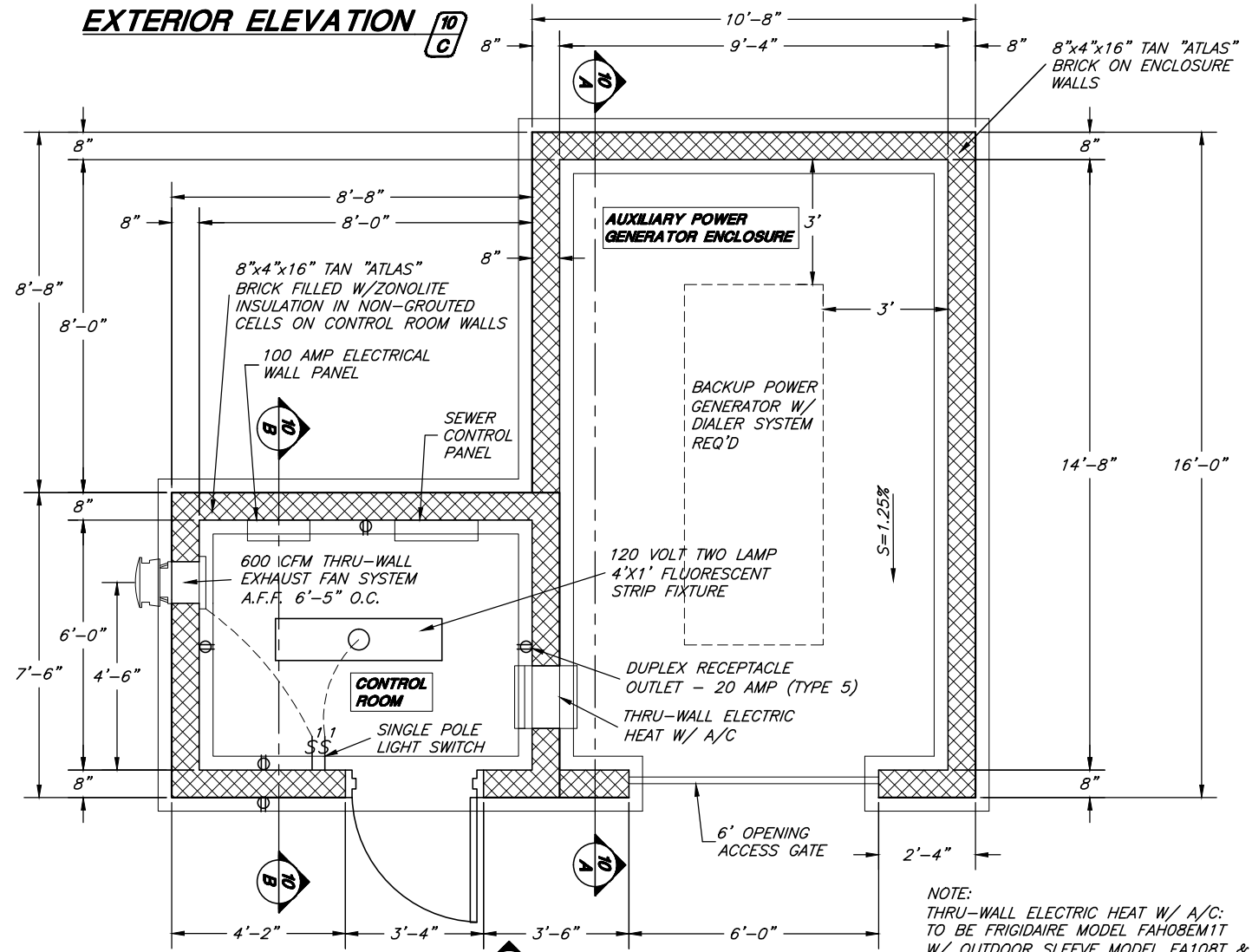
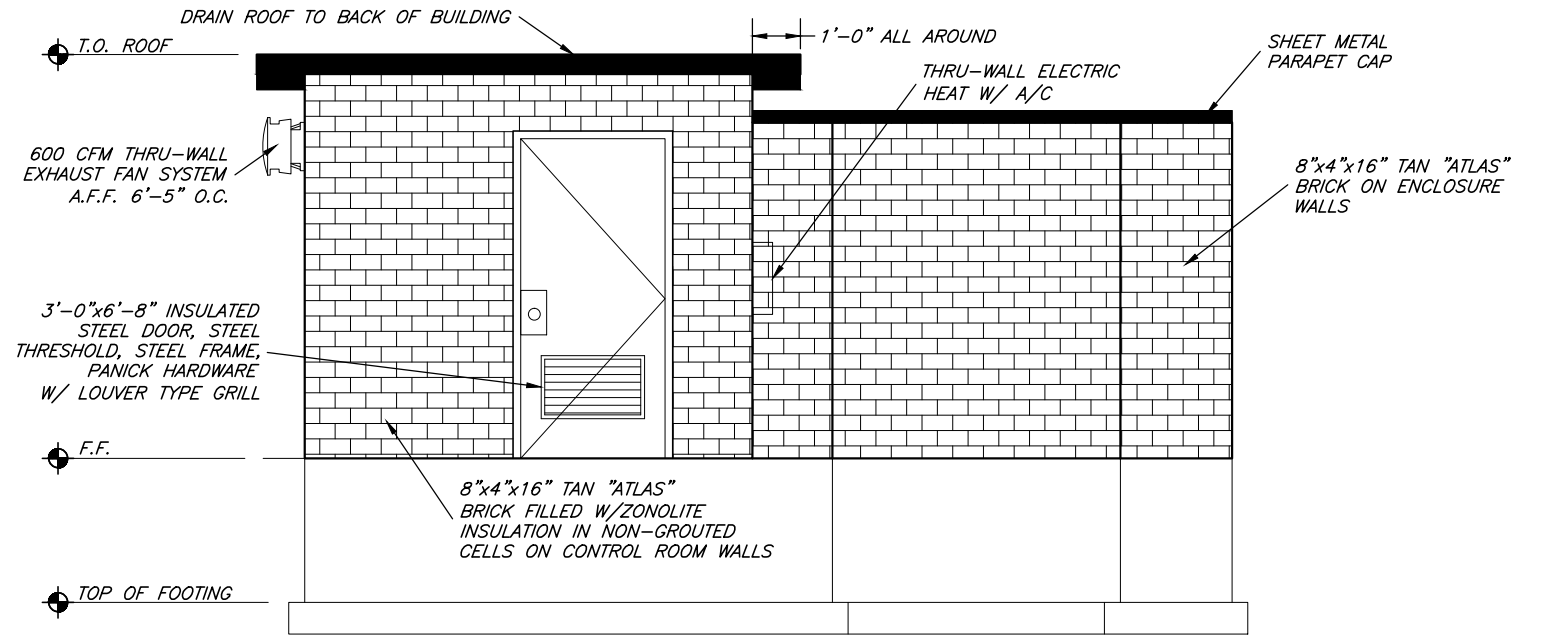
**BUILDING SECTION 10B**

**NOTES:**

1. ALL ELECTRICAL WIRING TO BE ENCLOSED IN CONDUIT.
2. ALL CONSTRUCTION TO BE IN ACCORDANCE WITH I.B.C. AND AND OTHER APPLICABLE CODES.
3. ALL CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 4000 PSI.
4. ALL REINFORCED BARS #4 OR GREATER SHALL BE GRADE 60.
5. ELECTRICAL SYSTEM BY OTHERS. GENERAL CONTRACTOR TO COORDINATE LOCATION OF ELECTRICAL APPURTENANCES WITH ELECTRICAL CONTRACTOR. TRENCHING, CONDUIT, AND BACKFILLING IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR.
6. ALL EXPOSED CONCRETE EXTERIOR SURFACES SHALL HAVE A HAND RUBBED CONCRETE FINISH.
7. FOOTINGS SHALL REST ON UNDISTURBED GROUND OR SHALL SIT ON IMPORTED GRANULAR BACKFILL COMPACTED TO 95% MAX. DRY DENSITY.
8. DOOR SHALL BE PAINTED W/ 1 PRIMER COAT AND 2 FINISH COATS OF ENAMEL PAINT. COLOR TO BE SPECIFIED BY THE CITY SEWER DIVISION SUPERVISOR.



**BUILDING SECTION 10A**



NOTE:  
THRU-WALL ELECTRIC HEAT W/ A/C:  
TO BE FRIGIDAIRE MODEL FAH08EM1T  
W/ OUTDOOR SLEEVE MODEL EA108T &  
GRILL MODELA109T PROVIDING 8000  
BTU OF COOL & 4200 BTU OF HEAT  
CAPACITY OR APPROVED EQUAL

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:

N.T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA



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**FARR WEST CITY CORPORATION**  
**PUBLIC WORKS STANDARD DRAWINGS**  
**SANITARY SEWER - TYPICAL LIFT STATION**  
**CONTROL BLDG.**

SHEET:

**CS-10**

OF 18 SHEETS

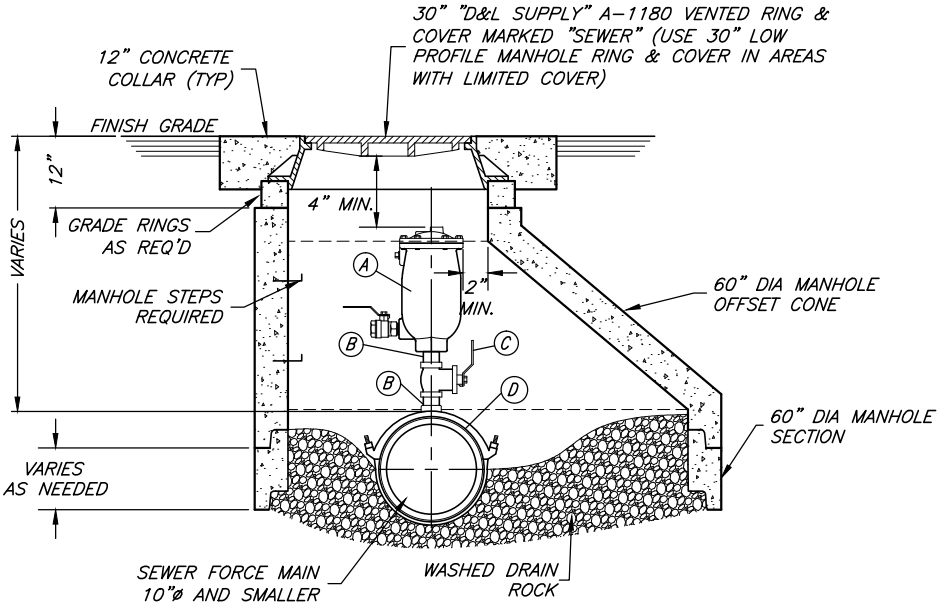
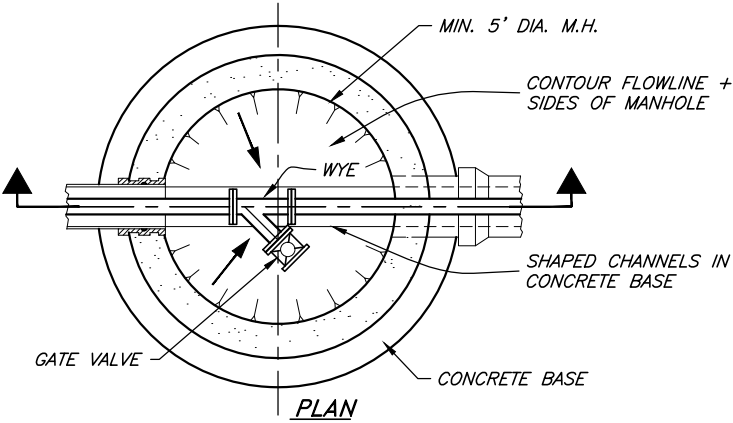
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PIPE & FITTING SCHEDULE

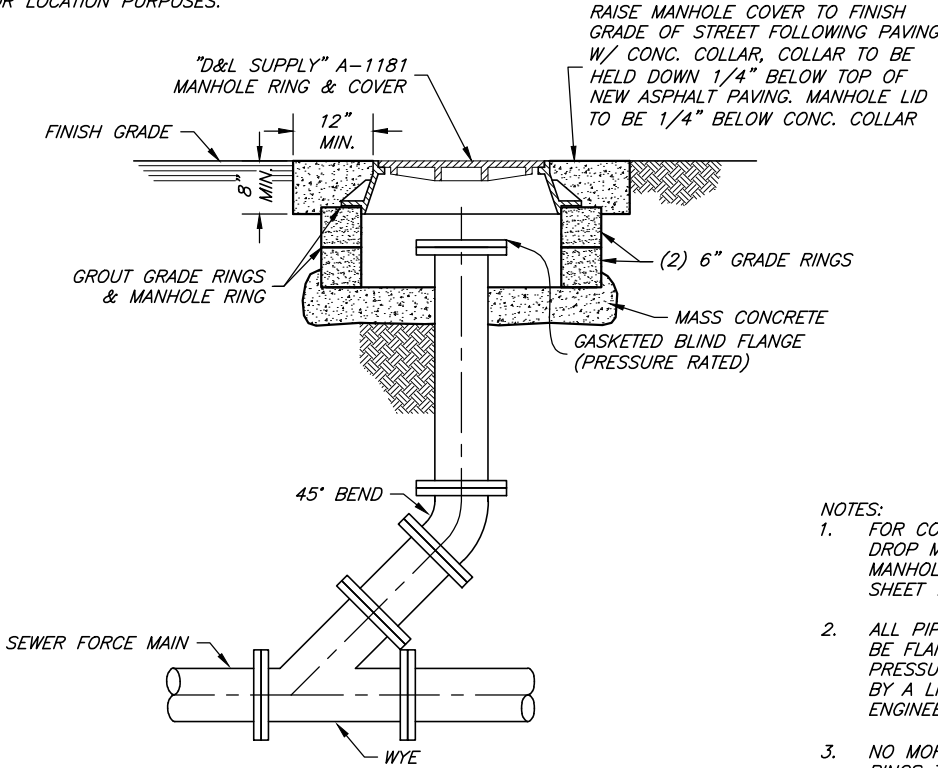
NO.	DESCRIPTION	FITTING
A	2" WASTEWATER AIR RELEASE VALVE "VAL MATIC" MODEL # 49A W/ OPTIONAL VACUUM CHECK ON THE OUTLET	THR.
B	2" BRASS PIPE	THR.
C	2" BALL VALVE (1/4 TURN 200 PSI MIN.)	THR.
D	2" NYLON COATED SERVICE SADDLE W/ STEEL STRAPS "ROMAC MODEL # 202NS	—

NOTES:  
1. WHERE SEWAGE WATER QUALITY IS ADEQUATE AS DICTATED BY THE CITY ENGINEER, AN A.R.I. D040 OR APPROVED EQUAL VALVE MAY BE SPECIFIED.

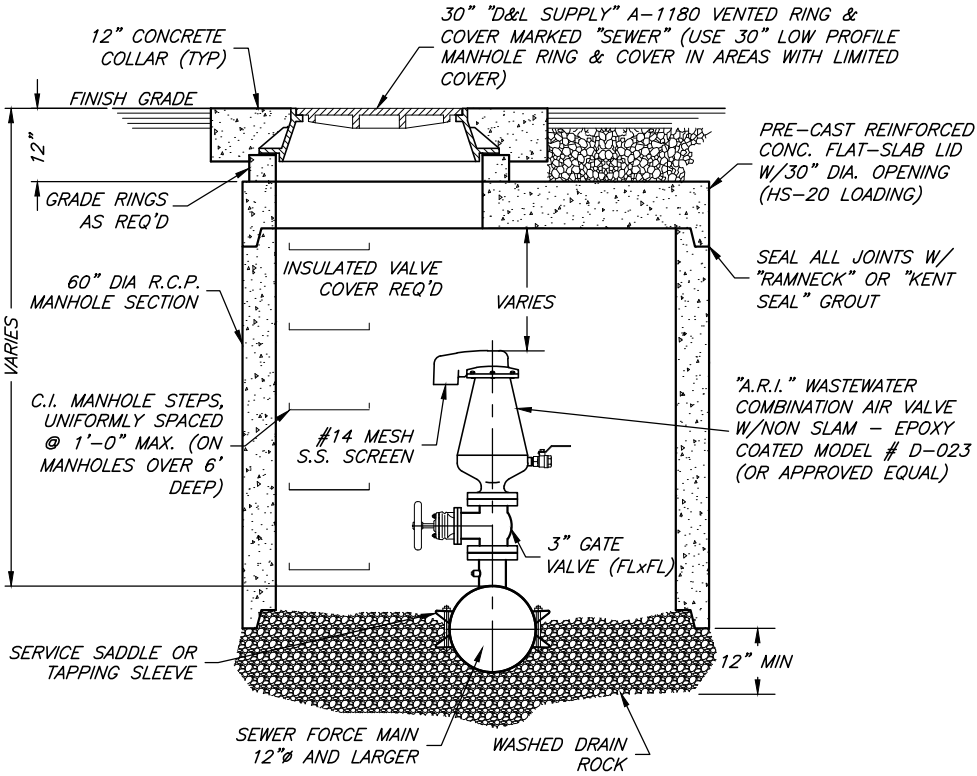


**TYPICAL 2" WASTEWATER AIR RELEASE VALVE STATION**  
10" MAINS AND UNDER

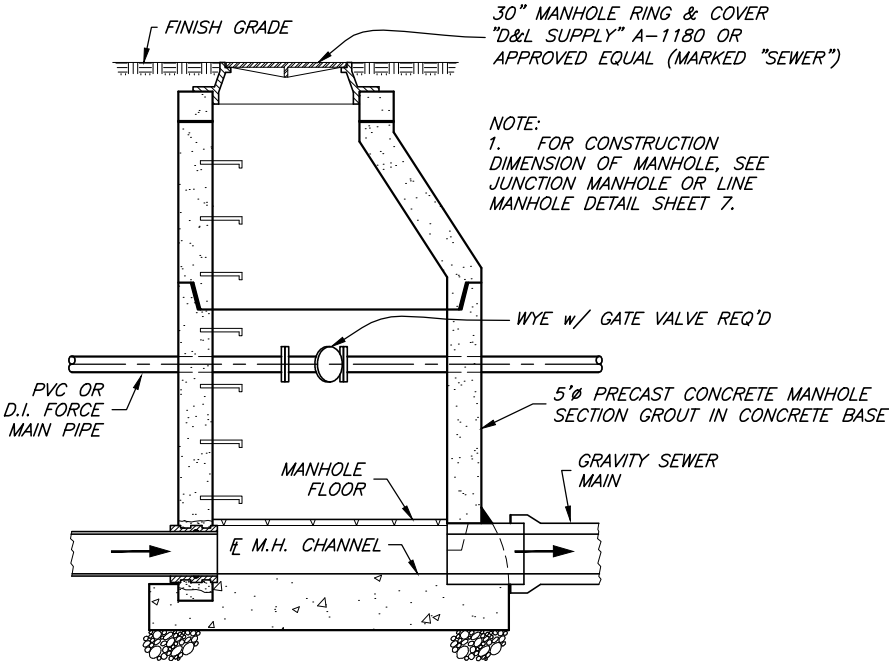
GENERAL NOTE:  
ALL CLEANOUTS SHALL BE MARKED AND FITTED WITH A METAL LID FOR LOCATION PURPOSES.



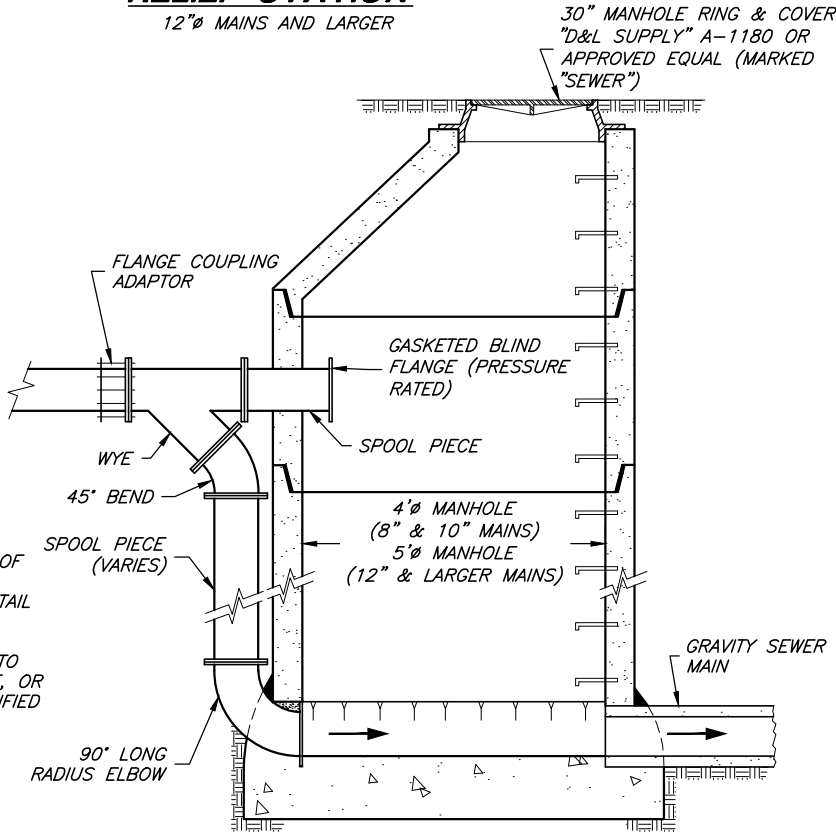
**STANDARD SEWER FORCE MAIN CLEANOUT**  
4" TO 12" MAINS



**TYPICAL 3" WASTEWATER AIR/VACUUM RELIEF STATION**  
12" MAINS AND LARGER



**FORCE MAIN CLEANOUT MANHOLE**  
WHERE SPECIFIED BY THE WASTEWATER TREATMENT MANAGER



**FORCE MAIN CONNECTION MANHOLE**  
FORCE MAIN CONNECTION TO GRAVITY SEWER SYSTEM

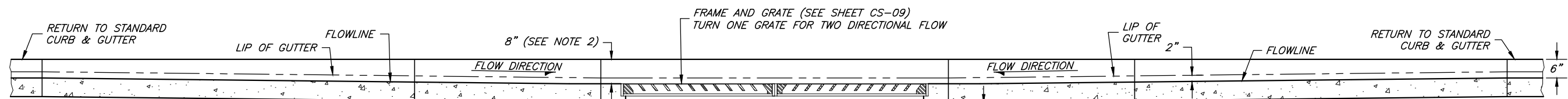
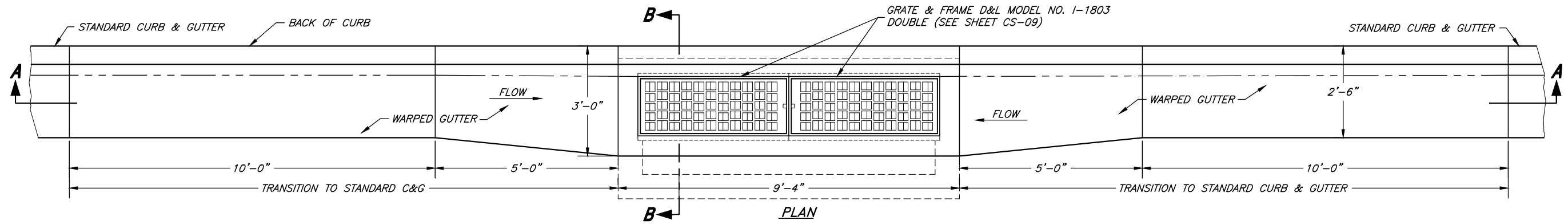
NOTES:  
1. FOR CONSTRUCTION DIMENSION OF DROP MANHOLE, SEE JUNCTION MANHOLE OR LINE MANHOLE DETAIL SHEET 7.  
2. ALL PIPE FOR DROP MANHOLE TO BE FLANGED DUCTILE IRON PIPE, OR PRESSURE RATED PVC AS SPECIFIED BY A LICENSED PROFESSIONAL ENGINEER.  
3. NO MORE THAN 12" OF GRADE RINGS TO BE ALLOWED ON ANY MANHOLE

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

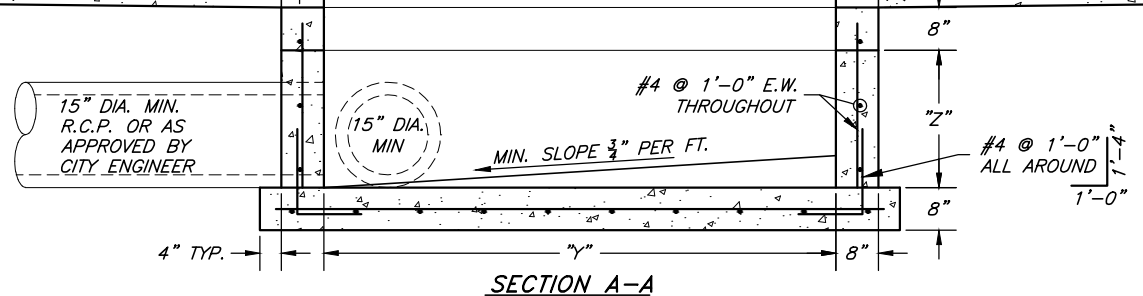
SCALE:	DESIGNED <u>BEB</u>
N.T.S.	DRAWN <u>BEB</u>
	CHECKED <u>DDA</u>

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

**FARR WEST CITY CORPORATION**  
PUBLIC WORKS STANDARD DRAWINGS  
**SANITARY SEWER - FORCE MAIN DETAILS**

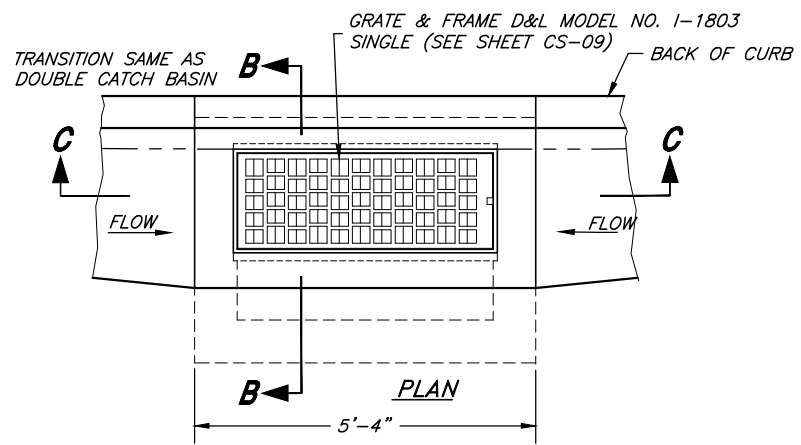
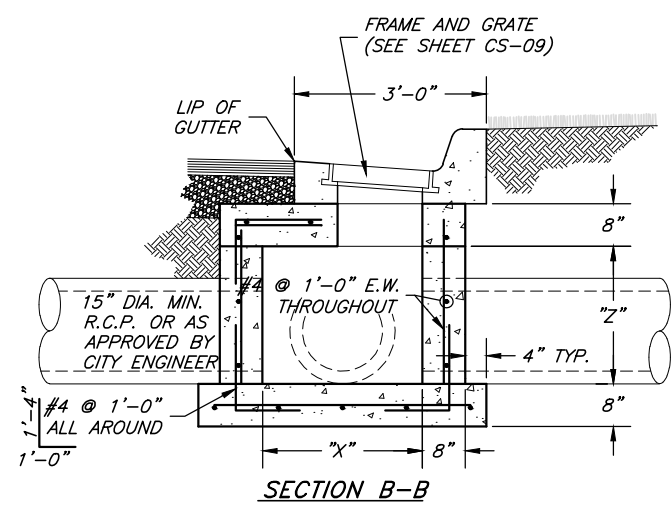
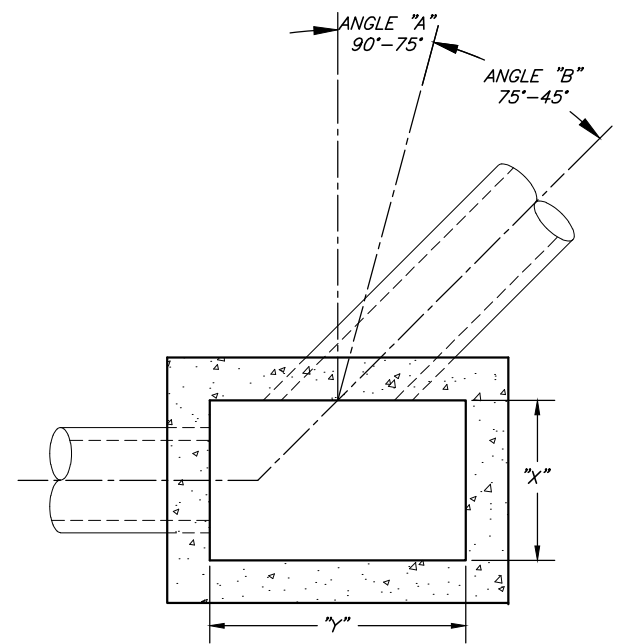


CATCH BASIN DIMENSION TABLE					
PIPE SIZE (IN.)	"X"	TYPE IV		TYPE III	
		"Y" (ANGLE A)	"Y" (ANGLE B)	"Y"	"Z" MIN.
15	2'-6"	4'-0"	4'-0"	8'-0"	2'-0"
18	2'-6"	4'-0"	4'-0"	8'-0"	2'-6"
21	4'-0"	4'-0"	4'-0"	8'-0"	3'-0"
24	4'-0"	4'-0"	5'-0"	8'-0"	3'-0"
30	4'-0"	4'-0"	6'-0"	8'-0"	3'-6"
36	4'-0"	4'-0"	6'-0"	8'-0"	4'-0"
42	6'-0"	6'-0"	7'-0"	8'-0"	5'-0"
48	6'-0"	6'-0"	8'-0"	8'-0"	5'-6"

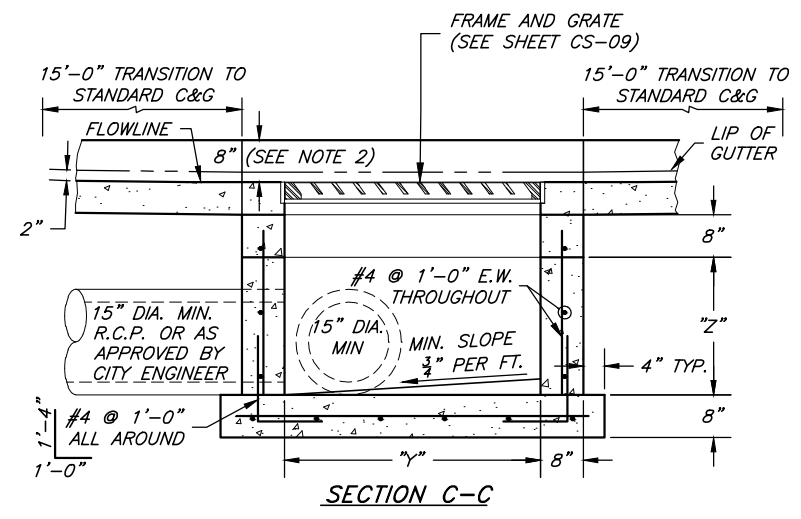


### DOUBLE CATCH BASIN

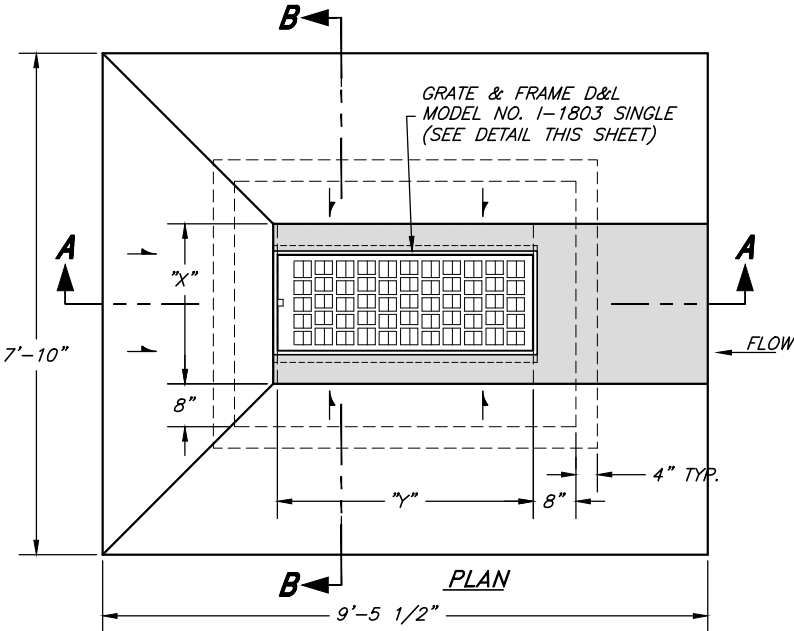
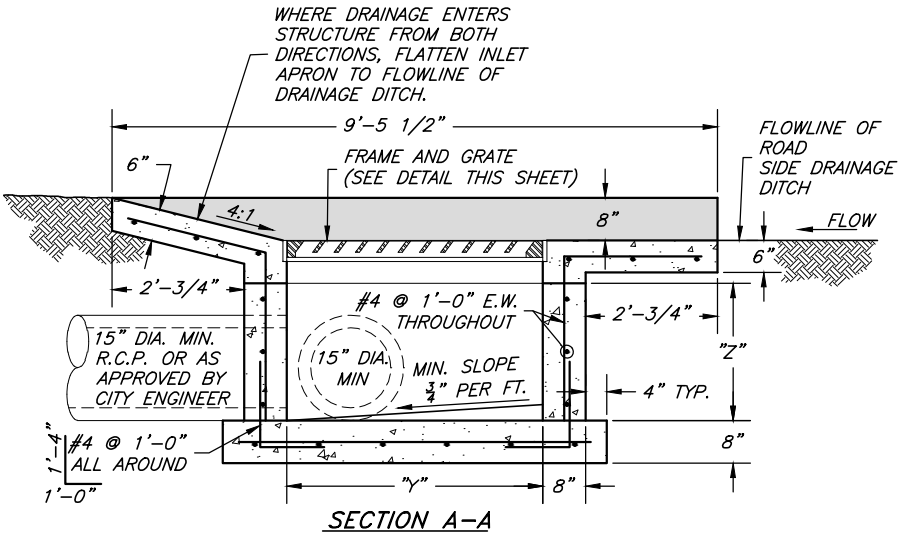
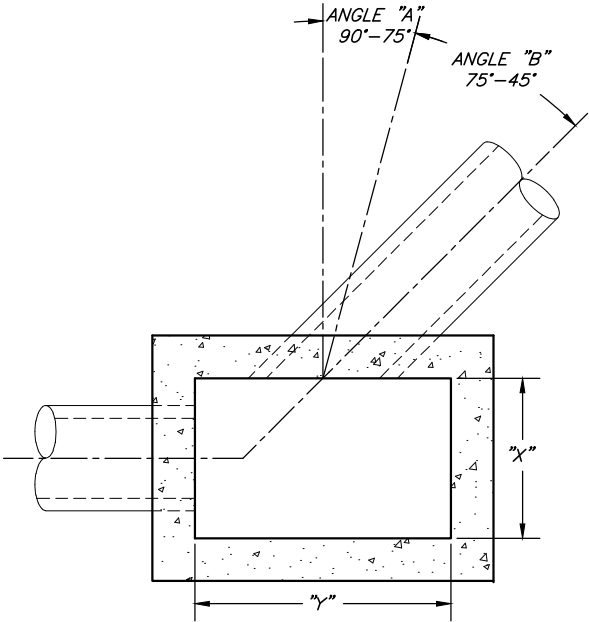
- NOTES:**
1. ALL CATCH BASIN BOX SIZES REFLECT DIMENSIONS FOR THE MINIMUM 15"Ø PIPE SIZE. BOX DIMENSIONS MUST INCREASE PROPORTIONALLY TO ACCOMMODATE LARGER PIPE SIZES.
  2. DEPTH MAY VARY FROM 6" TO 10" AS DIRECTED BY THE CITY ENGINEER
  3. CAST-IN-PLACE CONCRETE CATCH BASINS CAN BE REPLACED WITH PRECAST CONCRETE CATCH BASINS WITH HS-20 DECK LOADING AND COMPARABLE SIZE.
  4. ALL BOXES SHALL BE FORMED ON THE INSIDE AND OUTSIDE OF THE BOX AND INSPECTED BY THE CITY PRIOR TO THE PLACING OF CONCRETE.
  5. DOUBLE CATCH BASINS WILL BE REQUIRED IN LOCATIONS SPECIFIED BY THE CITY ENGINEER (TYPICALLY IN LOW SPOTS OR WHERE ADDITIONAL INLET CAPACITY IS NEEDED).



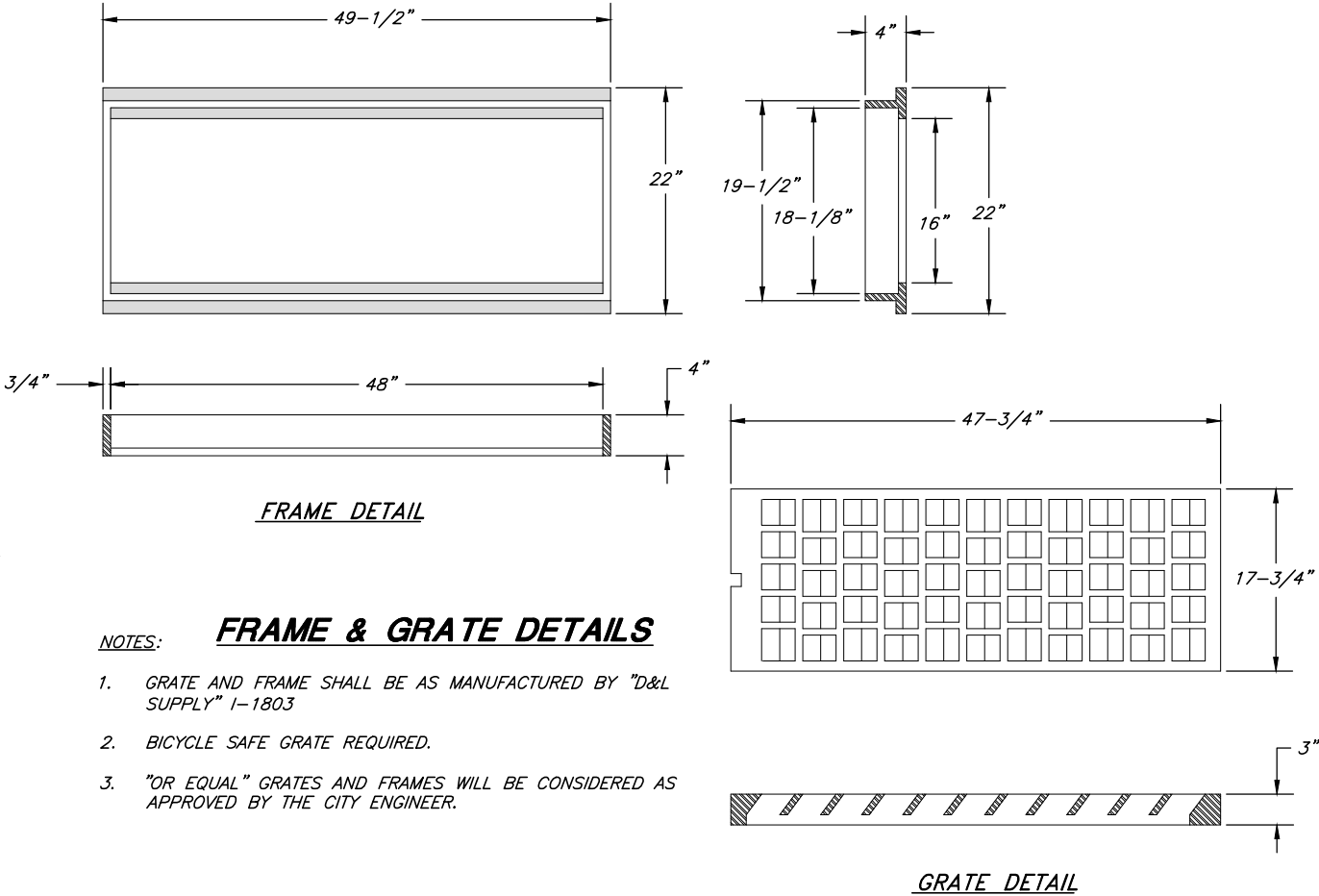
### SINGLE CATCH BASIN



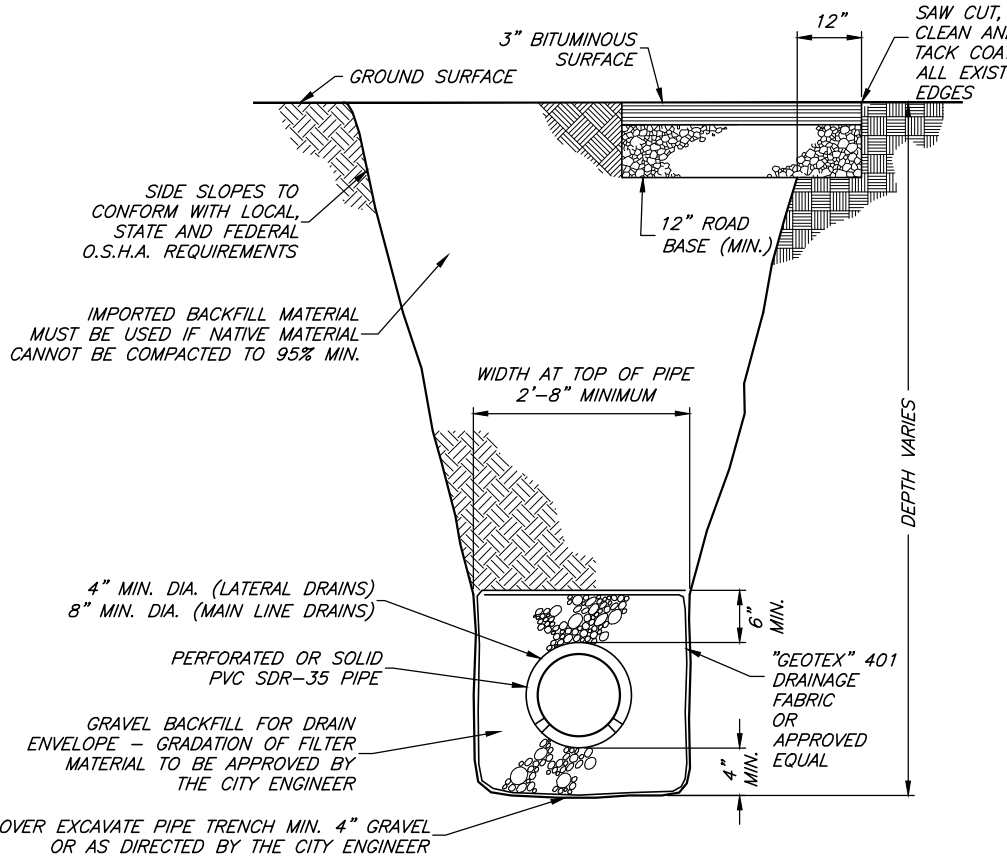
CATCH BASIN DIMENSION TABLE				
PIPE SIZE (IN.)	"X"	TYPE V		"Z" MIN.
		"Y" (ANGLE A)	"Y" (ANGLE B)	
15	2'-6"	4'-0"	4'-0"	2'-0"
18	2'-6"	4'-0"	4'-0"	2'-6"
21	4'-0"	4'-0"	4'-0"	3'-0"
24	4'-0"	4'-0"	5'-0"	3'-0"
30	4'-0"	4'-0"	6'-0"	3'-6"
36	4'-0"	4'-0"	6'-0"	4'-0"
42	6'-0"	6'-0"	7'-0"	5'-0"
48	6'-0"	6'-0"	8'-0"	5'-6"



**DRAINAGE DITCH INLET BOX**

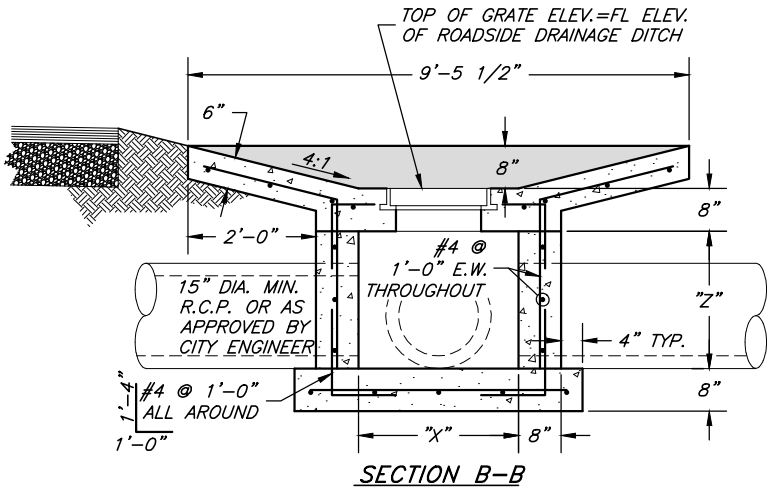


- FRAME & GRATE DETAILS**
- NOTES:
- GRATE AND FRAME SHALL BE AS MANUFACTURED BY "D&L SUPPLY" I-1803
  - BICYCLE SAFE GRATE REQUIRED.
  - "OR EQUAL" GRATES AND FRAMES WILL BE CONSIDERED AS APPROVED BY THE CITY ENGINEER.



**TYPICAL LAND DRAIN TRENCH SECTION**  
(USE ONLY UPON APPROVAL FROM THE CITY ENGINEER)

- NOTES:
- LAND DRAIN COLLECTION MAINS SHALL BE 8 INCH MINIMUM DIAMETER P.V.C. SDR 35 SEWER PIPE. LAND DRAIN SERVICE LATERALS SHALL BE 4 INCH DIAMETER P.V.C. SDR 35 PIPE. PIPE COLOR FOR BOTH THE MAIN AND THE LATERALS SHALL BE "WHITE."
  - AREAS WHERE PERFORATED OR SOLID PIPE IS TO BE INSTALLED, SHALL BE AS DETERMINED BY THE CITY ENGINEER.
  - REQUIRED SIZE OF MAIN LINE SHALL BE AS DETERMINED BY THE CITY ENGINEER.



- NOTES:
- ALL CATCH BASIN BOX SIZES REFLECT DIMENSIONS FOR THE MINIMUM 15" PIPE SIZE. BOX DIMENSIONS MUST INCREASE PROPORTIONALLY TO ACCOMMODATE LARGER PIPE SIZES. (SEE TABLE THIS SHEET)
  - CAST-IN-PLACE CONCRETE CATCH BASINS CAN BE REPLACED WITH PRECAST CONCRETE CATCH BASINS WITH HS-20 DECK LOADING AND COMPARABLE SIZE.
  - ALL BOXES SHALL BE FORMED ON THE INSIDE AND OUTSIDE OF THE BOX AND INSPECTED BY THE CITY PRIOR TO THE PLACING OF CONCRETE.

PROJECT ENGINEER				
DATE				
REV.	DATE	APPR.		

SCALE:  
N. T.S.

DESIGNED BEB  
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CHECKED DDA



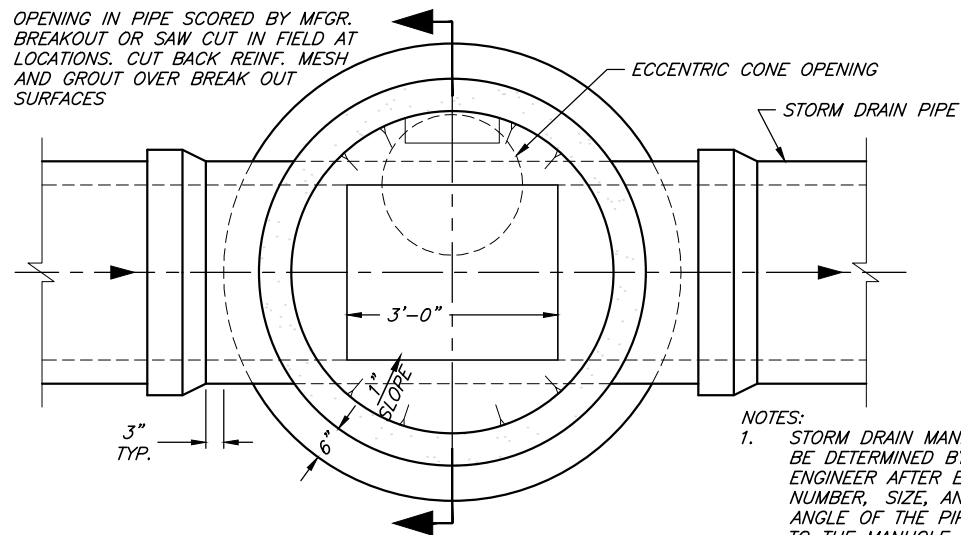
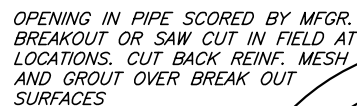
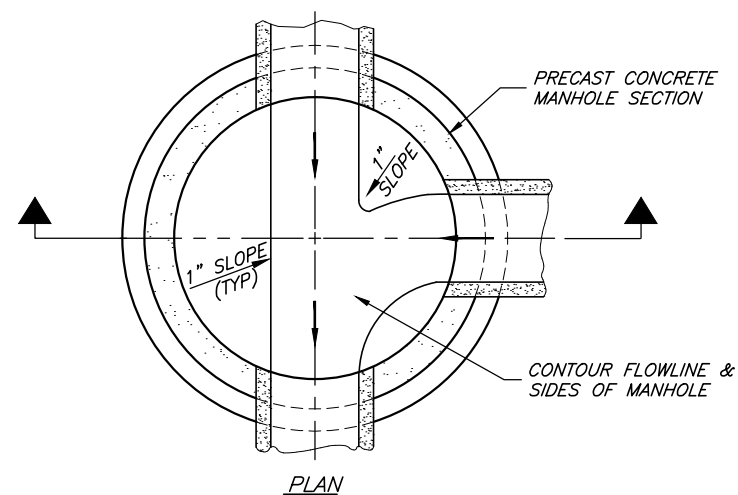
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Ogden, Utah 84403 (801) 476-9767

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PUBLIC WORKS STANDARD DRAWINGS  
**STORM DRAIN - DRAINAGE DITCH INLET BOX, GENERAL GRATE AND FRAME DETAILS & LAND DRAIN DETAILS**

SHEET:  
**CS-14**  
OF 18 SHEETS  
0

GENERAL NOTES:

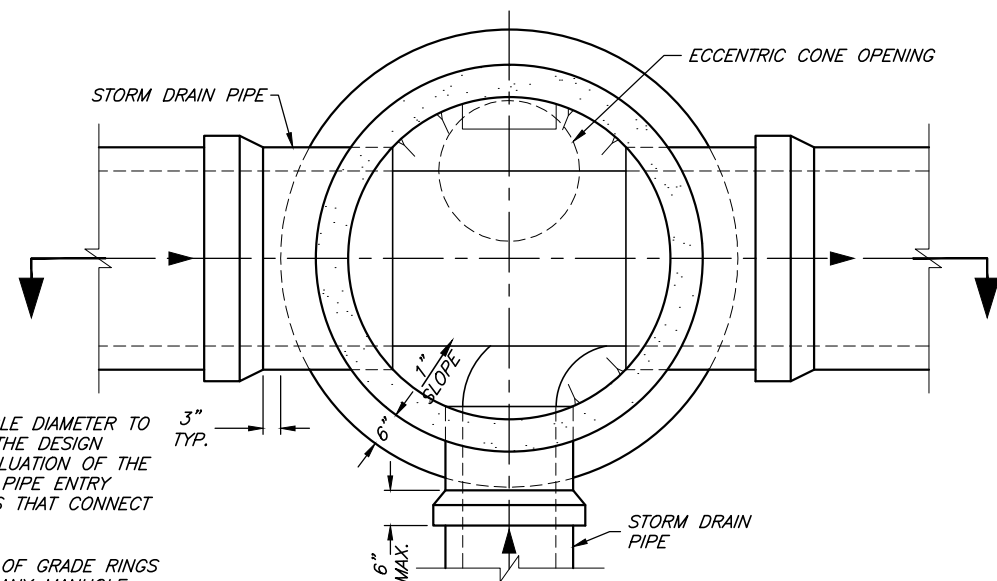
1. SUGGESTED "A" DISTANCE IS 6" OR GREATER FOR 48", 60" AND 72" DIAMETER MANHOLES
2. SUGGESTED "A" DISTANCE IS 8" OR GREATER FOR 84" AND 96" DIAMETER MANHOLES



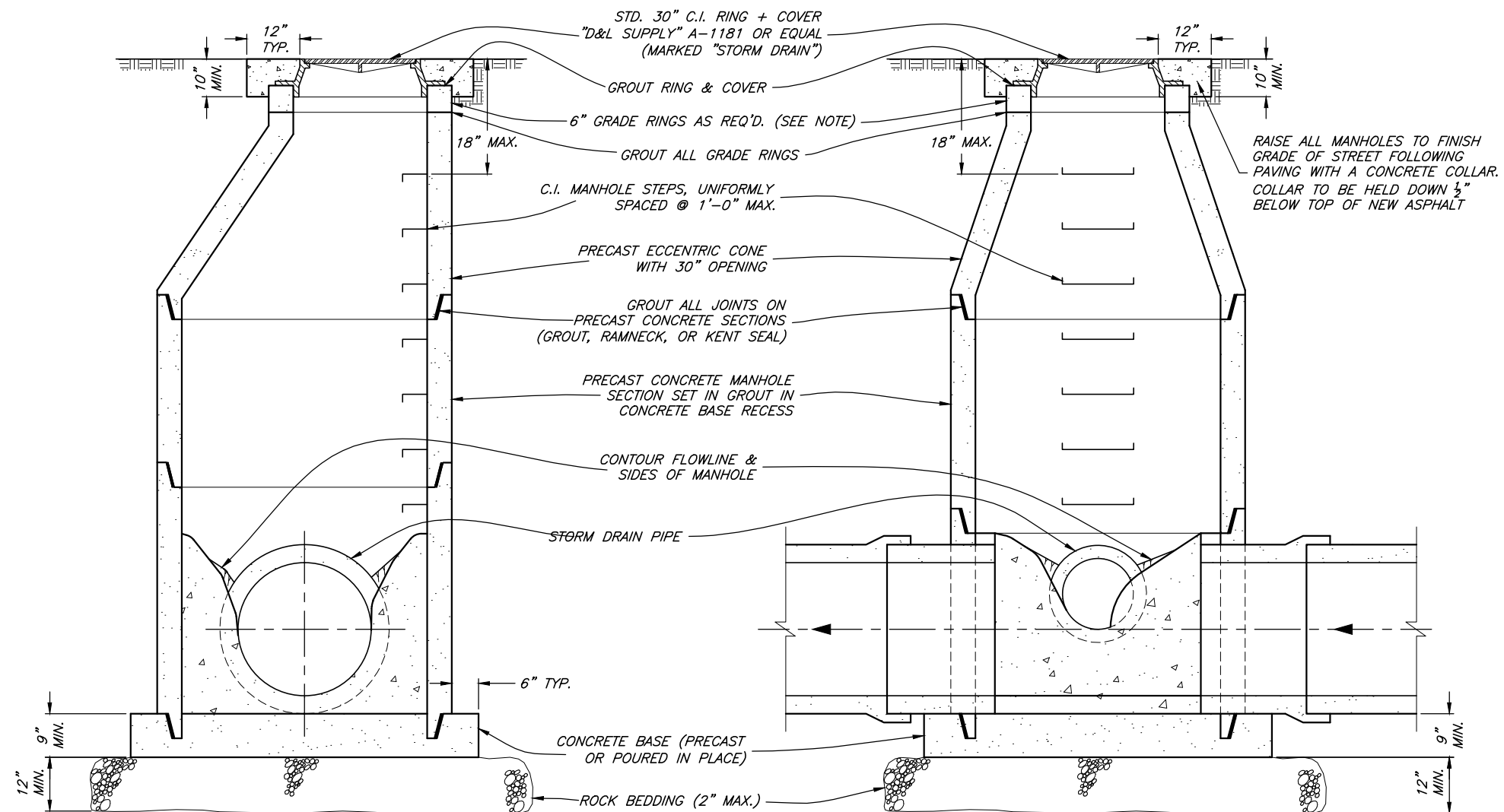
**NOTES:**

1. **STORM DRAIN MANHOLE DIAMETER TO BE DETERMINED BY THE DESIGN ENGINEER AFTER EVALUATION OF THE NUMBER, SIZE, AND PIPE ENTRY ANGLE OF THE PIPES THAT CONNECT TO THE MANHOLE.**
2. **NO MORE THAN 12" OF GRADE RINGS TO BE ALLOWED ON ANY MANHOLE**
3. **PLYWOOD COVERS SHALL BE USED AT MANHOLE FLOOR TO COVER FLOWLINE DURING CONSTRUCTION AND MAINTENANCE ACTIVITIES.**

**TYPICAL LINE MANHOLE**



### TYPICAL JUNCTION MANHOLE



PROJECT ENGINEER				
DATE	REV.	DATE	APPR.	

N.T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA



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### ***STORM DRAIN - MANHOLE AND CLEANOUT DETAILS***

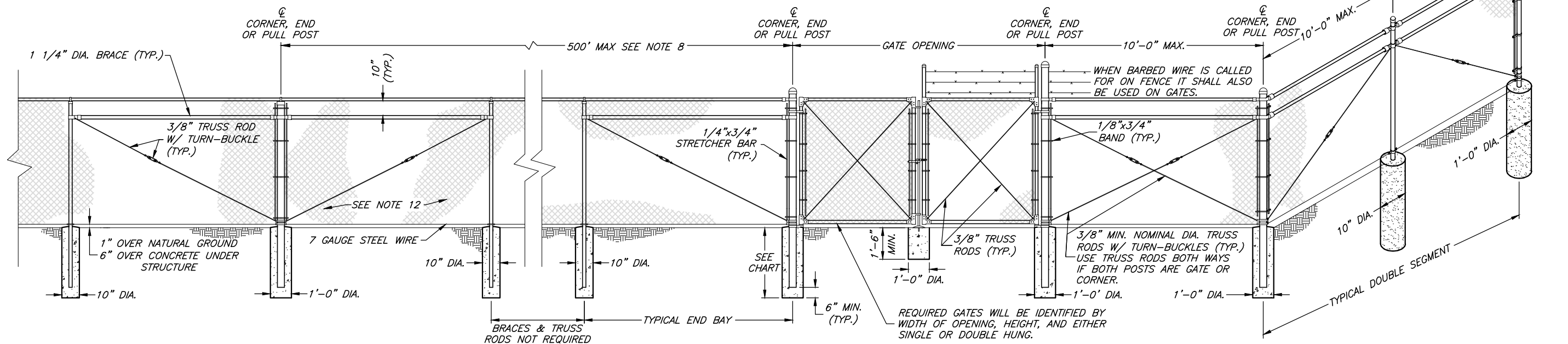
**CS-15**

OF 18 SHEETS





HEIGHT OF FABRIC	DEPTH OF POSTS	LENGTH OF END, CORNER OR PULL POST	LENGTH OF LINE POST HOLES	SIZE OF POSTS							
				END, CORNER, & PULL POSTS				LINE POST MIN. SIZE			
				NOM. SIZE	OUTSIDE DIA.	PIPE WEIGHT		NOM. SIZE	OUTSIDE DIA.	PIPE WEIGHT	
						ASTM A-120	TRIPLE COATED			ASTM A-120	TRIPLE COATED
7'	3'	10'	9'-8"	2 1/2"	2.875"	5.79	4.64	2"	2.375"	3.65	3.11
6'	3'	9'	8'-8"	2 1/2"	2.875"	5.79	4.64	2"	2.375"	3.65	3.11
5'	3'	8'	7'-8"	2"	2.375"	3.65	3.11	1 1/2"	1.900"	2.72	2.23
4'	3'	6'	5'-8"	2"	2.375"	3.65	3.11	1 1/2"	1.900"	2.72	2.23
3'	3'	5'	4'-8"	2"	2.375"	3.65	3.11	1 1/2"	1.900"	2.72	2.23



PROJECT ENGINEER				
DATE	REV.	DATE	APPR.	

SCALE:

N.T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA



CONSULTING ENGINEERS

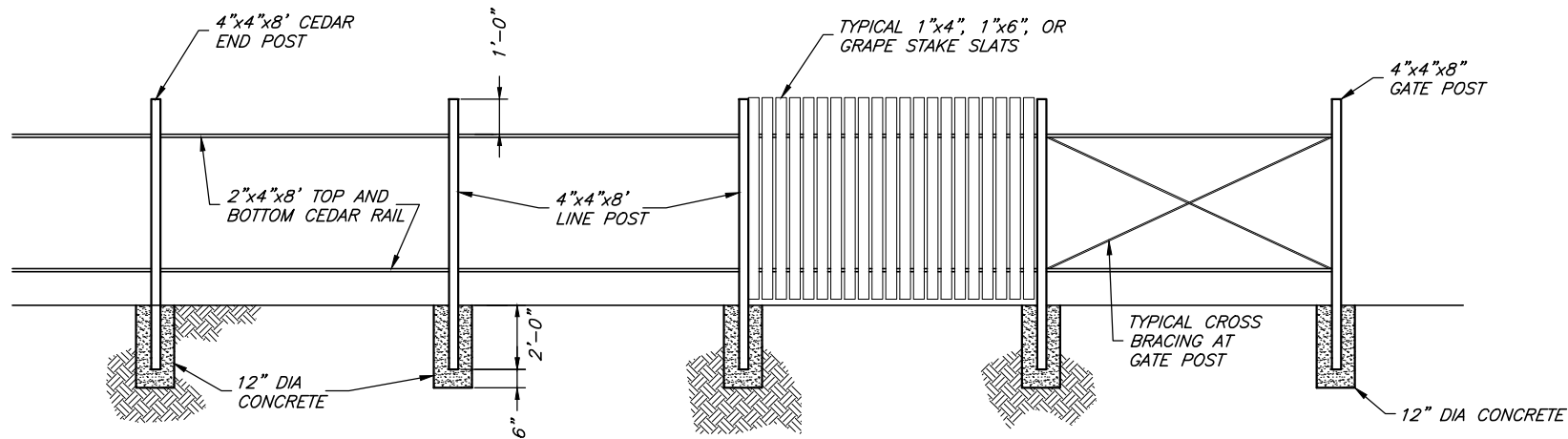
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**FARR WEST CITY CORPORATION**  
**PUBLIC WORKS STANDARD DRAWINGS**

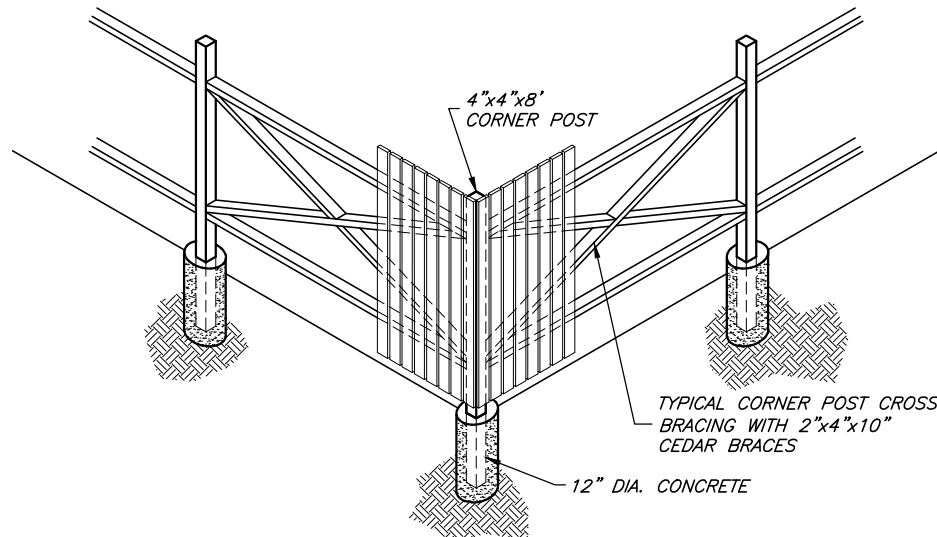
### GENERAL - CHAIN LINK FENCE DETAILS

SHEET:  
**3-16**  
8 SHEETS  
0

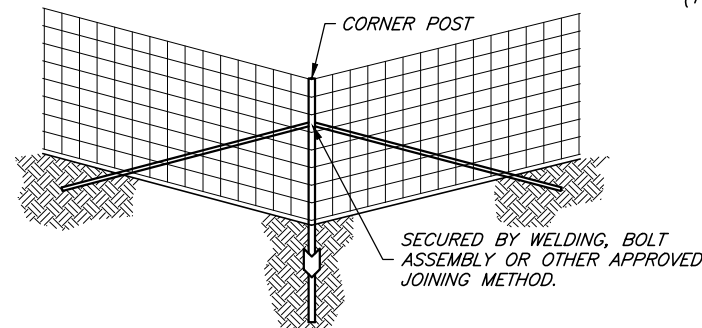




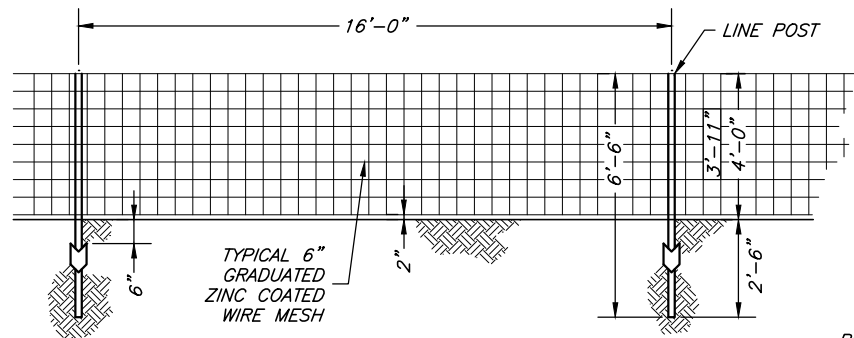
**TYPICAL WOOD FENCE**



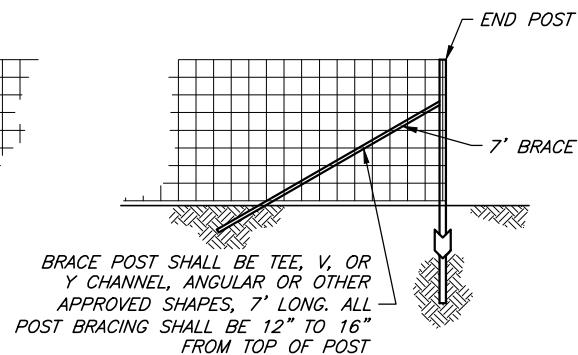
**CORNER POST DETAIL**



**CORNER POST DETAIL**



**TYPICAL WIRE FENCE**



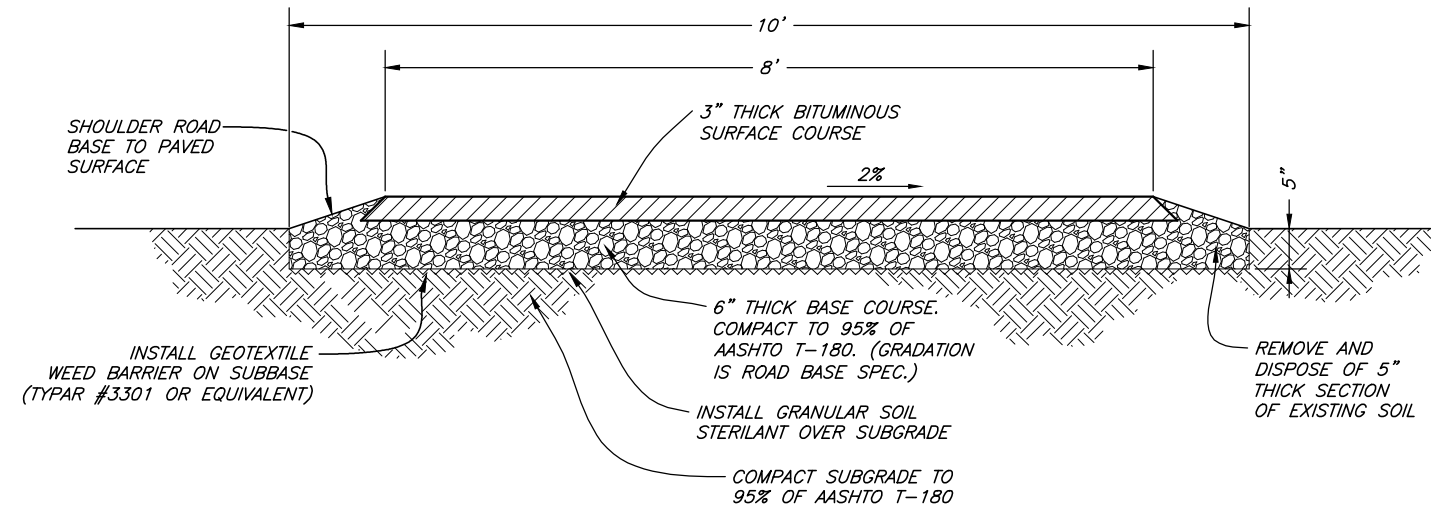
**END POST BRACING DETAIL**

**CRUSHED STONE GRADATION TABLE**

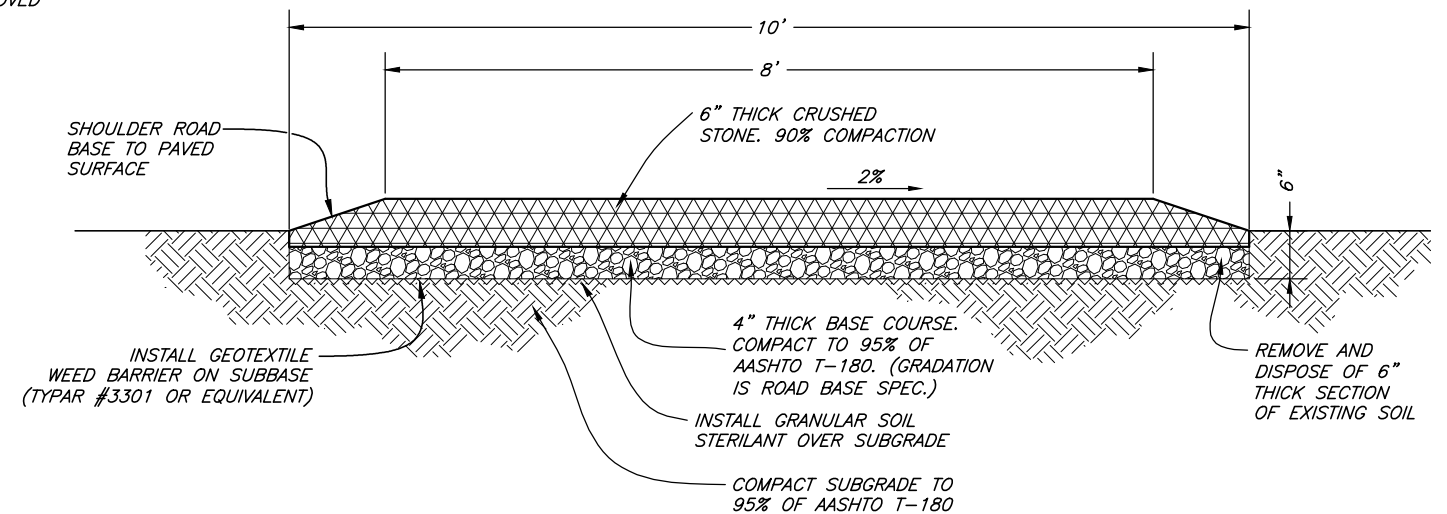
SIEVE	% PASSING
3/8"	100%
1/4"	65%
3/16"	50%
1/8"	35%
1/16"	25%

**NOTES:**

1. TRAILS SHOULD BE DESIGNED AND CONSTRUCTED AT GRADES LESS THAN 8% GRADE TO PROMOTE ACCESSIBLE USE.
2. GRADE AVERAGES OF LESS THAN 6% WILL PROVIDE THE MOST USER FRIENDLY EXPERIENCE AND ARE PREFERRED.
3. CRUSHED STONE SURFACE SHOULD BE MADE FROM CRUSHER FINES CRUSHED INTO IRREGULAR ANGULAR PARTICLES.



**8' ASPHALT TRAIL CROSS SECTION**



**8' CRUSHED STONE TRAIL CROSS SECTION**

PROJECT ENGINEER	REV.	DATE	APPR.
DATE			

SCALE:

N. T.S.

DESIGNED BEB  
 DRAWN BEB  
 CHECKED DDA



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FARR WEST CITY CORPORATION  
 PUBLIC WORKS STANDARD DRAWINGS

**GENERAL - WOOD FENCE, WIRE FENCE & TRAIL DETAILS**

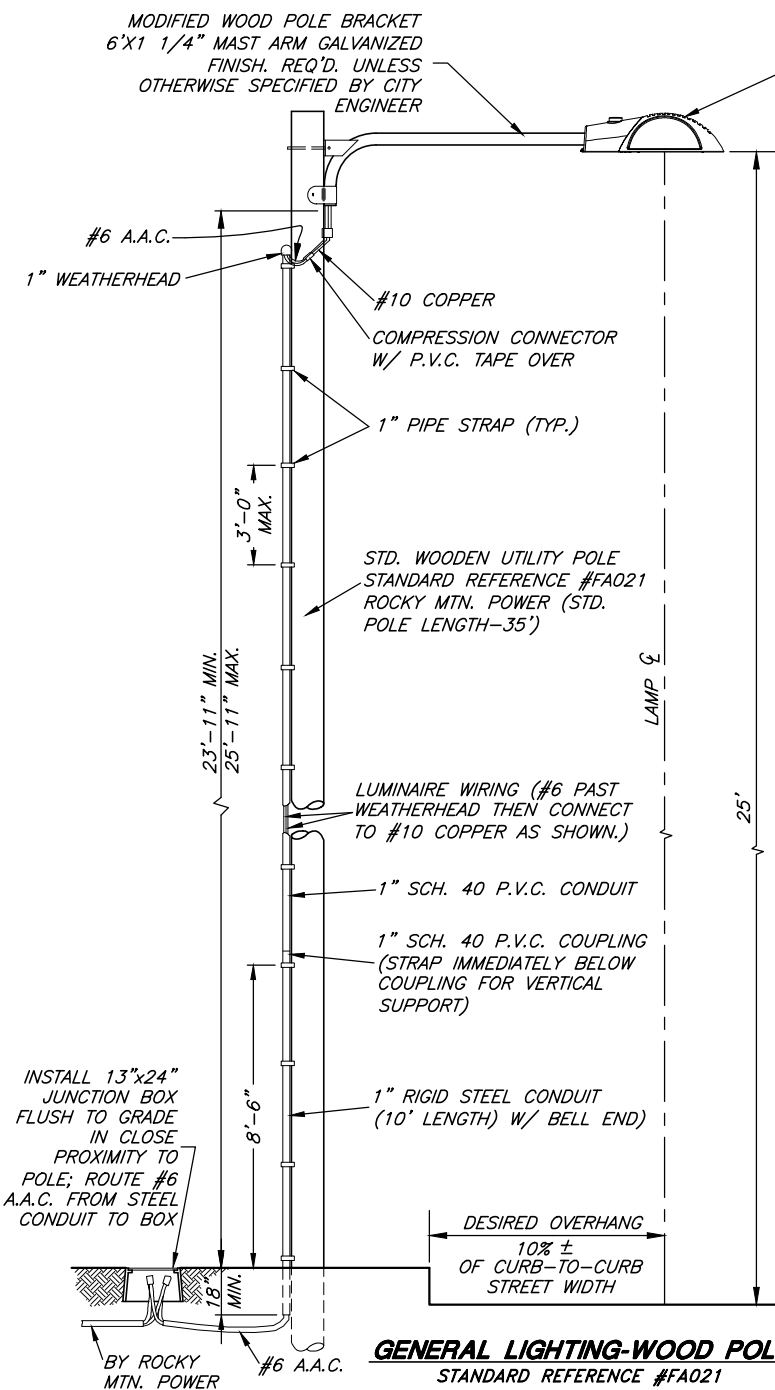
SHEET:

**CS-17**

OF 18 SHEETS  
 0

**ATTENTION**

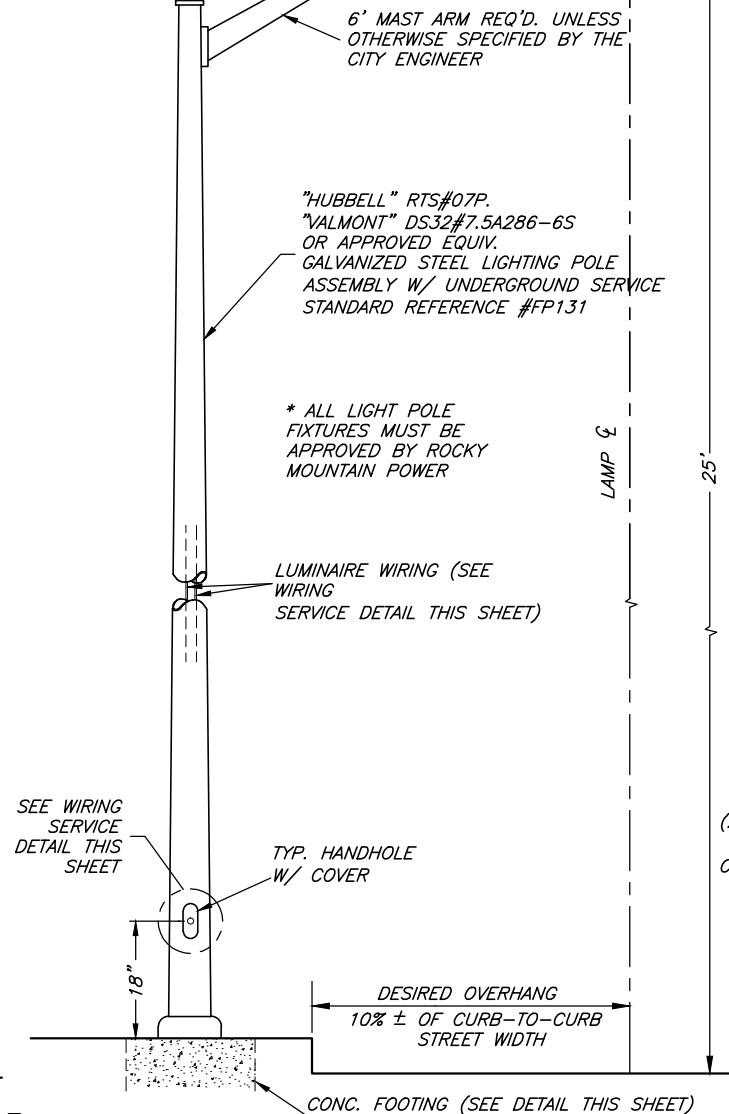
DEVELOPER/CONTRACTOR SHALL NOTIFY THE ROCKY MOUNTAIN POWER OFFICE PRIOR TO LIGHTING INSTALLATION TO ARRANGE FOR POWER TO BE PROVIDED ON SITE, AS WELL AS APPROVAL OF LIGHTING UNIT LOCATIONS AND APPROVAL OF ACTUAL COMPONENT SELECTION. REFER TO THE ROCKY MOUNTAIN POWER DISTRIBUTION CONSTRUCTION STANDARD MANUAL FOR IDENTIFICATION OF ALL STANDARD REFERENCE NUMBERS LISTED ON THIS SHEET. ALL FINAL WORK AND MATERIAL TO BE APPROVED BY THE CITY AND THE CITY ENGINEER.



**WOOD POLE NOTES:**

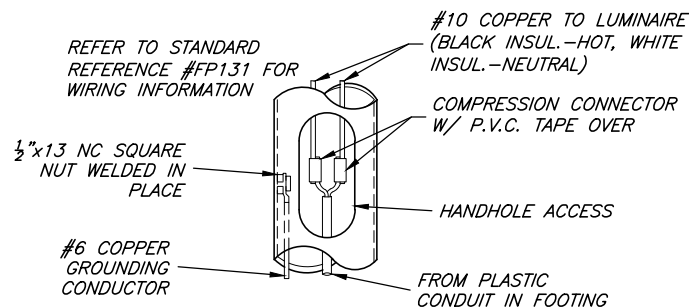
1. STANDARD MAST LENGTH FOR WOODEN UTILITY POLES SHALL BE 6"x1 1/4" UNLESS OTHERWISE SPECIFIED BY THE CITY ENGINEER. TYPE OF MAST ARM IS DEPENDENT ON LENGTH AND MAY VARY IF SIZE TO BE USED IS CHANGED. FOR VARIOUS SIZES, TYPES AND THEIR MOUNTING HEIGHTS CONSULT STANDARD REFERENCE #021. TABLES 1, 2 AND 3.
2. MAXIMUM HEIGHT MAY BE EXCEEDED ON EXISTING POLES, BUT ONLY IF SPACE ON SUCH POLES IS AVAILABLE AND UNUSED.
3. DUE TO HIGH GLARE CAUSED BY HPS LUMINAIRE, IT IS ESSENTIAL THAT LUMINAIRE ARE NOT MOUNTED AT ANY HEIGHT LOWER THAN THE MINIMUM SPECIFIED.
4. BURY POLE 10% OF TOTAL LENGTH +24"(5'-6" FOR 35' POLE), BURY POWER RISER MIN. 18".

LEDG 120 53 5K AS G L3 PCS R  
LEDGEND ROADWAY LED, 120 Leds, 525MA  
DRIVER, 5,000 K CCT, AUTO-SENSING VOLTAGE,  
120 THRU 277, GRAY, TYPE III, WIDE  
ASYMMETRIC, DTL SOLID-STATE LIGHTING  
PHOTOCONTROL 120-277V, NEMA TWISTLOCK  
PHOTOCONTROL RECEPTACLE.

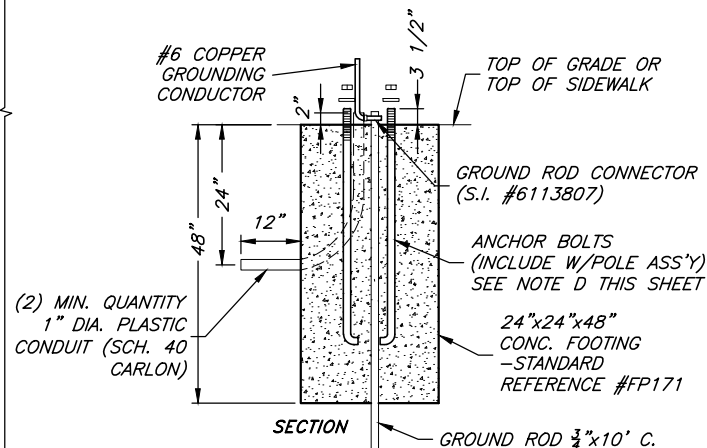
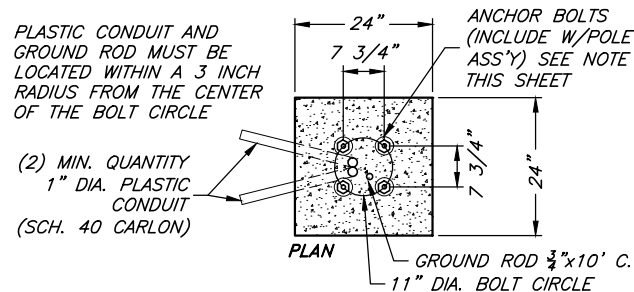


**STEEL POLE NOTES:**

- A. ALL STEEL POLES MUST HAVE PROVISIONS FOR GROUNDING AND MUST BE EFFECTIVELY GROUNDED AFTER INSTALLATION. A 1/2 INCH x 13 NC SQUARE NUT SHALL BE WELDED BE INSIDE THE POLE BY THE MANUFACTURER FOR GROUNDING CONNECTION.
- B. SPECIFY "HUBBELL" RTS#08P OR "VALMONT" DS32#7.5A286-8S OR APPROVED EQUIV. FOR 8' MAST ARM IF REQ'D.
- C. POLES SHALL BE HOT DIP GALVANIZED UNLESS OTHERWISE SPECIFIED.
- D. CATALOG NUMBERS INCLUDE HOT DIP GALVANIZED ANCHOR BOLTS AND BASE COVERS.
- E. POLE SIZE IS ADEQUATE FOR SINGLE OR TWIN BRACKET APPLICATION. SPECIFY "HUBBELL" RTS#22P OR "VALMONT" DS32#7.5A286-6D FOR 6' TWIN ARM, SPECIFY "HUBBELL" RTS#23P OR "VALMONT" DS32#7.5A286-8D FOR 8' TWIN ARM.
- F. MAST ARMS FOR METAL POLES ARE WITH TENON FOR 2 INCH LUMINAIRE SLIP-FITTER.



**WIRING SERVICE DETAIL**



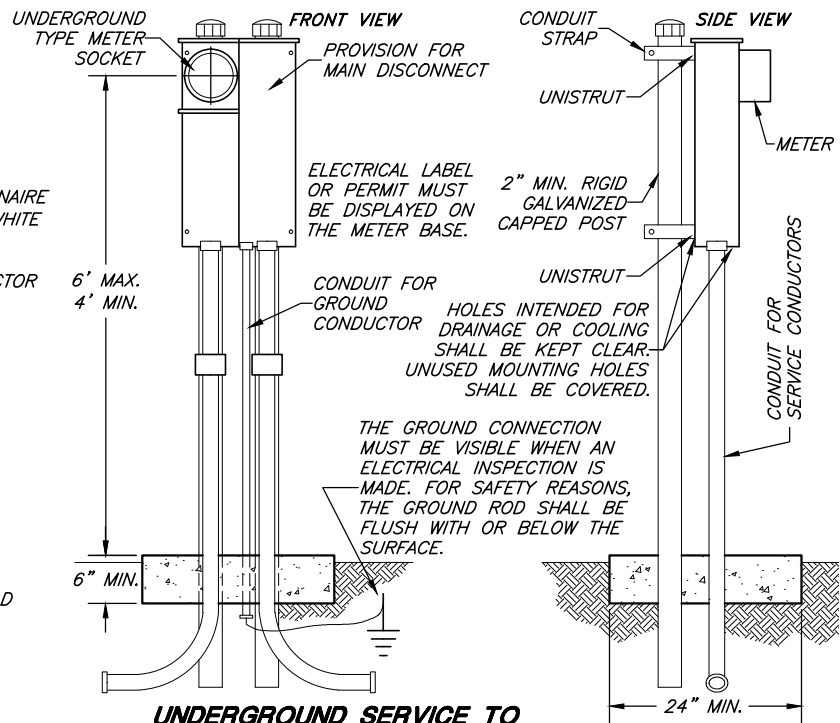
**TYPICAL CONCRETE FOOTING**

STANDARD REFERENCE #FP171

THE FOOTING AS SPECIFIED ON THIS STANDARD IS DESIGNED FOR USE WITH THE STD. 11 GA. (OR 10 GA.) METAL STREET LIGHT POLES FOR MOUNTING HEIGHTS UP TO 32 FEET. IT SHOULD NOT BE APPLIED IN LOCATIONS WHICH REQUIRE A POLE OF HIGHER STRENGTH (SUCH AS A DEAD-END POLE, COMBINATION STREET LIGHT/TRAFFIC SIGNAL POLE, OR ETC.)

**FOOTING NOTES:**

- A. FOOTINGS WILL GENERALLY BE INSTALLED BY A CONTRACTOR. FOOTINGS SHOULD BE LOCATED WITH THE VERTICAL C<sub>1</sub> 24" + BACK FROM THE EDGE OF CURB.
- B. THE MANUFACTURER SHALL FURNISH (4) ANCHOR BOLTS, (1) GROUND ROD & PLASTIC CONDUITS FOR EACH FOOTING AS REQ'D.
- C. NUMBER AND ORIENTATION OF THE PLASTIC CONDUITS ARE INFLUENCED BY THE UNDERGROUND CIRCUIT ROUTE AND SHOULD BE DETERMINED IN EACH LOCATION FOR THE MOST PRACTICAL SOLUTION.
- D. ANCHOR BOLTS SHALL BE FURNISHED WITH 6" MIN. THREAD LENGTH AND SHALL BE HOT DIP GALV.



**UNDERGROUND SERVICE TO  
A FREE-STANDING METER BASE  
(STEEL POLE)**

DEVELOPER/CONTRACTOR WILL FURNISH AND INSTALL:

1. METER SOCKET ENCLOSURE (UNDERGROUND TYPE WITH MANUAL-LINK BYPASS)
2. PEDESTAL HARDWARE
3. CONDUIT
4. RIGHT-OF-WAY OR EASEMENT
5. TRENCH EXCAVATION AND BACKFILL
6. GROUNDING PER NEC
7. CONCRETE PAD 24" x 24" x 6" DEPTH
8. LONG RADIUS SWEEP
9. 36" SWEEP

\*\*INSTALLATION SHALL BE MADE STABLE BY WAY OF THE PAD SIZE OR THE DEPTH OF THE GALVANIZED POST.

**FREE-STANDING METER BASE REQUIREMENTS:**

1. THE DEVELOPER/CONTRACTOR SHALL MEET WITH THE POWER COMPANY TO DETERMINE THE LOCATION OF THE FREE-STANDING METER BASE.
2. THE FREE-STANDING METER BASE SHALL BE LOCATED ADJACENT TO, OR IN, THE POWER COMPANY EASEMENT.
3. THE FREE-STANDING METER BASE SHALL MEET ALL LOCAL ORDINANCE REQUIREMENTS.
4. THE METER SOCKET SHALL BE PROTECTED FROM DAMAGE BY USE OF BARRIER POSTS OR OTHER SUITABLE PROTECTION APPROVED BY THE POWER COMPANY.
5. THE DEVELOPER/CONTRACTOR SHALL FURNISH, INSTALL AND MAINTAIN AN APPROVED PEDESTAL OR POLE POST.
6. THE ACCESS DOOR TO POWER COMPANY CONNECTIONS SHALL BE KEPT FREE OF OBSTRUCTIONS A MINIMUM OF 6" ABOVE THE FINAL GRADE, WITH A SEALABLE PROVISION FOR THE POWER COMPANY.
7. THE UNMETERED SERVICE CONDUCTOR AND THE METERED SERVICE CONDUCTOR SHALL NO BE RUN IN THE SAME CONDUIT, RACEWAY, OR GUTTER.
8. THE METER SOCKET AND SERVICE EQUIPMENT SHALL BE NEMA TYPE 3R (RAINPROOF), IN GOOD CONDITION WITH NO HOLES, DENTS OR DAMAGE, AND PLUMB IN ALL DIRECTIONS. THE INSTALLATION SHALL BE MADE WITH SUFFICIENT MATERIALS AND INSTALLED SUCH THAT IT REMAINS PLUMB FOR THE DURATION OF THE SERVICE.
9. CONDUIT AND CONDUCTOR TRENCHERS SHALL BE LOCATED AWAY FROM (AND NEVER UNDERNEATH) THE PAD AND FOUNDATION. FOR MOBILE HOMES, TRENCHES SHALL BE LOCATED CLEAR OF THE AREA PROVIDED FOR THE DWELLING.
10. WHERE TWO OR MORE METERS ARE LOCATED SIDE-BY-SIDE (SUCH AS WITH DUPLEXES OR IN MOBILE HOME PARKS), THE METER SOCKET ENCLOSURE SHALL BE PERMANENTLY LABELED WITH THE SPACE OR BERTH NUMBERS.

PROJECT ENGINEER					
DATE	REV.	DATE	APPR.		

SCALE:

N.T.S.

DESIGNED BEB  
DRAWN BEB  
CHECKED DDA



CONSULTING ENGINEERS

1716 East 5600 South  
Ogden, Utah 84403 (801) 476-9767

FARR WEST CITY CORPORATION  
PUBLIC WORKS STANDARD DRAWINGS

**GENERAL - STREET LIGHTING STANDARDS**

SHEET:

**CS-18**

OF 18 SHEETS  
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