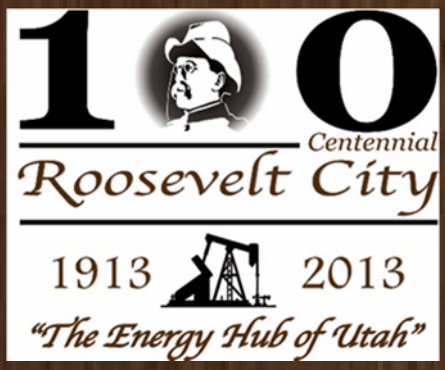

ROOSEVELT CITY

STANDARD SPECIFICATIONS AND DRAWINGS

September 2015

HORROCKS
ENGINEERS

Revisions Detail

Original Publication Date: March 2014

Revisions made September 2015:

Page	Detail
Cover Page	Date was changed from March 2014 to September 2015.
15 07 60 3.01	Maximum slope and minimum pipe sizing Criteria was added to 3.01 A.
Irrigation – 6	New Secondary Water Drain and Sump Details
Streets – 6	Added 24” reverse grade curb & gutter detail
Streets – 9	Added callout to ADA Ramp detail
Streets – 14	New ADA Ramp details
Streets - 15	New ADA parking stall details
Water – 9	New 2”+ water meter detail
Sewer – 2	Added detail to clarify Sewer Manhole Collar Requirements
Storm Drain – 5	Added Storm Drain box and steps detail

Revisions made October 2014:

Page	Detail
Cover Page	Date was changed from March 2014 to October 2014.
Standard Drawings Table of Contents	“Waterway Transition” was added to Streets – 4 title.
Streets 1-9 Drawings	Now include notes differentiating Commercial and Residential Sidewalks. Some drawings may have been also altered to detail the differentiation.
Streets – 4 Drawing	Title was changed to include “Waterway Transition” and a Waterway Transition Structure Detail was added to the page.
Sewer – 1 Drawing	Note 4 was added and a measurement was added to the Typical Sewer Service Conn. Detail. The measurement shows a 4 foot minimum depth to the top of the sewer lateral at the property line.

TABLE OF CONTENTS

SECTION 00 07 00

GENERAL IMPROVEMENT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the general requirements for improvements to be built by the Developer.

1.02 GENERAL REQUIREMENTS

A. The Developer is responsible to comply with the standard specifications. Alterations, substitutions, or changes from these standard specifications shall not be allowed unless prior authorization is obtained from the City Engineer. The developer is responsible for providing all documentation and research supporting requests for changes to these standards, and the associated costs. The City Engineer will decide all questions which may arise as to the quality and acceptability of alterations, substitutions, or changes proposed. In case any question should arise, relative to these standards, the final determination or decision of the City Engineer shall be complied with as a condition of the Developer receiving final approval of the work being questioned.

B. The improvements shall include all street improvements in front of all lots and along all dedicated streets to a connection with existing improvements of the same kind or to the boundary of the subdivision nearest existing improvements.

C. Public roads shall not exceed a grade of 8% without approval from the City Engineer.

D. Layout must provide for future extension to adjacent development and to be compatible with the contour of the ground for proper drainage.

E. All water lines, sewer lines, and any other buried conduit shall be installed to the boundary lines of the subdivision. This shall also apply to existing lots of record needing service from a utility not already fronting the lot.

F. If construction requires a specification not found herewith and is deemed necessary by City Engineer, the City Engineer will be allowed two weeks to provide an adequate specification to control and provide guidelines for construction.

G. Inspection: The term “inspection” or its derivatives means a review of the project, including but not limited to a visual review of the work completed to date. It does not include or imply an exhaustive or detailed review of the Work nor does it create a duty on the part of the Engineer or Owner to detect latent defects.

H. Easements for water, sewer, or storm drains not in the public right of way shall be a minimum of 20 feet for a single utility.

I. Public Utility Easement’s (PUE’s) shall be 10 feet wide around the perimeter of standard lots.

J. The top back of curb shall be stamped in the following manner, showing locations of water, sewer, and secondary irrigation stub pipes:
   a. A “w” stamp for culinary water.
   b. An “s” stamp for sewer.
   c. An “i” stamp for secondary irrigation.
   d. A “g” stamp for gas.
   e. A brass pin will be imbedded in the curb marking the location of each property line.

K. Developer is responsible to obtain all applicable permits.

PART 2 SUBMITTALS

2.01 **CONSTRUCTION DRAWINGS:**

A. Complete and detailed construction plans and drawings of improvements shall be submitted to the City Engineer prior to final approval of the project by City Council. The construction drawings will not be signed by the City Engineer until the following items have also been completed:

1. The plan check procedure has been completed.

2. All required easements have been designated on the subdivision plat or dedicated by separate document to the City.

3. An Engineers Estimate of the improvements costs has been submitted to the City.

B. The Mylar plat map will not be signed by the City Engineer for recordation until the following items have also been completed:

1. The performance agreement has been completed and executed.

2. All required water shares have been transferred to the city.

3. The City escrow deposits have been paid in full.

4. The drawings are stamped by a professional engineer licensed in the State of Utah.

5. Three (3) sets of blue line construction plans, printed from the signed mylars have been provided to the City.

6. One digital copy of the sign construction documents in pdf format is submitted to the City.

7. One copy of the final design drawings is submitted in AutoCAD format.

C. The signed construction drawings will be valid for two (2) years from the date of City approval. If construction has not begun within two (2) years from the approval date, the drawings shall become null and void. Expired drawings will require rechecking by the City.

2.02 **CUT SHEETS:** Seven (7) sets of cut sheets and profiles shall be submitted for sewer, storm water, culinary water, auxiliary lines, and curb & gutter. Allow 7 days for City Engineer review. No construction shall be started until plans have been checked and approved by the City Engineer.

PART 3 REQUIREMENTS

3.01 **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.

A. Seven sets of the construction plans shall be submitted with four (4) sets to be retained by the City Engineer at least two of which shall be 11" x 17" and three (3) sets returned to the Subdivider with approval mark of the City Engineer and appropriate department superintendent.

B. One approved set shall be kept available at the construction site.

C. The plans and designs shall meet the standards defined in the Specifications and Drawings hereinafter outlined. The minimum information required on drawings for improvements are as follows:

1. All drawings and/or prints shall be clear and legible and conform to good engineering and drafting room practice.

2. Size of drawings shall be 24" x 36" or 11" x 17" (trim line) with minimum borders of ½" on top, bottom, and right sides, left side 1 ½".

3. In general, the following shall be included on drawings:
   a. North arrow (plan)
   b. Scale and elevations referenced to U.S.G.S. datum.
   c. Stationing and elevations for profiles
   d. Title block, located in lower right corner of sheet to include
      - Name of City
      - Project title (subdivision, etc.)
      - Specific type and location of work
      - Space for approval signature of City Engineer and date
      - Name of engineer or firm preparing drawings with license number.

3.02 **CURB AND GUTTER, DRAINS AND DRAINAGE STRUCTURES, SIDEWALKS, AND STREET SURFACING DRAWING REQUIREMENTS**

A. Scale: 1"=50' horizontal; 1"=5' or 10' vertical.

B. Plans and profiles for each side of the street whether existing or proposed with elevations clearly indicated. Centerline profile may be eliminated.

C. Stationing and top of curb elevations with curve data for all curb returns.

D. Flow direction and type of cross drainage structures at intersections with adequate flow line elevations.

E. B.M. location and elevation (use U.S.G.S. datum).

F. Type of curb and gutter and distance from front to back of curb.

G. Cross slopes to gutter as shown on the standard cross section drawings.

H. Vertical curves for grade breaks equal to or greater than 1%.

I. Typical street cross- section for all street sizes and variations.

J. Street survey monument locations.

K. Plan and profile of existing ground and purposed profiles extending 200' beyond the proposed project.

L. Requirement to install reference pins in curb identifying location of property lines.

M. Requirement to scribe letter on curb where utility crosses, i.e. “s” for sewer, “i” for irrigation, “w” for water, “g” for gas, etc.

3.03 **SEWER DRAWING REQUIREMENTS**

A. Scale: 1"=50' or 1"=100' horizontal 1"=5' or 1"=10' vertical.

B. Location, size and grade of mains.

C. Manhole size, location and Rim & Flowline elevation.

D. Type of pipe.

E. B.M. location and elevation (use U.S.G.S. datum).

F. Profile drawing.

3.04 **CULINARY WATER DRAWING REQUIREMENTS**

A. Scale: 1"=50' or 1"=100' horizontal 1"=5' or 1"=10' vertical.

B. Size and location of water mains, valves, hydrants, and related appurtenances.

C. Type of pipe.

D. Minimum cover.

E. Details of all utility conflicts

3.05 **IRRIGATION PIPE**

A. Scale: 1”=50’ horizontal; 1”=10’ vertical.

B. Location, size and grade of mains. The mains shall be sloped to drain.

C. Elevations of main shall provide minimum 3 feet of cover on transmission lines and 2 feet of cover on distribution lines.

D. Type of pipe

E. B.M. location and elevation (use U.S.G.S. datum)

3.06 **STRUCTURES**

A. Each set of plans shall be accompanied by a separate sheet of details for structures which are to be constructed.

B. All structures shall be designed in accordance with minimum requirements established by the Roosevelt City Standard Specifications.

C. All structural drawings shall contain the following:

1. Drawing size: 24" x 36" (trim line).

2. Scale of each detail.

3. Title block, lower right hand corner (same format on all sheets) including the name of the subdivision.

4. Completely dimensioned and described.

PART 4 INSPECTION

4.01 GENERAL

A. All construction work involving the installation of improvements in subdivisions shall be subject to inspection by the City.

B. Certain types of construction shall require approval prior to proceeding with the work while other types will only require periodic inspection while the work is occurring.

1. Approval is required prior to proceeding with the following types of work:
   a. Placing concrete for curb, gutter, sidewalks, thrust blocks, collars, and other structures.
   b. Connections or tie-in's to existing water, sewer, storm drain, and irrigation systems.
   c. Pipe line flushing, pressure testing, and videoing of water, sewer, storm drain, and irrigation lines.
   d. Street subgrade proof roll, placing subbase, and laying street asphalt.
   e. Laying of street surfacing.

2. Periodic inspections shall be required on the following:
   a. Street grading and gravel base.
   b. Excavations for curb and gutter and sidewalks.
   c. Excavations for structures.
   d. Trenches for laying pipe.
   e. Forms for curb and gutter, sidewalks and structures.

C. On construction requiring approval prior to proceeding with the work, any work done in the absence of an Inspector's approval shall be subject to rejection.

4.02 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference shall be held before any excavation or other work is begun in the subdivision or project. The meeting will be held at the Roosevelt City Offices and will include:

1. City Engineer
2. Developer or Project Manager
3. Subdivision or Project Engineer
4. All Contractors and Subcontractors involved with installing the subdivision or project improvements
5. A representative of Roosevelt Inspection Department
6. Representatives of local utility companies as may be required by Roosevelt City. Items pertaining to the construction and inspection of the subdivision or Project Improvements will be discussed. One (1) copy of the Roosevelt City Standard Specifications and Drawings will be issued to the contractor during this meeting.

4.03 REQUESTS FOR INSPECTION

A. Requests for inspections shall be made to the City, in writing or by personal contact with the inspector assigned to the project, by the person responsible for construction.

B. Requests for inspection on work requiring continuous inspection shall be made three (3) days prior to the commencing of the work.

C. Notice for all other inspections shall be given one (1) day in advance of the required inspection (subsequent inspections and re-inspection shall require the same notification period.)

D. After hour and/or weekend inspections are available under extreme conditions for $100 per hour.

E. The Contractor/Developer shall GPS surface features (i.e. valves, meter cans, hydrants, cleanouts, manholes, irrigation boxes, etc.) for the Record Drawings.

4.04 REQUEST FOR WATER SHUT DOWN

A. Request for water shut down shall be made a minimum of 24 hours prior to the desired shut down.

B. Requests shall be made to the Public Works Superintendent and include, date, time and location.

C. Valves are to be opened and closed by City personnel only.

D. Contractor is to provide a minimum of 24 hour notification to all customers affected by the shut down including but not limited to door to door contact and a flyer or handout describing the estimated date, time, location of the shut down, and emergency phone numbers.

4.05 CONSTRUCTION COMPLETION INSPECTION

A. An inspection shall be made by the City Engineer after all construction work is completed.

B. 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 City Engineers Inspection Report defining the faulty or defective work.

C. The Developer shall furnish "Record" drawings of all improvements prior to subdivision final approval. Record Drawings shall be, signed by the City and the Engineer of record with corrections noted from minor changes that occurred during construction. Major changes that significantly change a drawing sheet will have a new sheet created during construction and re-signed by the City.

In addition, electronic versions of the "Record" drawings shall be submitted on CD or ZIP disks. The electronic files shall be submitted in either AutoCAD or TIFF formats.

D. The Developer shall furnish tie sketches for sewer laterals, water laterals, manholes, and valve boxes.

4.06 GUARANTEE OF WORK

A. The Developer shall warrant and guarantee the improvements and post a cash bond equivalent in value to 10% of the improvements constructed that the improvements provided for hereunder, and every part thereof, will remain in good condition for a period of two (2) years, after the date of the Construction Completion Inspection Report by the City Engineer, and agrees to make all repairs to and maintain the improvements and every part thereof in good condition during the time with no cost to the City.

B. The determination for necessity of repairs and maintenance of the work rests with the City Engineer. His decision upon the matter shall be final and binding upon the Developer, and the guarantee hereby stipulated shall extend to and include, but shall not be limited to the entire street base, and all pipe, joints, valves, backfill, and compaction as well as the working surface, curbs, gutter, sidewalks, and other accessories that are, or may be affected by the construction operations, and whenever , in the judgment of the City Engineer, said work shall be in need of repairs, maintenance, or rebuilding.

C. If the Developer fails to begin making repairs within ten (10) days from the date of the service of such notice, the City Engineer shall have such repairs made and the cost of such repairs shall be paid by the Developer together with 25 percent in addition thereto as and for stipulated damages for such failure on the part of the Developer to make the repairs.

4.07 SUBDIVISION ORDINANCES

A. The Developer and his Engineer must familiarize themselves with the existing subdivision ordinances and codes, requirements of which are not included in these standards.

B. Requirements for surface water disposal design and storm drain design/sizing are included in these ordinances.

4.08 ROADWAY PERMITS

A. For construction material and procedures not addressed by the specifications, the most recent revision of the standard specification of the following agencies shall apply:

1. American Association of State Highway & Transportation Officials. (A.A.S.H.T.O)

2. American Society for Testing & Material (A.S.T.M.)

3. American Waterworks Association (A.W.W.A.)

4. Uniform Building Code of the International Conference of Building Officials (U.B.C.)

5. Utah Department of Transportation (U.D.O.T.) Standard Specifications and Standard Plans.

6. Manual on Uniform Traffic Control Devices (MUTCD)

4.09 OCCUPANCY

A. Subdivisions and other large scale development shall be "substantially completed," as defined below before a certificate of occupancy for a building will be issued. Such substantial completion shall be certified in writing by the City Engineer. The certification shall verify that the project has been built as per approved plans.

1. Substantial Completion for a subdivision or other large scale development shall mean when the electrical, natural gas, water, and sewer utilities are installed and the City has been notified by the serving utilities that connection to the utilities is available and also when the curb, gutter, sidewalk, road base, and asphalt are installed and approved by the City Engineer.

B. Occupancy will be allowed within any subdivision or development only upon compliance with Roosevelt City Ordinances.

4.10 UNUSUAL LOADINGS

A. In unusual circumstances of structural loading, the City Engineer shall have the authority to require measures to strengthen structure and/or foundations as needed to protect the City's interests.

4.11 SNOW REMOVAL FOR ROADS AND FIRE HYDRANTS

A. The owner of the subdivision or other large scale development shall be responsible to keep the roads and the fire hydrants cleared of snow until the roads are paved and accepted by the City Engineer.

B. The fire hydrants shall be cleared for at least three (3) feet in all directions.

C. A Hydrant Flag will be placed on all Fire Hydrants.

D. The top two (2) feet of the pole shall be painted fluorescent orange.

END OF SECTION

SECTION 01 35 50

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Comply with all Federal, State, local laws and regulations, and provisions of this Section.

B. Prevent pollution of streams, lakes, ponds, and reservoirs with sediment, fuels, oils, bitumens, chemicals, or other harmful materials and pollution of the atmosphere from particulate and gaseous matter.

C. Use Best Management Practices to prevent hazardous material releases by segregating wastes, providing secondary containment and having spill kits and absorbents on hand.

1.2 RELATED SECTIONS

A. Section 02 97 00 Petroleum contaminated Soil Handling

B. Section 02 97 50 Asbestos Cement Pipe Demolition and Disposal or Abandonment

1.3 REFERENCES

A. ANSI

B. Title 40, Code of Federal Regulations (CFR)

C. U. S. Environmental Protection Agency Regulations

D. Utah Administrative Code

E. Utah State Department of Environmental Quality Regulations

1.4 DEFINITIONS

A. Receptor - An occupied residential dwelling, church, hospital, school, outdoor stage, or structure confining other noise sensitive activities.

B. Noise Sensitive Zone - The land enclosed within a 1500-ft radius circle of any receptor.

C. Sound Level - The total sound pressure level from all concurrent construction activities related to the subject project, as measured with a sound level meter using the A-weighting network (ANSI S1.4). The standard notation is dB(A) or dBA.

D. Percussive Noise - Short bursts of banging or clattering noise including but not limited to blasting, pile driving, and jack-hammering.

1.5 SUBMITTALS Not Used

1.6 HAZARDOUS MATERIAL DISCOVERED DURING CONSTRUCTION

A. Immediately suspend work in the area and if abnormal conditions are encountered or exposed during construction that indicates the presence of a hazardous material, toxic or hazardous waste.

1. Treat the conditions with extreme caution.

2. Abnormal conditions include, but are not limited to, the following: presence of barrels, buried storage tanks, above ground tanks, obnoxious odors, excessively hot earth, stained and discolored soils, smoke, unidentifiable powders, sludges, pellets, or any other condition that can be a possible indicator of hazardous material and toxic or hazardous waste.

B. Execute the following notifications if hazardous waste is discovered that meets the definition for disclosure as defined in Title 40 CFR Part 261, Subpart D – Lists of Hazardous Wastes. Refer to http://www.udot.utah.gov/go/standardsreferences.

1. Notify the City Engineer immediately after the discovery.

2. Notify the Utah Department of Environmental Quality (DEQ) according to R315.9 of Utah Administrative Rules. 24-hour phone number: (801) 536-4123.

3. Notify the DEQ in writing within five calendar days of the discovery.

C. Contact the City Engineer to initiate development of a remediation plan according to Utah State Department of Environmental Quality and the United States Environmental Protection Agency (EPA) regulations and requirements.

D. Dispose of hazardous material, toxic or hazardous waste under the direction of the City Engineer, according to the remediation plan, and requirements and regulations of the Utah State Department of Environmental Quality and the United States Environmental Protection Agency.

E. Resume operation in the affected area when directed by the City Engineer.

1. Perform necessary work required to dispose of these materials as extra work.

2. Deposition of waste materials requiring special procedures by certified personnel will be arranged by the Department with qualified persons to dispose of the material.

1.7 HAZARDOUS MATERIAL – CONTRACTOR CAUSED

A. Execute the following notifications if a petroleum-based or hazardous waste spill occurs that meets the definition for disclosure as defined in Title 40 CFR Part 261, Subpart D – Lists of Hazardous Wastes. Refer to http://www.udot.utah.gov/go/standardsreferences for the Electronic Code of Federal Regulations Web site.

1. Notify the City Engineer immediately after the discovery of any spill defined as a reportable release which includes spills that are:
   a. greater than 25 gallons
   b. released to a water body.

2. Notify the Utah Department of Environmental Quality (DEQ) according to R315.9 of Utah Administrative Rules. 24-hour phone number: (801) 536-4123.

3. Notify the DEQ in writing within five calendar days of the discovery.

B. In the event of a petroleum or chemical spill:

1. Immediately respond to a spill <25 gallons with spill kits.

2. For spills >25 gallons, implement measures to minimize the spread of contaminants.

C. Capture and dispose of the spilled materials under the direction of the City Engineer according to the requirements of the State of Utah Department of Environmental Quality and the United States Environmental Protection Agency.

D. Document the spill and response action and submit a copy to the City Engineer.

E. Pay for all required clean-up operations.

1.8 STREAMS

A. Any work in or adjacent to a perennial or ephemeral stream or river requires a General Permit 40 (stream alteration permit) issued by the Utah Department of Water Rights, Utah Administrative Code: Rule R655-13 Stream Alteration.
1. Adhere to the General and Special Conditions associated with the permit.
2. Conform to stream disturbance limits identified in the plans.

B. Obtain approval from the Utah Division of Water Rights before proceeding if a stream alteration permit is not issued for the project and work needs to be done in or adjacent to a stream. Notify the Utah Division of Water Quality if construction activity increases water turbidity in the stream by 10 NTUs or more. Use a dike or barrier to separate temporary work areas located in streams from the main stream when working in a live stream. Minimize sediment from entering streams.

C. Use filtration, settling basins, or other methods to treat sediment-laden water before allowing it to enter a water body.

1.9 OPEN BURNING

A. Do not conduct open burning along highway rights-of-way without approval orders from the Executive Secretary of the Utah Division of Air Quality.

1.10 ABRASIVE BLASTING – VISIBLE EMISSION STANDARDS

A. Visible Emission Standards:
1. Do not discharge into the atmosphere opacity darker than 40 percent for a period or periods aggregating more than three minutes in any one hour.

B. Visible Emission Evaluation Techniques:

1. Read emissions from unconfined blasting at the densest point of the emission after a major portion of the spent abrasive has fallen out. Densest point will be between 6 ft and 25 ft from the impact surface of the abrasive blasting nozzle.

2. Judge emissions from unconfined blasting employing multiple nozzles as a single source unless each nozzle meets the emission and performance standards.

3. Read emissions from confined blasting at the densest point after the air contaminant leaves the enclosure.

C. Performance Standards**:** Any one of the following may be used as a performance standard.

1. Confined blasting

2. Wet abrasive blasting

3. Hydroblasting

4. Unconfined blasting using abrasives defined below:
   a. Before blasting, the abrasive will not contain more than one percent by weight material passing a #70 U.S. standard sieve.
   b. After blasting, the abrasive will not contain more than 1.8 percent by weight material 5 micron or smaller.
   c. Abrasives reused for dry unconfined blasting are exempt from the requirements of "after blasting," but must conform to the requirements of "before blasting" above.

D. Abrasive Certification**:** Sources using the performance standard for unconfined blasting must demonstrate they have obtained abrasives from people who have certified through submitted test results to the Utah Air Quality Executive Secretary at least annually that such abrasives meet the requirements outlined above for abrasives.

1.11 NOISE CONTROL

A. Identify haul routes and percussive noise sources that annoy sensitive receptors and prevent these sources from becoming a problem.

B. Prohibitions - Suspend construction work under the following conditions:

1. Construction activity in a noise sensitive zone causes the sound level within 1500 ft of the nearest receptor to exceed: 95 dBA in daytime (7 a.m. - 9 p.m.), or 55 dBA in nighttime (9 p.m. - 7 a.m.)

2. A noise sensitive zone on Sundays and State Holidays.

3. Project related construction noise does not meet specifications. Suspend the portion of construction work responsible for the problem until noise is reduced to the required noise standards.

C. Compliance:

1. Follow all local noise ordinances, except where a variance according to local regulations has been granted.

2. Local noise ordinance variance does not provide an exemption from complying with the requirements of this article, paragraph C.

D. Percussive Noise:

1. Notify the City Engineer at least two weeks in advance of any percussive noise activity that is expected to exceed the provisions of this article, paragraph C.

2. Coordinate notification of the public with the City Engineer.

1.12 **DISCOVERY OF HISTORICAL, ARCHAEOLOGICAL, OR PALEONTOLOGICAL OBJECTS, FEATURES, SITES, HUMAN REMAINS, OR MIGRATORY AVIAN SPECIES**

A. Immediately suspend construction operations in the vicinity (minimum 100-ft buffer around the perimeter) of the discovery if a suspected historic, archaeological, or paleontological item, feature, or site is encountered, or if suspected human remains are encountered.

B. Verbally notify the City Engineer of the nature and exact location of the findings.

C. The City Engineer contacts the UDOT Region staff archaeologist, who will assess the nature of the discovery and determine the necessary course of action.

D. Notify the City Engineer who in turn notifies the Region Environmental Manager and the UDOT Wildlife Biologist if bats or migratory birds are discovered on structures.

1. Coordinate to determine the necessary course of action.

E. Protect the discovered objects or features and provide written confirmation of the discovery to the City Engineer within two calendar days.

F. The City Engineer keeps the Contractor informed concerning the status of the restriction.

1. The time necessary for the Department to handle the discovered item, feature, or site is variable, dependent on the nature and condition of the discovered item.

2. The City Engineer will provide written confirmation when work may resume in the area.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 01 45 50

TESTING AND PROCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the responsibility of the Developer or Contractor to adequately test native materials and construction materials, and to furnish the City with manufacturer's certifications of material quality.

1.02 QUALITY ASSURANCE

A. The developer or Contractor shall be responsible for all sampling, delivery of samples to a qualified testing agency, testing, and delivery of test results or materials certifications to City at no charge to the City. Testing and certifications reports shall be approved by the City as to conformance to City standard specifications prior to final inspection and/or acceptance by the City of any materials or workmanship.

1.03 SUBMITTALS

A. Field Test Report: When possible submit original report immediately to Engineer or inspector, but in no case later than end of current day.

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

PART 2 EXECUTION

2.01 SAMPLING

A. Sampling of materials shall be as specified in each test.

B. The City Engineer or City Inspector may require that sampling be performed in their presence, in which case the Developer or Contractor shall be notified of this requirement in writing at the time the building permit is issued, or at the preconstruction meeting, or when construction drawings are released by the City for construction, as applicable.

C. The presence of a City Inspector shall not relieve the Developer/Contractor of any requirement in Section 01 45 00.

D. Each sample or test shall be accompanied by the following written data, which shall be reported to the City with test results:

1. Name of Project

2. Name of Developer/Contractor

3. Project Street Address

4. Appropriate Test Name

5. Date of Sampling

6. Sample Number (if more than one sample per day)

7. Name of technician who performed the testing

8. Location of sample

2.02 TESTING AGENCY

A. All materials testing, whether in a laboratory or in the field, shall be conducted by a testing agency approved by City.

2.03 SOIL CLASSIFICATION TEST

A. The soil classification test shall be conducted to determine the suitability of native soils for road subbase and building foundations.

B. The soil classification test shall conform to AASHTO M-146 of latest revision.

C. The soil shall be classified according to AASHTO soil classifications.

D. One soil classification test shall be required for each test area. A test area shall be limited to one parcel of one soil type, a maximum 1,000 feet long and maximum 5 acres.

E. In test areas of less than 2 acres, the City Engineer may waive this requirement.

F. The soil sample shall be taken from a test area at a minimum depth of 24 inches below the future design grades, of native soil, and shall be free from foreign material, asphalt, concrete, ice or manmade materials.

G. Where deep footings or pile foundations are proposed, soil classification tests at several depths may be required in each test area.

H. The results of all determinations shall be reported in writing to City.

2.04 COMPACTION TEST OF SOIL AND UNTREATED BASE COURSE

A. Laboratory tests to establish maximum laboratory density shall be determined in accordance with AASHTO T-180, Method D for A-1 classification soils and AASHTO T-99, Method D for all other soils.

B. Samples to determine laboratory density shall be taken from the stockpiled backfill or from the uncompacted base course in place.

C. The acceptance of soil and base course with respect to compaction, shall be based upon the average density of all density tests made in a lot.

1. Field density tests shall be as specified by AASHTO T-191 or by use of a portable nuclear density testing device. Field density tests shall be taken at a depth equal to ½ the maximum depth of the lift tested.

2. A lot shall equal the amount of soil or untreated base course compacted in each production day.

3. A test lot shall be divided into sublots and one density test shall be taken within each sublot.

4. The location of sampling sites within the sublot shall be chosen on a random basis by use of a suitable random number table.

5. Each test lot shall have a minimum of two (2) sublots. A sublot shall be no larger than 1,000 cubic yards for embankment, no larger than 200 cubic yards for backfill over pipe or against structures and no larger 1,000 cubic yards for untreated road base.

D. The test results of all samples tested shall be reported to City. A test lot shall be accepted when the average of the density determinations is not less than the density required for that improvement in these specifications and when no one density determination is less than 95% of the density required by these specifications.

E. Compaction tests not conforming to required specifications may be rejected and recompaction or related construction efforts to obtain compaction shall be at the Developer's expense.

2.05 TEST ROLL OF ROADWAY SUBGRADE

A. Roll Test shall be performed when required by City Engineer to determine the structural integrity of the subgrade and street section.

B. The Roll Test shall be performed as follows:

1. The contractor shall provide a loaded 10 wheel dump truck or water truck to drive over the subgrade material within the roadway.

2. The loaded truck shall be driven slowly over the subgrade to locate soft spots in the subgrade surface.

3. Soft spots in the subgrade shall be identified and marked by the City Engineer.

4. It shall be the developer's responsibility to remove the rejected subgrade material to depth determined by City Engineer. The rejected material shall be replaced with A-1 granular backfill approved by City Engineer.

2.06 GRADATION TEST OF UNTREATED BASE COURSE

A. The gradation of untreated base course shall be determined in accordance with AASHTO T-27.

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

C. The acceptance of road base with respect to gradation shall be based upon the average of all determinations in a lot. A lot shall be limited to one source of borrow and limited to one subdivision plat or one development. One sample shall be required for each 1,000 tons of untreated base course in a test lot. When the test lot is less than 100 tons, the requirement for the gradation test may be waived by the City Engineer.

D. The location of sampling sites within a test lot shall be chosen on a random basis by a suitable random number table.

E. All material not conforming to the specified gradations may be rejected at the Developer's expense.

2.07 EXTRACTION - GRADATION TESTING OF BITUMINOUS SURFACE COURSE

A. Samples of the bituminous surface course or asphalt concrete shall be tested with respect to gradation and bitumen content in accordance with Utah Department of Highways Test Procedure 8-946 and 8-947 if required by the City Engineer.

B. Mix design shall be submitted to the City Engineer for approval 5 days before work is to begin.

C. Acceptance of bituminous surface course with respect to gradation and bitumen content shall be based upon the average of the determinations made in a lot.

1. A lot shall equal the amount of bituminous surface course placed in each production day.

2. When a lot exceeds 1,000 tons, a minimum of three (3) samples shall be taken in each lot.

3. When a lot is 1,000 tons or less, a minimum of two (2) samples shall be taken.

4. Samples shall be taken at the time of lay-down of bituminous surface course and before compaction. Samples shall be taken from the mat behind the lay-down machine.

5. Sampling shall be timed to represent the entire production day. The time of day, date of sample, station and offset location shall be clearly marked with the sample.

6. If the average oil is less than 2.5% of optimal content, the Contractor may be required to lay an additional lift or slurry seal, based on the City Engineer's recommendation.

2.08 COMPACTION TESTING OF BITUMINOUS SURFACE COURSE

A. Laboratory tests to establish the maximum laboratory density of bituminous surface course shall be determined by the "Marshall Test" in accordance to ASTM D-1559.

B. Samples to determine maximum laboratory density shall be taken at the time of lay-down of bituminous surface course and before compaction.

C. Acceptance of bituminous surface course with respect to compaction shall be based upon the average determination of field density tests made in a lot.

1. Field density tests shall be by a portable nuclear density testing device or by laboratory density analysis of core samples.

2. A test lot shall be the quantity of surface course placed and compacted in each construction day.

3. The test lot shall be subdivided into sublot(s) of approximately equal size and no larger than 1,600 square yards in area.

4. One field density test shall be taken in each sublot, randomly located in the test lot by use of a suitable random number table.

D. The test lot shall be accepted with respect to density when the average of all density determinations is not less than the density required by Section 02 50 40.

E. Core Tests

1. Acceptance of the completed bituminous surface course with respect to thickness shall be based on the average thickness of a test lot.

a. A test lot shall equal approximately 4,000 square yards of completed roadway.
b. A lot shall be divided into sublots of approximately 2,000 square yards.

2. One thickness test, randomly selected by use of a random number table, shall be taken within each sublot. A minimum of three core tests will be taken.

3. A lot shall be accepted when the average thickness of all sublots is not less than 3/8 inch the total designated bituminous surface course thickness and when no individual sublot shows a deficient thickness of more than ½ inch.

4. Lots or sublots that are not acceptable because of deficient thickness shall be brought into compliance by placing additional surface course as directed by the City Engineer.

5. The removed core will be replaced with low strength concrete.

2.09 COMPRESSIVE STRENGTH TESTING OF CONCRETE CYLINDERS

A. Samples of concrete shall be taken at the construction site, molded in standard cylinder shapes, allowed to cure, and tested with respect to comprehensive strength when required by the City Engineer.

B. All samples of concrete shall be taken in conformance to AASHTO T-141 of the latest revision.

C. Acceptance of concrete with respect to compressive strength shall be based upon the average determination of all "strength tests" made in a lot.

1. A test lot shall be the quantity of concrete placed at one job in a construction day.

2. For each 50 cubic yards of concrete in a test lot, three (3) compressive "strength tests" shall be run, except that for lots of less than 5 cubic yards, the number of "strength tests" per lot shall be the average strength of three standard cylinders.

3. The making, curing and compressive strength testing of concrete cylinders shall conform to AASHTO T-22 and AASHTO T-23.

D. Concrete may be rejected, if desired strengths are not obtained, at the Developer's expense.

2.10 ADDITIONAL CONCRETE TESTING

A. Slump Test: Determine slump in accordance with ASTM C 231.

B. Air Test: Determine normal weight concrete air content; ASTM C 231 and light weight concrete air content; ASTM C 173.

C. When requested by Engineer, test concrete in place by impact hammer, sonoscope, or other nondestructive device:

1. To determine relative strengths in various locations in Work.

2. To aid in evaluating concrete strength.

3. To select areas to be cored.

2.11 CERTIFICATIONS FOR WATER SYSTEM VALVES

A. In certain water system equipment, steel items and pipe listed below, a manufacturer's certificate shall be furnished with each unit of equipment, certifying conformance to the applicable requirements of City Standard Specifications:

1. Gate Valves

2. Butterfly Valves

3. Steel Reinforcing Bars

4. Structural Steel

5. Corrugated Metal Pipe

6. Polyvinyl Chloride Pipe

7. ABS Composite (Truss) and Solid Wall Pipe

2.12 SUMMARY TABLE OF TESTS AND CERTIFICATIONS

A. The following is a summary of the tests, number of samples per test and certificates that are required for construction work and developments in City. This summary is provided as a reference guide. For details governing each item, refer to the appropriate test specification herein.

Test Subject	Specific Test	Number of Tests
Soil Classification	AASHTO M-145	1 test per test area of uniform soil type and 5 acres maximum.
Compaction of Soil & Base Course	Lab Density- AASHTO T-99 Method D or AASHTO T-180 Method D Embankment & Base Course Field Density- Portable Nuclear Equipment or AASHTO T-191 Backfill Field Density- Portable Nuclear Equipment or AASHTO T-191	As needed to establish laboratory density 1 test plus minimum one test per 1,000 cu.yds. 1 test plus minimum one test per 200 cu.yds.
Base Course Gradation	Sieve Analysis- AASHTO T-27 Passing No. 200 Sieve- AASHTO T-11	1 test per 1,000 tons
Extraction-Gradation Test of Bituminous Surface Course	UDOT Test Procedure 8-946 & 8-947	3 tests per pavement construction day
Compaction of Bituminous Surface Course	Lab Density- Marshall Test, ASTM D-1559 Field Density- Portable Nuclear Equipment	1 test per pavement construction day 1 test per 1600 square yards sublot
Core Tests	4" Core Sample	1 thickness test per 2,000 square yards or 3 test minimum
Concrete Test Cylinders	AASHTO T-23	3 cylinders per 50 cubic yards or minimum of 3 cylinders on placements less than 50 cubic yards
Pressure Reducing & Regulating Valves	Manufacturer's Certificate	1 for each valve
Gate Valve	Manufacturer's Certificate	1 for each valve over 12" diameter
Butterfly Valves	Manufacturer's Certificate	1 for each valve
Steel Re-Bar	Manufacturer's Certificate	1 for each 1,000 pounds of one grade
Structural Steel	Manufacturer's Certificate	1 for each lot of one shape, one grade
Corrugated Metal Pipe	Manufacturer's Certificate	1 for each 500 lineal feet of one size, one class
Polyvinyl Chloride Pipe	Manufacturer's Certificate	1 for each 500 lineal feet of one size, one class
A.B.S. Pipe	Manufacturer's Certificate	1 for each 500 lineal feet of one size, one class

END OF SECTION

SECTION 02 15 00

SHORING AND UNDERPINNING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shoring for open excavations requiring a protective system.

1.02 REFERENCES

A. OSHA Construction Standards Chapter P: Excavations, Trenching, and Shoring.

1.03 RESPONSIBILITY

A. Contractor/Developer is solely responsible for safety. It is the Contractor/Developer's responsibility to adhere to all of OSHA's current regulations.

1.04 DEFINITIONS

A. Accepted Engineering Practices: Those requirements or practices which are compatible with standards required by a duly licensed or recognized authority.

B. Benching: A method of protecting persons and property against cave-ins by excavation the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

C. Excavation: Any man-made cut, cavity, or depression in an earth surface, including trenches, formed by earth removal and producing unsupported earth conditions (sides). If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.

D. Failure: The permanent deformation or breakage of a structural member or connection; or the collapse of all or part of an excavation.

E. Protective System: Any recognized method of protecting persons and property against cave-ins, the collapse of adjacent structures, or material that may fall or roll from an excavation side or into an excavation. Protective systems include support systems, sloping and benching systems and shield systems.

F. Shield/Trench Box: A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect persons and property within the structure without preventing a cave-in. Shields may be permanent structures or may be designed to be portable and moved along as work progresses. Portable shields used in trenches are usually referred to as "trench boxes" or "trench shields".

G. Shoring: A structure that supports the sides of an excavation and thereby protects persons and property by preventing cave-ins.

H. Sides: A vertical or inclined earth surfaces formed at the outer edges of an excavation.

I. Sloping: A method of protecting persons and property against cave-ins by excavation to form sides that are inclined away from the excavation, the angle of incline being of such a degree for the conditions of exposure that a cave-in will not occur.

J. Support System: A structure which protects persons and property by providing support to an adjacent structure, underground installation, or the sides of an excavation.

K. Trench: A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.

L. Unfractured Rock: Rock that can be excavated with vertical sides and remain intact while exposed. Fractured rock is considered equivalent to unfractured rock when the material on the side or sides of the excavation is secured against caving-in or movement by rock bolts, netting or other means approved by a professional engineer.

1.05 **DESIGN OF PROTECTIVE SYSTEMS**

A. Use professional engineer to design support systems, shield systems, and the structural components of these systems, and sloping and benching systems to resist without failure all loads that are intended to be imposed or transmitted to them.

B. Fully compensate in design procedures for hydrostatic pressure in the excavation sides.

1.06 **SUBMITTALS**

A. Submit to Engineer shoring drawings and specification, signed and sealed by a professional engineer, designing the support systems.

PART 2 PRODUCTS

2.01 **MATERIALS**

A. Steel, Wood: Contractor's option.

PART 3 EXECUTION

3.01 **PREPARATION**

A. Make safe or remove trees, boulders and other surface encumbrances which are hazardous to shoring and bracing operations.

B. Provide adequate ventilation of excavations and control dust and groundwater.

3.02 **STABILITY OF ADJACENT STRUCTURES**

A. Use support systems such as shoring, bracing, or underpinning where stability of adjoining buildings, walls, sidewalks, pavements, or other structures is endangered by excavation operations.

B. Excavation below level of base of footing of any structural foundation or wall shall not be permitted except as follows:

1. Underpinning or other support systems is provided to ensure stability of structure for protection of persons and property, or

2. Excavation is in unfractured rock, or

3. A professional engineer determines and states in writing that such work will in no way pose a hazard to persons and property or the integrity of the structure.

3.03 PROTECTION OF PERSONS AND PROPERTY, ENGINEERS AND INSPECTORS

A. Protect persons and property, Engineer and inspectors from cave-ins by installing a support system, by sloping, by benching, by use of a shield system, or by use of combination of the methods in excavations.

B. Provide additional protection against loose rock or soil that may fall or roll from an excavation side, by scaling to remove loose material, rock bolting, use of wire mesh, installation of protective barricades, or other means that provide equivalent protection.

C. Protect persons and property from excavated or other materials that may fall or roll into excavations.

D. Stairway, Ladder, Ramp: Comply with OSHA Construction Standards Chapter P.

E. Do not allow work on sides of sloped or benched excavations at levels where hazard of falling or rolling material exists or is created.

F. Protect against cave-ins from vibratory loads adjacent to excavation operations.

3.04 INSPECTIONS

A. Contractor/Developer shall employ and have on site at all times a competent person, as defined by OSHA, who is responsible for excavation inspection.

B. Inspect excavations daily for evidence of possible cave-ins, indications of failure of protective systems, or other hazardous conditions.

C. Upon discovery of hazardous conditions, cease all work in the excavations until additional precautions have been taken to ensure persons and property safety.

3.05 SHIELD SYSTEMS

A. Construct each shield system according to its design as soon as practical to minimize the time the sides of the excavation remains unsupported. Do not subject shield systems to loads other than those considered for their design.

B. Do not expose persons and property to hazard of cave-ins when entering or exiting areas protected by shields.

C. Remove all persons and property from excavation when portable shields are being relocated.

3.06 INSTALLATION AND REMOVAL OF SUPPORT SYSTEMS

A. Install each support system in accordance with its design.

B. Do not submit individual members of support systems to loads other than those considered for in their design.

C. Install additional members to carry the loads imposed upon the support system when temporary removal of individual members is necessary.

D. When removing the support system, release member by member slowly so as to avoid possible failure of the remaining members or cave-ins.

E. Coordinate backfilling to minimize time an unsupported excavation remains open.

3.07 ADDITIONAL REQUIREMENT FOR TRENCH EXCAVATION

A. Do not excavate material to a level greater than 2 feet below the bottom of the members of a support system if the system is designed to resist the forces calculated for the full depth of the trench, and indications of a possible cave-in below the bottom of the support system are not evident while the trench is open.

END OF SECTION

SECTION 02 20 50

COMMON FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Common fill material requirements.

1.02 REFERENCES

A. AASHTO M 145: Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

B. AASHTO T-27: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

1.03 DEFINITIONS

A. Common Fill: Backfill material which is not mechanically graded.

1.04 ACCEPTANCE

A. Acceptance of common fill shall be determined by Engineer and based upon 1 sublot of 500 tons plus any additional sublots for each 500 tons or portion thereof over and above the first 500 tons of each common fill placed in any 1 week.

B. Engineer reserves the right to select and test backfill on a random basis from any location in the Work, on the site or from the backfill source.

PART 2 PRODUCTS

2.01 BORROW/GRANULAR FILL (AASHTO TYPE A-1-a)

A. Bank run material: free of shale, clay, slag, friable material and debris.

B. The material must be within the following limits:

Sieve Size	Percent by Weight Passing Sieve
3 inches	100
No. 4 (4.75 mm)	30 to 70
No. 200 (75 micro m)	3 to 15

2.02 **NATIVE MATERIAL**

A. Sound, earthen material passing 2 inch sieve.

B. Percent of material by weight passing Number 200 sieve shall not exceed 20% when tested in accordance with AASHTO T-27.

2.03 **SAND**

A. Clean, coarse, natural sand.

B. Nonplastic when tested in accordance with ASTM D 4318.

C. 100 percent shall pass a ½ inch screen.

D. No more than 20 percent shall pass a number 200 screen.

2.04 **SOURCE QUALITY CONTROL**

A. Verify gradation compliance in accordance with AASHTO T-27. Select samples uniformly in time on a random basis.

1. Rodded Weight: Not less than 75 pounds per cubic foot.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Excavation and Backfill Operations: In accordance with Section 02 22 50.

END OF SECTION

SECTION 02 20 60

SELECT FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Select fill material requirements.

1.02 REFERENCES

A. AASHTO T-96: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

B. AASHTO T-27: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

1.03 DEFINITIONS

A. Select Fill: Backfill material which is mechanically graded.

1.04 SUBMITTALS

A. Material analysis of each select fill material to be used.

1.05 ACCEPTANCE

A. Engineer reserves the right to select, reject, and test backfill on a random basis from any location in the Work or from the backfill source.

PART 2 PRODUCTS

2.01 AGGREGATES

A. Clean, hard, tough, durable and sound mineral aggregates that consists of crushed stone, crushed gravel or crushed slag; free of deleterious and organic matter; and complies with the following:

1. Rodded Weight: Not less than 75 pounds per cubic foot.

2. Material Passing No. 40 sieve: Non-plastic.

3. Aggregate Wear Under AASHTO T-96: Less than 50 percent.

4. Material shall be classified as A-1 material.

B. Aggregates - master grading band limits

1. Aggregates shall be per the master grading band limits. The following limits are based on fine and course aggregate having approximately the same bulk specific gravities. The limits are wider than necessary for good job control. Sieve gradations are based upon percent of aggregate passing by weight in accordance with AASHTO T-27.

MASTER GRADING BAND LIMITS

Sieve Size	UNTREATED BASE COURSE Type 1 Min	Max	Type 3/4 Min	Max	PEA GRAVEL Min	Max
1-1/2"	--	--	--	--	--	--
1"	100	--	--	--	--	--
3/4"	--	--	100	--	--	--
½"	79	91	--	--	--	--
3/8"	--	--	78	92	--	--
No. 4	49	61	55	67	100	--
No. 16	27	35	28	38	--	3
No. 200	7	11	7	11	--	2

2. Source quality control
   a. Verify job-mix grading band material compliance in accordance with AASHTO T-27. Select samples uniformly in time on a random basis.

3. Type 1 for Collector Roads, Type ¾ for all other roads.

2.02 **DRAIN ROCK**

A. Consist of hard, durable particles of stone or gravel, screened or crushed to specified size and gradation.

B. Free from vegetable matter, lumps or balls of clay, or other deleterious matter.

C. Crush or waste coarse material and waste fine material as required to meet gradation requirements.

D. Durability Index: Percentage of wear not greater than 40 percent when tested in accordance with AASHTO T-96.

E. Conform to size and grade within the limits as follows when tested in accordance with AASHTO T-27 and ASTM C 117:

Sieve Size (Square Openings)	Percent By Weight Passing Sieve
2 inch	100
1-1/2 inch	95-100
3/4 inch	50-100
3/8 inch	15-55
Number 4	0-25
Number 8	0-5
Number 200	0-2

2.03 **GRAVEL**

A. Consist of hard, durable particles or fragments of stone or gravel, screened or crushed to specified sizes and gradations.

B. Free from vegetable matter, lumps or balls of clay, alkali, adobe, or other deleterious matter.

C. When sampled and tested in accordance with specified test methods, material shall comply with the following requirements:

1. Durability index: Percentage of wear not greater than 40 percent after 500 revolutions when tested in accordance with AASHTO T-96.

2. Plasticity Index: Not greater than 5 when tested in accordance with ASTM D 4318.

3. Liquid limit: Not greater than 25 percent when tested in accordance with ASTM D 4318.

D. Conform to sizes and grade within the limits as follows when tested in accordance with ASTM C 136 and ASTM C 117:

Sieve Size (Square Openings)	Percent By Weight Passing Sieve
3 inch	--
1-1/2 inch	100
Number 4	30-70
Number 8	20-60
Number 30	10-40
Number 200	0-12

2.04 BEDDING MATERIAL

A. Bedding material for PVC Water Pipe shall be sand or other aggregate material that is clean and free of organic matter conforming to the following sizes and limits:

Sieve Size (Square Openings)	Percent By Weight Passing Sieve
1/2 inch	100
3/8 inch	85-100
Number 4	30-100
Number 200	0-20

PART 3 EXECUTION

3.01 INSTALLATION

A. Excavation and Backfill Operations: In accordance with Sections 02 22 00 & 02 22 50.

END OF SECTION

SECTION 02 22 00

EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation permit requirements.

B. Excavation and disposal of excavated materials

C. Protecting existing facilities, utilities, and structures affected by excavation.

D. Dust and Drainage Control

1.02 REFERENCES

A. UBC Chapter 33.

B. UDOT Section 02316-Roadway Excavation.

C. National Fire Protection Association (NFPA) Standards.

D. UOSH Construction Standards

1.03 DEFINITIONS

A. Roadway: Area within the street right-of-way, including the area under the street, curb, gutter, and one (1) foot behind curb.

B. Rock: Material that cannot be excavated and removed without blasting, chipping, cutting, or ripping.

1.04 STORAGE AND HANDLING

A. Stockpile excavated material in a manner as to cause a minimum of inconvenience to public travel and provide for emergency traffic as necessary.

B. Maintain free access to all existing fire hydrants, water and gas valves, and meters.

C. Maintain clearance for free flow of storm water in all gutters, conduits, and natural water courses.

D. Utilize appropriate traffic signs, markers, and procedures in all product storage and handling activities.

E. Promptly remove all other material from site.

1.05 **SITE CONDITIONS**

A. Prior to excavation operations, photograph existing surfaces along which Work may take place in order to determine, after construction is completed, whether any damage of existing improvements occurred prior to construction operations.

B. Slope, shore, sheet, brace, or otherwise support excavations over 4 feet deep. When soil conditions are unstable, excavation shallower than 4 feet deep must also be sloped, supported or shored.

C. The slope shall never be in excess of 1 to 1 unless adequately shored.

D. Unsuitable Weather Limitations: Do not place, spread, or roll any fill material during unsuitable weather conditions. Do not resume operations until moisture content of material is satisfactory.

E. Softened Subgrade: Remove and replace weather softened subgrade as indicated at no additional cost to City.

F. Protection of Graded Areas: Protect graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

1.06 **SUBMITTALS**

A. Cut Sheets: Sewer, water, stormwater, and auxiliary line cut sheets must be submitted to and approved by the City Engineer in accordance with Section 00 07 00.

B. Test Reports: Submit compaction and relevant pressure and disinfection tests requested by City Engineer verifying compliance with specified standards.

C. Material Analysis Reports: In accordance with Section 02 20 50 or 02 20 60 as applicable.

D. Density Test Reports: In accordance with Section 02 25 00.

E. Submit proposed method of blasting, delay pattern, explosive types, and type of blasting mat cover.

PART 2 PRODUCTS Not used.

2.01 **EXPLOSIVES**

A. Use explosives, delay fuses, and all blasting materials as recommended by the explosives firm. Refer to NFPA 495: Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.

PART 3 EXECUTION

3.01 **PERMITS**

A. Contractor is responsible to obtain any applicable permits.

3.02 **EXAMINATION**

A. Verify areas to be backfilled are free of debris, snow, ice, or water and ground surfaces are not frozen.

B. Verify foundation of basement walls are braced to support surcharge forces imposed by backfilling operations.

C. Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of work area.

3.03 **PREPARATION**

A. When excavation is required in jurisdictions other than City, satisfy all conditions of the appropriate agencies.

B. Identify required lines, grades, contours, and benchmarks.

C. Notify all affected utility companies and Blue Stakes prior to commencing excavation operation.

D. Support and protect from damage, until completion of the Work, any existing facilities and structures which exist in, pass through, or pass under the site.

E. For pipelines, use means necessary to avoid displacement, and injury to, pipe and structures while compacting soil or operating equipment next to pipeline.

F. Movement of construction machinery over a pipeline at any stage is solely at Contractor's risk.

3.04 **SHORING**

A. Comply with Section 02 15 00 when required by field conditions.

3.05 **GENERAL EXCAVATION OPERATIONS**

A. If topsoil is on site, remove and store it for later use on site.

B. Excavate site to required grade for Work. Use all means necessary to control dust on or near Work and on or near all off-site borrow and disposal areas.

C. Keep surface and ground water out of excavation. Dispose of water in a manner that will not cause damage to adjacent areas or facilities.

D. Where soil has been softened or eroded by flooding or hardened by drying during unfavorable weather, remove all damaged areas and replace with approved material at no additional cost to City.

E. Notify Engineer of unexpected subsurface conditions.

F. Underpin adjacent structure which may be damaged by excavation work, including service utilities and pipe chases.

G. If unstable material is encountered at the bottom or face of excavation, do not perform extra excavation without Engineer's written approval. Correct unauthorized extra excavations at no cost to City.

H. Provide necessary protection to excavation walls as required. If conditions permit, slope excavation walls to maintain a safe and clean working area. Remove loose materials.

I. Correct excavation beyond the specified lines and grades by filling the resulting voids with approved compacted fill. If the fill is to become the subgrade for other fill, use material approved by Engineer. Do not proceed until Engineer has approved the material and the proposed method of backfilling for over excavation errors.

3.06 CONTROL OF GROUNDWATER

A. All trenches shall be kept free from water during excavation, fine grading, pipe laying, jointing, and back fill operations.

B. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in cases where the static groundwater elevation is above the bottom of any trench or bell holed excavation, such groundwater shall be lowered by pumping or other means 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. Trench foundation stabilization material shall be required; depth determined by City Engineer subject to condition of existing soils.

C. Groundwater shall be kept below the flow line of the pipe level.

D. Surface water shall be prevented from entering trenches.

3.07 ROADWAY EXCAVATIONS

A. In advance of setting line and grade stakes, clean subgrade area of brush, weeds, vegetation, grass, and debris. Drain all depressions or ruts which contain water.

B. A soils classification, as determined by AASHTO T-27, shall be made on the proposed subgrade, and the following shall be required based on that classification:

SOIL CLASSIFICATIONS	REQUIREMENT*
A-1	The subgrade shall be scarified to a depth of 12" and the loosened material shall be moistened and compacted to the equivalent of 95% of maximum dry density as measured by AASHTO T-180.
A-2, A-3, A-4 or A-5	The subgrade shall be over-excavated a minimum of 12" subgrade scarified and compacted, replaced with A-1 granular material, and be moistened and compacted as above.
A-6 or A-7	The subgrade shall be over-excavated a minimum of 18" subgrade scarified and compacted, replaced with A-1 granular material, and be moistened and compacted as above.

*All requirements are subject to a geotechnical investigation.

C. No organic material, soft clay, spongy material, or other deleterious material will be permitted in the scarified or imported subgrade layer.

D. Rough subgrades shall be shaped and graded to within a tolerance of 0.15 feet of design grade and drainage shall be maintained at all times.

E. Moisture content of the subgrade layer shall be maintained at not less than 95% or more than 105% of optimum moisture content, during the compaction process. The entire roadbed, to one foot in back of curb, must be compacted to the specified density to a minimum depth of 8 inches.

F. If removal of boulders, rubble, or existing improvements, found within the excavated area results in a lower excavation elevation than indicated, backfill over excavation in a manner approved by Engineer.

G. Remove all deposits susceptible to frost heave.

H. Excavations through or under City streets, sidewalks, street shoulders, driveways, etc. shall comply with the following requirements:

1. Material removed by excavation is not to be used as backfill or placed back into the trench under any paved portion of the street. However, sand may be used for backfill up to one foot above top of pipe.

2. The remaining trench shall be filled with select fill as per section 02 20 60.

3. The trench shall be filled to the existing asphalt level and guarded from traffic until set.

4. Within 10 days of the fill, sufficient fill material shall be removed and replaced with material comparable to the adjacent surface material shall meet the requirements of Section 02 50 40 of these specifications.

5. The City Engineer shall inspect all work.

3.08 EXCAVATION FOR PIPELINES

A. Excavation for pipelines shall follow lines parallel to and equidistant from the location of the pipe centerline.

B. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

1. Except in ledge rock, cobble rock, stones or water saturated earth, mechanical excavation of trenches shall not extend below an elevation of 4 inches below the bottom of the pipe after placement in its final position.

2. All additional excavation necessary for preparation of the trench bottom shall be made manually.

3. Excavation shall not be carried below the grade shown on the approved Drawings.

4. Any unauthorized excavation made below grade for any reason shall be backfilled in accordance with these Specifications.

5. 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 4 inches below the bottom of the pipe.

6. A bedding of special material shall be placed and thoroughly compacted with pneumatic tampers in 4-inch lifts to provide a smooth, stable foundation.

7. Special foundation material shall consist of suitable earth material free from roots, sod, or organic material.

8. Trench bottoms shall be hand shaped as specified in paragraph (2) above.

9. The maximum width of trench, measured at the top of the pipe, shall be as narrow as possible but a minimum of 6 inches on each side of the pipe.

10. Where ground water is encountered, clay dikes and/or filter fabric may be required at a minimum of 100 feet or as directed by the City Engineer.

11. In the presence of petroleum contaminated soils, as determined by the Engineer, refer to Section 02 97 00

C. Grade bottom of trenches to provide uniform bearing surface.

D. If necessary, make bellholes and depressions required to complete joining of pipe or box.

E. In public thoroughfares, regardless of trench depth, safely barricade and limit open trenches to a maximum of 200 lineal feet in the daytime, except in traveled roadways where a maximum of 80 lineal feet of open trench will be allowed.

F. Close trenches during nighttime conditions.

3.09 STRUCTURAL EXCAVATION

A. Provide all required shoring, cribs, cofferdams, and caissons including all pumping, bailing, draining, sheathing, bracing, and related items.

B. If conditions permit, slope excavation sides as excavation progress to maintain a safe and clean working area as required by OSHA.

C. Support excavation. Do not interfere with the bearing of adjacent foundations, pipelines, etc.

D. All unauthorized excavation below the specified structure subgrade shall be replaced with concrete, monolithic with that of the slab above or with coarse gravel thoroughly compacted into place.

E. Subgrade soil for all concrete structures shall be firm, dense, thoroughly compacted, and consolidated.

F. Subgrade soil shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen engaged in subgrade surfacing, laying reinforcing steel, and depositing concrete.

G. Coarse gravel or crushed stone may be used for subsoil reinforcement if results satisfactory to the City Engineer can be obtained thereby.

1. Material shall be applied in lifts of 6” or less.

2. Each lift shall be embedded in the subsoil by thorough tamping.

3. 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 specified subgrade.

3.10 SHEETING, BRACING AND SHORING OF EXCAVATIONS

A. In accordance with Section 02 15 00.

3.11 ROCK FACES

A. Scale rock cuts of all loose rocks and fragments and leave in a neat and safe condition.

3.12 BLASTING

A. Blasting will not be allowed except by permission from the City Engineer.

1. 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.

2. And he shall be fully responsible for all damage attributable to his blasting operations.

3. 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 by the Contractor.

3.13 BLASTING MATERIAL STORAGE

A. Store all explosives securely in compliance with Laws and Regulations. Refer to UDOT Section 00820. Refer to NFPA 495: Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.

B. Mark all storage places clearly.

3.14 ROCK REMOVAL – NONEXPLOSIVE METHOD

A. Excavate solid rock 6 inches to 1 feet below subgrade and backfill with acceptable material.

3.15 DISPOSAL OF EXCESS MATERIALS

A. All excess material shall be hauled away from the construction site and disposed of by the Contractor.

3.16 ROCK REMOVAL – EXPLOSIVE METHOD

A. Comply with UOSH Constructions Standards Chapter U rules and regulations.

B. Comply with NFPA 495: Code for the Manufacture, Transportation, and Use of Explosive Materials.

C. Provide a qualified explosives expert to act as an advisor and consultant during drilling and blasting operations.

D. Do not blast beyond designated areas.

3.17 GRAVEL FOR PIPELINES

A. Gravel will not be used to bed or cover culinary water pipelines.

END OF SECTION

SECTION 02 22 50

BACKFILL OPERATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for backfilling underground pipelines.

B. Backfilling operations adjacent to and under structures including boxes, headwalls, or other structures as required by City Engineer.

C. Compaction requirements for fill under and adjacent to slabs.

D. Backfilling and compacting operation for construction and reconstruction of roadways, embankments, streets, parking lots, and other paved surface areas.

1.02 RELATED WORK

A. Excavation: in accordance with Section 02 22 00.

B. Bedding: in accordance with Section 02 20 60.

1.03 DEFINITIONS

A. Subgrade: That surface of the excavation or portion of the pipe zone below the pipe.

B. Pipe Zone: That zone in an excavation which supports, surrounds, and extends to 1 foot above the top of the pipe barrel.

C. Bedding: 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.

D. Roadway: Area within the street right-of-way, including the area under the street, curb, gutter, and one (1) foot behind curb.

1.04 SUBMITTALS

A. Cut Sheets: Sewer, water, stormwater, and auxiliary line cut sheets must be submitted to and approved by the City Engineer. In accordance with Section 00 07 00.

B. Test Reports: Submit compaction and relevant pressure and disinfection tests requested by City Engineer verifying compliance with specified standards.

C. Material Analysis Reports: In accordance with Sections 02 20 50 or 02 20 60 as applicable.

D. Density Test Reports: In accordance with Section 02 25 00.

E. Depth of backfill lift. This information shall be contingent upon type of equipment used in compaction operation (see Section 02 25 00). Engineer may order lesser thickness if compaction is not achieved.

1.05 **SITE CONDITIONS**

A. Unsuitable Weather Limitations: Do not place, spread, or roll any fill material during unsuitable weather conditions. Do not resume operations until moisture content of material is satisfactory.

B. Softened Subgrade: Remove and replace weather softened subgrade as indicated at no additional cost to City.

C. Protection of Graded Areas: Protect graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

D. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or unsuitable weather, scarify surface, reshape, and compact to required density prior to further construction.

E. Prior to excavation operations, photograph existing surfaces along which Work may take place in order to determine, after construction is completed, whether any damage of existing improvements occurred prior to construction operations.

F. Grading: In compaction operations, do not vary the surface or finished aggregate base course more than ¼" above or below grade.

1.06 **STORAGE AND HANDLING**

A. Stockpile excavated material in a manner as to cause a minimum of inconvenience to public travel and provide for emergency traffic as necessary.

B. Maintain free access to all existing fire hydrants, water and gas valves, and meters.

C. Maintain clearance for free flow of storm water in all gutters, conduits, and natural water courses.

D. Utilize appropriate traffic signs, markers, and procedures in all product storage and handling activities.

E. Promptly remove all other material from site.

PART 2 PRODUCTS

2.01 **WATER**

A. Make arrangements for source of water during construction and make arrangements for delivery of water to site. Comply with all local laws and regulations when securing water from water utility company at no additional cost to City.

2.02 **SOIL MATERIALS**

A. Over-excavation Fill: in accordance with Section 02 22 00.

B. Common Fill: in accordance with Section 02 20 50.

C. Select Fill: in accordance with Section 02 20 60.

D. Native Backfill:

1. When approved by City Engineer, native backfill material obtained from project excavations may be used as backfill, provided organic material, rubbish, debris, and other objectionable materials are removed.

2. Bituminous pavement obtained from project excavations will not be permitted as backfill except for the following:
   a. May be mixed with road subbase if will meet section 02 20 50 2.01 gradation.

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Verify areas to be backfilled are free of debris, snow, ice, or water and ground surfaces are not frozen.

B. Verify foundation of basement walls are braced to support surcharge forces imposed by backfilling operations.

C. Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of work area.

3.02 **SUBGRADE PREPARATION**

A. Compact subgrade surfaces to density specified for overlying backfills. Refer to Section 02 25 00.

B. If areas of subgrade not readily capable of in-situ compaction, secure City Engineer's authorization for extra excavation and backfill. Refer to Section 02 22 00.

C. Maintain minimum overburden cover of 2 feet over pipelines or conduits during subgrade preparation.

3.03 **PREPARATION**

A. For pipelines, use means necessary to avoid displacement, and injury to, pipe and structures while compacting soil or operating equipment next to pipeline.

B. Movement of construction machinery over a pipeline at any stage is solely at Contractor's risk.

C. Identify required lines, grades, contours, and benchmarks.

D. Support and protect from damage, until completion of the Work, any existing facilities and structures which exist in, pass through, or pass under the site.

3.04 **SHORING**

A. Comply with Section 02 15 00 when required by field conditions.

3.05 CONTROL OF GROUNDWATER

A. All trenches shall be kept free from water during excavation, fine grading, pipe laying, jointing, and back fill operations.

B. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in cases where the static groundwater elevation is above the bottom of any trench or bell holed 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.

C. Groundwater shall be kept below the flow line of the pipe level.

D. Surface water shall be prevented from entering trenches.

3.06 BACKFILLING FOR PIPELINES

A. 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.

B. Pipe bedding material shall be cohesionless, free draining material. Refer to Section 02 20 60.

C. Trench backfilling above the level of the pipe bedding shall normally be accomplished with A-1 native excavated materials and shall be free from rocks larger than 8-inches in diameter.

D. Compaction Requirements

1. The backfill in all utility trenches shall be either compacted or consolidated according to the requirements of the materials being placed.

2. 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.

3. In shoulders and other areas the in-place density shall be a minimum of 92% of the maximum dry density as determined by the same laboratory method.

E. Clay cut off dikes shall be constructed as required by City Engineer.

3.07 BACKFILLING FOR STRUCTURES

A. Do not fill adjacent to structures until approval is obtained from the City Engineer.

B. All forms shall be removed and the excavation shall be cleaned of all trash and debris.

C. Backfill areas to contours and elevations indicated. Do not use frozen materials.

D. Do not use compaction equipment adjacent to walls or retaining walls that may cause wall to become overstressed or moved from final alignment.

E. Place select fill a minimum of 3 feet around the outside of structures.

F. Place and compact select fill materials in continuous lifts not exceeding 12" loose depth.

G. Place and compact common fill material in continuous lifts not exceeding 8" loose depth.

H. Do not disturb or damage foundation perimeter drainage, foundation, dampproofing, foundation waterproofing and protective cover, or utilities in trenches.

I. Backfill against foundation walls simultaneously on each side. Do not backfill against walls until concrete has obtained 7 day strength.

J. Make smooth changes in grade. Blend slopes into level areas.

K. Remove surplus backfill materials from site.

L. Leave stockpile areas completely free of excess fill materials.

M. Slope grade away from structure at a minimum of 3" in 10 feet unless otherwise indicated.

N. Compaction: Each layer of material 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.

O. Restore any damaged structure to its original strength and condition and rebackfill to specifications.

3.08 SUBGRADE PREPARATION

A. Compact subgrade surfaces to density specified for overlying backfills. Refer to Section 02 25 00.

B. If areas of subgrade not readily capable of in-situ compaction, secure City Engineer's authorization for extra excavation and backfill.

C. Maintain minimum overburden cover of 2 feet over pipelines or conduits during subgrade preparation.

3.09 BACKFILLING FOR PAVEMENT

A. Before beginning backfilling operations obtain Engineer's approval of excavation operation.

B. Do not damage subsurface structures or service lines.

C. Process backfill and avoid segregation. Keep base course free from pockets of coarse or fine material.

D. Deposit base course on the roadbed in a uniform manner which will provide the required compacted thickness. Maintain moisture content.

E. Shoulders are an integral part of the embankment. Do not build shoulders to a grade higher than that of the adjacent granular base course. Maintain efficient surface runoff at all times.

F. Compaction: in accordance with Section 02 25 00.

G. Prior to placing pavements, test roll in accordance with Section 01 45 50.

3.10 SHEETING, BRACING AND SHORING OF EXCAVATIONS

A. In accordance with Section 02 15 00.

3.11 COMPACTION OF BACKFILL

A. In accordance with Section 02 25 00.

3.12 IMPORTED BACKFILL MATERIAL

A. In the event the native excavated material is not satisfactory for backfilling as determined by the City Engineer, the Contractor shall provide imported granular fill in accordance with Section 02 20 50.

3.13 DISPOSAL OF EXCESS MATERIALS

A. All excess material shall be hauled away from the construction site and disposed of by the Contractor.

END OF SECTION

SECTION 02 24 50

FLOWABLE FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials and procedures for placing flowable fill.

1.02 REFERENCES

A. AASHTO M 194: Chemical Admixture for Concrete.

B. AASHTO M 154: Air-Entraining Admixtures for Concrete.

C. ASTM C 150: Portland Cement.

D. ASTM C 618: Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

E. ASTM D 4832: Preparation and Testing of Controlled Low Strength Material (CLSM) Test.

1.03 SUBMITTALS

A. Batch Proportions: Submit to Engineer 7 days before placement.

B. Trial Batch:

1. Submit certified test results or conduct laboratory trial batch to verify strength prior to placement.

2. The Department or its representative witnesses the trial batch.

1.04 RELATED SECTIONS

A. UDOT Section 03575: Flowable Fill. Install flowable fill in UDOT Right of Way to UDOT standards and specifications.

B. Section: 03 30 40: Portland Cement Concrete.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C 150.

B. Pozzolan: ASTM C 618.

C. Sand.

D. Coarse aggregate: Determine a suitable aggregate size and gradation for the intended application.

E. Admixtures:

1. Water reducers and set accelerators: AASHTO M 194.

2. Air entrainment: AASHTO M 154.

PART 3 EXECUTION

3.01 INSTALLATION

A. Combine materials to meet the requirements for strength and constructability as required. Determine strength from trial batches at 28 days.

1. Minimum strength: 50 psi. ASTM D 4832.

2. Maximum strength: 150 psi. ASTM D 4832.

3. Slump: 5 inches to 10 inches.

B. Determine a suitable aggregate size and gradation for the intended application.

END OF SECTION

SECTION 02 25 00

SOIL COMPACTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Compaction control of native and imported backfill material.

1.02 REFERENCES

A. AASHTO M 145: Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

B. AASHTO T-99: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Hammer and 12-In. (305-mm) Drop.

C. AASHTO T-180: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 10-lb (4.54-kg) Hammer and an 18-In. (457-mm) Drop.

D. AASHTO T-238: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.03 DEFINITIONS

A. A-1 Soils: AASHTO M 145 describes the nature of these soils.

B. Modified Proctor: The test method used for moisture-density relationship of soils as determined by the ASTM D 1557 test method.

C. Percent Compaction or Percent Density: The ratio of the field dry density to the laboratory maximum dry density expressed as a percentage.

D. Standard Proctor: The test method used for moisture-density relationship of soils as determined by the ASTM D 698 test method.

1.04 SUBMITTALS

A. Compaction test results according to Section 01 45 50.

1.05 WARRANTY

A. Correct deficient conditions. Replace or repair surfacing materials and damaged facilities.

B. The method of construction repair shall be proposed in writing by Contractor for approval by City Engineer prior to correcting the failed condition.

C. Failure to detect any defective work or material does not prevent later rejection of the work nor obligate City Engineer for final acceptance when such defective work or material is discovered.

PART 2 EXECUTION

2.01 COMPACTION REQUIREMENTS

A. The Contractor shall be responsible to perform and pay for all testing of earth materials. See Section 01 45 50.

B. Moisten or de-water backfill material to obtain optimum moisture for compaction compliance.

C, The material shall be deposited in horizontal layers having a compacted thickness of no more than 12 inches for roadway and 6 inches for trenches.

D. The distribution of materials shall be such that the compacted material will be homogeneous and free from lenses, pockets, or other imperfections.

E. The material shall have the optimum moisture content required for the purpose of compaction and the moisture content shall be uniform throughout the layer, insofar as practicable.

F. Backfill shall be compacted by means of sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers of a size and type approved by the Engineer.

G. If the required relative density is not attained, test sections will be required to determine any adjustments in compacting equipment, thickness of layers, moisture content and compaction effort necessary to attain the specified minimum relative density.

H. Approval of equipment, thickness of layers, moisture content and compaction effort shall not be deemed to relieve the Contractor of the responsibility for attaining the specified minimum relative densities.

I. The Contractor in planning his work shall allow sufficient time to perform the work connected with test sections and to permit the Engineer to make tests for relative densities.

2.02 FIELD QUALITY CONTROL

A. Optimum Soil Density: Unless indicated otherwise.

1. In accordance with AASHTO T-180 Method D test (Modified Proctor).

2.03 COMPACTION UNDER ROADWAYS

A. Fill or embankment material shall be compacted to not less than 95% of maximum dry density as measured by AASHTO T-180.

1. Compaction shall extend one foot beyond edge of pavement or proposed curb line.

2.04 COMPACTION OF OTHER FILLS AND EMBANKMENTS

A. Fill or embankment materials other than those mentioned above shall be compacted to not less than 95% of maximum dry density as measured by AASHTO T-180.

2.05 COMPACTION UNDER SIDEWALKS, CURB AND GUTTER, AND DRIVEWAYS

A. Fill or embankment material shall be compacted to not less than 95% of maximum dry density as measured by AASHTO T-180

B. Compaction of material shall extend to at least one foot each side of the edge of the slab.

END OF SECTION

SECTION 02 50 40

HOT MIX ASPHALT (HMA)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This is a material specification for hot mix and cold mix bituminous paving mixtures.

1.02 REFERENCES

A. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregate.

B. ASTM D 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

C. ASTM D 1075: Standard Test Method for Effect of Water on Cohesion of Compacted Bituminous Mixtures.

D. ASTM D 1559: Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

E. ASTM D 1560: Standard Test Methods for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.

F. ASTM D 1664: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.

G. ASTM D 3515: Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

H. ASTM D 4215: Standard Specification for Cold-Mixed, Cold-Laid Bituminous Paving Mixture.

1.03 DEFINITIONS

A. Traffic Classifications:

1. Class I: Parking lots, driveways, light traffic residential streets, light traffic farm roads.

2. Class II: Residential streets, rural farm and residential roads.

3. Class III: Urban minor collector streets, rural minor collector roads.

4. Class IV: Urban minor arterial and light industrial and light industrial streets, rural major collector and minor arterial highways.

5. Class V: Urban freeways, expressways and principal arterial highways, rural interstate and other principal arterial highways.

1.04 **SUBMITTALS**

A. Mix Design: Submit each proposed mix design 14 days prior to use in the Work. Include in the report the following information:

1. Mix design method (Rice or Marshall). If Marshall, use a five (5) point design.

2. Job control target data for aggregate ideal grading.

3. Permissible range limits of bitumen content in mixture.

4. Mixture's index of retained strength, ASTM D 1075.

5. Additives. If none, state none are required.

6. Percent voids.

B. Source Aggregate Sample Report. Indicate rodded weight of aggregate, percentage of wear, weight loss, sand equivalent value, percent of fractured faces, amount of organic matter, plasticity of fines, and percentage of fines retained on the aggregate.

C. Pre-Approved Mix Design Data: If supplier has on record, a UDOT approved mix design, submit name and address of supplier for each mix design 3 days prior to using asphalt concrete mix.

1.05 **QUALITY ASSURANCE**

A. Bitumen weights shall be determined by the mix design.

B. Use asphalt cement when recycled asphalt mixtures are indicated.

C. Do not change source of supply of paving asphalt or aggregate without City Engineer's written approval.

D. Each shipment of bituminous material shall be uniform in appearance and consistency with no foaming when heated to the specified mixing temperature.

E. Do not use storage containers contaminated with other asphalt types.

F. Gradation, asphalt content, marshal density, and maximum density shall be determined by extraction tests.

1.06 **RELATED SECTIONS**

A. Install HMA in UDOT roadways to UDOT standards and specifications.

PART 2 PRODUCTS

2.01 PAVING ASPHALT

A. Provide type.

B. The mix design shall target 3% voids. However, the percent asphalt or fines may need to be adjusted to achieve optimal strength.

2.02 AGGREGATES - MATERIALS

A. Clean, hard, tough, durable and sound mineral aggregates that consist of crushed stone, crushed gravel, or crushed slag conforming to the following requirements:

1. Rodded Weight density; not less than 75 pounds per cubic foot.

2. Percentage of wear of coarse aggregate retained on the No. 8 sieve; not exceeding 40 unless specific aggregates having higher values are known to be satisfactory.

3. Weight loss; not exceeding 16 percent by weight when subject to 5 cycles of sodium sulfate.

4. The combined aggregate after going through the dryer shall have a sand equivalent value of not less than 50 percent.

B. Coarse Aggregate: Use an aggregate that the portion retained on the No. 4 sieve has not less than 50 percent of particles by weight with at least two mechanically fractured faces or clean angular faces.

C. Fine Aggregate:

1. Fine aggregate passing the No. 4 sieve may be either a natural or manufacture product containing not more than 2 percent by weight of organic matter or other deleterious substances.

2. Aggregate passing the No. 40 sieve is nonplastic.

3. The weight of minus 200 mesh material retained in the aggregate, as determined by the difference in percent passing a No. 200 sieve by washing and dry sieving without washing, does not exceed 6 percent of the total sample weight.

D. Mineral Filler: When mix design indicated need, add as a separate ingredient; ASTM D 242.

2.03 AGGREGATES - MASTER GRADING BAND LIMITS

A. Gradiation DM-1/2 will be used unless otherwise specified

B. The following gradations describe the total percent passing by weight, ASTM C 136, and is based on fine and coarse aggregate having approximately the same bulk specific gravities.

MASTER GRADING BAND LIMITS														
	DENSE MIXTURES						OPEN MIXTURES				FRICTION MIXTURES			
Sieve Size	Type DM-1 Min	Max	Type DM-3/4 Min	Max	Type DM-1/2 Min	Max	Type OM-1 Min	Max	Type OM-2 Min	Max	Type FM-1 Min	Max	Type FM-2 Min	Max
1"	100	-----												
3/4"	-----	-----	100	-----									100	-----
½"	75	91	-----	-----	100	-----	100	-----	100	-----	100	-----	90	100
3/8"	-----	-----	75	91	-----	-----	95	99	95	99	90	100	60	100
# 4	46	62	46	62	60	80	36	40	36	40	30	50	15	40
# 8	-----	-----	-----	-----	-----	-----	14	20	27	33	5	15	4	12
# 16	21	35	22	34	28	42	10	14	18	24	-----	-----	-----	-----
# 50	12	22	11	23	11	23	6	10	11	15	-----	-----	-----	-----
# 200	5	9	5	9	5	9	2	4	3	5	2	5	2	5

2.04 AGGREGATES - JOB-CONTROL GRADING BAND LIMITS

A. The job control formula shall produce a smooth curve approximately paralleling the master grading band limits for the designated mix. If application of the tolerances results in a job control grading band outside the master grading band, the full job control tolerances shall apply. The following describes the job control grading bands.

JOB-CONTROL GRADING BAND LIMITS					
Sieve	Amount Passing Sieve, weight %				
Size	1 Test	2 Tests	3 Tests	4 Tests	5 Tests
≥ ½	± 10	± 7.3	± 6.3	± 5.6	± 5.2
3/8	± 9	± 6.9	± 5.9	± 5.3	± 4.9
No. 4	± 9	± 6.7	± 5.7	± 5.2	± 4.8
No. 8	± 7	± 5.6	± 4.8	± 4.3	± 4.0
No. 16	± 7	± 5.2	± 4.6	± 4.2	± 3.9
No. 50	± 6	± 4.3	± 3.8	± 3.4	± 3.2
No. 200	± 3	± 2.4	± 2.0	± 1.8	± 1.7

2.05 MARSHALL MIX DESIGN

A. The Marshall Mix design shall be based upon ASTM D 1559, traffic classifications, and the following.

MARSHALL MIX DESIGN REQUIREMENTS						
	CLASS I		**CLASS II & III**		**CLASS IV & V**	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**
Number of Compaction Blows (each end of specimen)	35	34	50	50	75	75
Stability, lb	1500	-----	1500	-----	1750	-----
Flow, in 0.01 in. units	8	20	8	18	8	16
% Air Voids,						
Surfacing and Leveling	3	5	3	5	3	5
Base	3	8	3	8	3	8
Unconfined Compression Strength Retention, % (ASTM D 1075)	65	-----	65	-----	65	-----

B. Compensate for specific gravity and absorption of aggregate to determine bitumen content by laboratory testing.

2.06 MIXING PLANT

A. Hot-mixed, hot-laid paving mixtures; ASTM D 3515.

2.07 SOURCE QUALITY CONTROL

A. Unconfined Compression Strength Retention: When crushed mineral aggregate which is thoroughly coated with bitumen has an index of retained strength less than 65 percent bring the strength into compliance by adding any of the following additives to the mix.

1. Antistripping agent.

2. Hydrated lime.

3. Portland cement.

B. Coating and Stripping of Bitumen-Aggregate Mixture: Immediately after mixing, the mixing shall meet the requirements of ASTM D 1664, whereby not more than 5 percent of the aggregate particles shall remain uncoated.

2.08 SAMPLING, TESTING, AND ACCEPTANCE

A. Acceptance of bituminous surface course with respect to gradation and bitumen content shall be based on the average deviation from the job-mix formula of the samples taken. A lot shall equal the number of tons of bituminous mix placed each production day. When the daily production exceeds 2,500 tons, a minimum of five samples shall be required. When it is between 1,500 and 2,500 tons, a minimum of four samples shall be required. When it is less than 1,500 tons, a minimum of three samples shall be required. In the event the minimum number of samples required cannot be obtained, the test lot may be evaluated on the basis of fewer samples. Test samples shall be taken as the bituminous mix is being placed and shall be obtained immediately behind the paver prior to any further processing or compaction. The samples shall be chosen on a random basis by means of suitable random number table. In addition, the samples shall be distributed as uniformly as possible in time throughout the test lot so as to be representative of the material being introduced during the entire production day. Acceptance shall be in accordance with Tables 02 50 40-1 and 02 50 40-2.

B. The mean of the deviations is hereby defined as the sum of the absolute values of the deviations divided by the number of tests in the lot.

C. During the first day's operation, the Contractor may elect to eliminate the test results from any one sample for both gradation and bitumen content. The applicable factor shall then be for one less sample than was tested. Use Table 02 50 40-2 for these determinations.

D. If the mean result of the deviation of the lot acceptance tests from the job-mix formula for a particular sieve or sieves, or for bitumen content is more than the maximum value shown under the 0.70 quality factor in Table 02 50 40-1 or 02 50 40-2, the City Engineer may order the removal of any or all of the bituminous mix in the lot.

E. In addition to the random acceptance samples taken from each lot, the City Engineer may sample bituminous mix from any portion of the course that exhibits a nonuniform appearance. The Engineer may reject this material when test results show a deviation from the job-mix formula that exceeds maximum deviation allowed under the 0.70 quality factor in Table 02 50 40-1 or 02 50 40-2.

F. The Contractor shall take steps to bring the bituminous surface course into specification when the test results show a deviation from the job-mix formula that exceeds the maximum deviation under the 1.00 quality factor in Table 02 50 40-1 or 02 50 40-2.

TABLE 02 50 40-1

ACCEPTANCE SCHEDULE BITUMEN CONTENT AND AGGREGATE GRADATION OF BITUMINOUS MIXTURE **MEAN OF THE DEVIATIONS OF FIVE LOT ACCEPTANCE TESTS FROM THE JOB-MIX FORMULA**					
PERCENTAGE POINTS					
BITUMEN CONTENT	**QUALITY FACTOR**				
	1.00 0 - 0.38	0.95 .39 - .45	0.90 .44 - .47	0.80 .48 - .52	0.70 .53 - .56
SIEVE SIZE					
½ inch and larger	0 - 5.2	5.3 - 5.8	5.9 - 6.4	6.5 - 7.1	7.2 - 7.7
3/8 inch	0 - 4.9	.0 - 5.5	5.6 - 6.1	6.2 - 6.6	6.7 - 7.2
No. 4	0 - 4.8	4.9 - 5.4	5.5 - 5.9	6.0 - 6.5	6.6 - 7.0
No. 8	0 - 4.0	4.1 - 4.5	4.6 - 4.9	5.0 - 5.4	5.5 - 5.8
No. 16	0 - 3.9	4.0 - 4.3	4.4 - 4.7	4.8 - 5.1	5.2 - 5.4
No. 50	0 - 3.2	3.3 - 3.5	3.6 - 3.8	3.9 - 4.1	4.2 - 4.5
No. 200	0 - 1.7	1.8 - 1.9	2.0 - 2.1	2.2 - 2.3	2.4 - 2.5

TABLE 02 50 40-2

ACCEPTANCE SCHEDULE FOR LESS THAN FIVE LOT ACCEPTANCE TESTS BITUMEN CONTENT AND AGGREGATE GRADATION OF BITUMINOUS MIXTURE (PERCENTAGE POINTS) **MEAN OF THE DEVIATIONS OF THE LOT ACCEPTANCE TESTS FROM THE JOB-MIX FORMULA**					
	QUALITY FACTOR	**1 TEST**	**2 TEST**	**3 TEST**	**4 TEST**
Bitumen Content	1.00 0.95 0.90 0.80 0.70	0 - 0.7 0.8 0.9 1.0 1.1	0 - .54 .55 - .61 .62 - .68 .69 - .75 .76 - .82	0 - .46 .47 - .52 .53 - .58 .59 - .64 .65 - .69	0 - .41 .42 - .46 .47 - .51 .52 - .56 .57 - .61

ACCEPTANCE SCHEDULE FOR LESS THAN FIVE LOT ACCEPTANCE TESTS
BITUMEN CONTENT AND AGGREGATE GRADATION OF BITUMINOUS MIXTURE (PERCENTAGE POINTS)

MEAN OF THE DEVIATIONS OF THE LOT ACCEPTANCE TESTS FROM THE JOB-MIX FORMULA

½ inch and larger	1.00 0.95 0.90 0.80 0.70	0 - 10 11 - 12 13 14 15	0 - 7.3 7.4 - 8.3 8.4–9.3 9.4 - 10.3 10.4 - 11.3	0 - 6.3 6.4 - .7.1 7.2 - 7.9 8.0 - 8.7 8.8 - 9.5	0 - 5.6 5.7 - 6.3 6.4 - 7.0 7.1 - 7.7 7.8 - 8.4
3.8 inch sieve	1.00 0.95 0.90 0.80 0.70	0 - 9 10 11 12 - 13 14	0 - 6.9 7.0 - 7.8 7.9 - 8.7 8.8 - 9.6 9.7 - 10.5	0 - 5.9 6.0 - 6.6 6.7 - 7.3 7.4 - 8.0 8.1 - 8.9	0 - 5.3 5.4 - 5.9 6.0 - 6.6 6.7 - 7.2 7.3 - 7.9
No. 4 sieve	1.00 0.95 0.90 0.80 0.70	0 - 9 10 11 12 - 13 14	0 - 6.7 6.8 - 7.6 7.7 - 8.5 8.6 - 9.4 9.5 - 10.2	0 - 5.7 5.8 - 6.3 6.4 - 6.9 7.0. - 7.5 7.6 - 8.0	0 - 5.2 5.3 - 5.8 5.9 - 6.4 6.5 - 7.0 7.1 - 7.6
No. 8 sieve	1.00 0.95 0.90 0.80 0.70	0 - 7 8 9 10 11 - 12	0 - 5.6 5.7 - 6.3 6.4 - 7.0 7.1 - 7.7 7.8 - 8.5	0 - 4.8 4.9 - 5.4 5.5 - 6.0 6.1 - 6.6 6.7 - 7.2	0 - 4.3 4.4 - 4.8 4.9 - 5.3 5.4 - 5.8 5.9 - 6.4
No. 16 sieve	1.00 0.95 0.90 0.80 0.70	0 - 7 8 9 10 11	0 - 5.2 5.3 - 5.8 5.9 - 6.4 6.5 - 7.0 7.1 - 7.6	0 - 4.6 4.7 - 51. 5.2 - 5.6 5.7 - 6.1 6.2 - 6.6	0 - 4.2 4.3 - 4.6 4.7 - 5.1 5.2 - 5.5 5.6 - 5.9

ACCEPTANCE SCHEDULE FOR LESS THAN FIVE LOT ACCEPTANCE TESTS
BITUMEN CONTENT AND AGGREGATE GRADATION OF BITUMINOUS MIXTURE
(PERCENTAGE POINTS)

MEAN OF THE DEVIATIONS OF THE LOT ACCEPTANCE TESTS FROM THE JOB-MIX FORMULA

No. 50 sieve	1.00 0.95 0.90 0.80 0.70	0 - 6 7 8 9 10	0 - 4.3 4.4 - 4.8 4.9 - 5.3 5.4 - 5.8 5.9 - 6.4	0 - 3.8 3.9 - 4.1 4.2 - 4.5 4.6 - 4.9 5.0 - 5.5	0 - 3.4 3.5 - 3.8 3.9 - 4.1 4.2 - 4.4 4.5 - 4.9
No. 200 sieve	1.00 0.95 0.90 0.80 0.70	0 - 3.0 3.1 - 3.5 3.6 - 4.0 4.1 - 4.5 4.6 - 5.0	0 - 2.4 2.5 - 2.7 2.8 - 3.0 3.1 - 3.3 3.4 - 3.6	0 - 2.0 2.1 - 2.2 2.3 - 2.4 2.5 - 2.7 2.8 - 3.0	0 - 1.8 1.9 - 2.0 2.1 - 2.2 2.3 - 2.4 2.5 - 2.6

PART 3 EXECUTION

3.01 INSTALLATION

A. Asphalt Paving: In accordance with Section 02 51 00.

END OF SECTION

SECTION 02 50 50

EMULSIFIED ASPHALT SLURRY SEAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This is a material specification and application specification for emulsified asphalt slurry seal.

1.02 REFERENCES

A. ASHTO T-27: Standard Method for Sieve Analysis of Fine and Coarse Aggregate.

B. AASHTO T-2: Sampling Mineral Aggregates.

C. AASHTO T-11: Materials Finer than No. 200 in Mineral Aggregate.

D. AASHTO 176: Sand Equivalent Value of Soils and Fine Aggregate.

E. AASHTO T-84: Specific Gravity and Absorption of Fine.

F. AASHTO T-19: Unit Weight Aggregate.

G. AASHTO T-96: Resistance to Abrasion of Small Size Coarse Aggregate by use of the Los Angeles Machine.

H. AASHTO T-37: Sieve Analysis of Mineral Filler.

I. AASHTO T-40: Sampling Bituminous Materials.

J. AASHTO T-59: Testing Emulsified Asphalt.

K. AASHTO M-140: Specification for Emulsified Asphalt.

L. AASHTO T-49: Penetration 100 gm at 5 sec. 77°F(25°C).

M. ASTM D242: Mineral Filler for Bituminous Paving Mixtures.

1.03 DEFINITIONS

A. The slurry seal shall consist of a mixture of an approved emulsified asphalt, mineral aggregate, water and specified additives, proportioned, mixed and uniformly spread over a properly prepared surface. The completed slurry seal shall leave a homogeneous mat, adhere firmly to the prepared surface, and have a friction resistant surface texture throughout its service life.

1.04 SUBMITTALS

A. Mix Design: Submit each proposed mix design 14 days prior to use in the Work.

PART 2 PRODUCTS

2.01 **EMULSIFIED ASPHALT**

A. The emulsified asphalt shall conform to Grade CQS-1H as specified in AASHTO M140. The asphalt emulsion shall be CQS-1H. Each shipment of emulsified asphalt shall be accompanied by a certificate of analysis / compliance from the manufacturer.

B. POLYMER MODIFIED EMULSION: (Optional, if specified) The emulsified asphalt shall be CQS-1HL, CQS-1HP, QS-1HL, or QS-1HP. The polymer modifier shall be either a solid synthetic rubber or latex material. The polymer modifier shall be combined with the base asphalt or asphalt emulsion at a minimum rate of 3% solids by weight of asphalt prior to loading at the manufacturing plant. The polymer modified emulsion shall be compatible with the mix design developed for the conventional slurry seal.

2.02 **AGGREGATES – MATERIALS**

A. The mineral aggregate shall be manufactured (100% crushed) stone such as granite, slag, limestone, chat, or other high quality aggregate that is free from dirt, organic matter, clay balls, adherent films of clay, dust, or other objectionable matter.

B. The Contractor shall insure that all oversize aggregate and other objectionable matter are removed from the mineral aggregate utilized in the slurry seal mixture. Screening shall be required at the stockpile if there are problems created by oversize materials in the mixture.

2.03 **AGGREGATES - GRADING BAND LIMITS**

A. Gradation Type II will be used unless otherwise specified.

B. The following gradations describe the total percent passing by weight, AASHTO T-27, and is based on fine and coarse aggregate having approximately the same bulk specific gravities.

	GRADING BAND LIMITS						
Sieve Size	DENSE MIXTURES						Stockpile Tolerance
	Type I Min	Type I Max	Type II Min	Type II Max	Type III Min	Type III Max	
3/8"	100	-----	100	-----	100	-----	
# 4	100	-----	90	100	70		+ or - 5%
# 8	90	100	65	90	90		+ or - 5%
# 16	65	90	45	70	45	70	+ or - 5%
# 30	40	65	30	50	28	50	+ or - 5%
# 50	25	42	18	30	19	34	+ or - 4%
# 100	15	30	10	21	12	25	+ or - 3%
# 200	10	20	5	15	7	18	+ or - 2%
					5	15	

2.04 AGGREGATES - JOB-CONTROL GRADING BAND LIMITS

A. The job mix gradation shall be within the gradation band for the desired type. After the target gradation has been submitted, then the percent passing each sieve shall not vary by more than the stockpile tolerance and still remain within the gradation band.

2.05 MINERAL FILLER

A. Portland Cement, hydrated lime, limestone dust, fly ash, Aluminum sulfate, or other approved filler meeting the requirements of ASTM D242 shall be used if required by the mix design. They shall be considered as part of the dry aggregate. The quantity and type of filler, if required, shall be determined by the job mix design. It shall be used for one or more of the following reasons only: to improve the gradation of the aggregate to provide improved stability and workability of the slurry, or the increase the durability of the cured slurry.

2.06 WATER

A. Water for the slurry mixture shall be clear, potable, free from harmful soluble salts, and compatible with the slurry mixture. If the water is obtained from a source other than sanitary systems, such as a river, stream, or pond, a sample of the water must be tested and approved by the laboratory performing the mix design.

2.07 MIX DESIGN

A. The mix design shall be made with the same aggregate gradation that the Contractor will provide on the project. Sources of all materials shall be selected prior to the time when the mix design is prepared and the materials are required to be used in the work. Slurry seal mixture shall not be placed until a mix design, submitted by the Contractor, has been approved by the Project Manager. The exact proportions of asphalt emulsion, aggregate, mineral filler, additives, and water to be used in the preparation of the slurry seal shall be determined by an approved testing laboratory experienced in slurry seal mix design procedures.

The approved slurry mix shall be a homogeneous mixture, sufficiently stable during the entire mixing/spreading period so that the emulsion does not break, there are no segregation of the fines from the coarse aggregate, and the liquid portion of the mix does not float to the surface. The amount and type of asphalt emulsion to be blended with aggregate shall be determined by the laboratory mix design. The set control additive shall be introduced into the slurry seal mixture by an approved method that will assure uniform distribution and proper control. The exact amount shall be determined by conditions in the field and indicated in the mix design. A minimum amount of water shall be used as necessary to obtain a workable and homogeneous mixture. The slurry seal mixture shall show no signs of uncoated aggregate or premature breaking of emulsion when applied to the pavement surface.

B. The mix design and all slurry seal materials shall be approved by the City Engineer prior to use.

The component materials shall be within the following limits:

1. Residual Asphalt Type I: 10% - 16%
   Type II: 7.5% - 13.5%
   Type III: 6.5% - 12%

   Based on dry weight of aggregate

2. Mineral Filler 0.5% - 2.0%
   Based on dry weight of aggregate

3. Additives As needed

4. Water As needed to achieve proper mix consistency

2.08 **ADDITIVES**

A. Additives may be used to accelerate or retard the break-set of the slurry seal, or improve the resulting finished surface. The quantity and type of set control additive, if required, shall be determined by the job mix design and conform to the applicable sections of ASTM D3910 and ISSA T102. The use of additives in the slurry mix shall be made initially in quantities predetermined by the mix design with field adjustments if required, after approval by the City Engineer.

PART 3 EXECUTION

3.01 **EQUIPMENT – GENERAL**

A. All equipment, tools, and machines used in performance of this work shall be maintained in satisfactory working condition.

3.02 **MIXING EQUIPMENT**

A. Mixing Unit. The slurry seal shall be mixed and applied with a machine designed and manufactured to lay slurry seal with a minimum aggregate capacity of eight (8) cubic yards to reduce the number of transverse joints. The slurry seal mixing machine shall be a continuous flow mixing unit, capable of delivering accurately predetermined proportions of aggregate, asphalt emulsion, and mineral filler (if required) to a revolving spiraled multi-blade mixer and of discharging the thoroughly mixed product on a continuous basis. The mixing unit shall be capable of thoroughly blending all ingredients together without violent action. The mixing machine shall be equipped with an approved fines feeder that provides an accurate metering device or method of introducing a predetermined proportion of mineral filler to the aggregate. The fines feeder shall be used only when mineral filler is part of the mix design. The mixing machine shall be equipped with a water pressure system and fog type spray bar. The machine shall be capable of mixing materials at preset proportions regardless of the speed of the machine and without changing machine settings.

Each mixing unit to be used in performance of the work shall be calibrated prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted, provided it was made during the current calendar year. The documentation shall include an individual calibration of each material at various settings which can be related to the machine metering device(s).

Attached to the mixing machine shall be a mechanical squeegee distributor (spreader box) having a rubber-like material in contact with the surface to prevent unwanted egress of slurry. It shall prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. An appropriate mechanical device for lateral distribution of the slurry shall be operated within the spreader box. There shall be a steering device, a flexible strike-off, and a burlap or other approved drag. The spreader box shall be adjustable to widths from eight (8) to fifteen (15) feet to minimize the number of longitudinal joints. Broken slurry seal mixture shall not be allowed to collect in the spreader box or on the flexible strike-off.

3.03 **SPREADING EQUIPMENT**

A. The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the road contact point.

3.04 **WEATHER LIMITATIONS**

A. The slurry seal shall not be applied if either the pavement or air temperature is below 50°F(10°C) and falling, but may be applied when both pavement and air temperature are above 45°F(7°C) and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

3.05 **NOTIFICATION AND TRAFFIC CONTROL**

A. All homeowners and business affected by the paving shall be notified one day in advance of the surfacing. If work does not occur on the specified day, a new notification will be distributed.

B. Suitable methods shall be used by the contractor to protect the slurry seal from all types of vehicular traffic without damage. Opening to traffic does not constitute acceptance of the work. Traffic control shall in accordance with the MUTCD manual.

3.06 **SURFACE PREPARATION**

A. Immediately prior to applying the slurry seal the surface shall be cleared of all loose material, oil spots, vegetation, and other objectionable material. Any standard cleaning method will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before slurry surfacing. Manholes, valve boxes, drop inlets and other service entrances shall be protected from the slurry seal by a suitable method. The City Engineer shall approve the surface preparation prior to surfacing.

B. It is advisable to pre-treat cracks in the pavement surface with an acceptable crack sealer prior to application of the slurry seal.

3.07 **APPLICATION**

A. When required by local conditions, the surface shall be pre-wetted by fogging ahead of the spreader box.

B. The slurry seal shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained.

C. No streaks, such as those caused by oversized aggregate shall be left in the finished surface.

D. No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The Contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the project. When possible, longitudinal joints shall be placed on lane lines. Half passes and odd width passes will be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of six inches (6") shall be allowed for overlap of longitudinal lane line joints.

E. Areas which cannot be reached with slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be handworked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type finish as applied by the spreader box shall be required. Handwork shall be completed during machine applying process.

F. Care shall be taken to insure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide good appearance.

G. All areas, such as manways, gutters and intersections, shall have the slurry seal removed as specified by the City Engineer. The Contractor shall remove any debris associated with the performance of the work on a daily basis.

H. Rate of Application:

APPLICATION RATE	
Type I	8-12#/SY
Type II	12-20#/SY
Type III	18-30#/SY

I. The longitudinal joint between adjacent lanes shall have no visible lap, pinholes, or uncovered areas. Thick application caused by overlapping shall be smoothed immediately with hand squeegees before the slurry seal mixture breaks. When possible, longitudinal joints shall be placed on lane lines. The Contractor shall provide suitable spreading equipment to minimize the number of longitudinal joints. Overlays that occur at transverse joints shall be smoothed before the slurry seal mixture breaks, so that a uniform surface is obtained.

J. Care shall be taken to insure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections shall be kept straight to provide a good appearance.

3.08 SAMPLING AND TESTING

A. Suitable sized samples of aggregate, asphalt emulsion, and mineral filler (if required) shall be submitted, when requested by the Project Manager, for approval not less than ten (10) days before the work starts. All samples of materials shall be supplied by the Contractor at his expense, and all tests necessary to determine conformance with requirements specified shall be performed without cost to the Contractor. Additional samples of materials shall be furnished as directed by the Project Manager during progress of the work. The owner will notify the Contractor immediately if any test fails to meet the specifications. If it is established that a satisfactory slurry seal mixture meeting the requirements specified herein cannot be produced from the materials furnished, the materials shall be rejected and the Contractor shall submit new samples.

END OF SECTION

SECTION 02 51 00

ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section covers the requirements for bituminous surface paving on roads.

1.02 RELATED SECTIONS

A. Asphalt Paving in UDOT roadways shall meet UDOT standards and specifications.

PART 2 SUBMITTALS

A. Contractor shall establish a mix gradation and the amount of bituminous material shall be submitted two (2) working days prior to surfacing for the approval by the City Engineer and shall meet the requirements of the gradation selected.

B. Test Reports: Submit test reports as requested by City Engineer verifying compliance with specified standards.

PART 3 EXECUTION

3.01 ALL STREETS SHALL BE SURFACED IN ACCORDANCE WITH THE FOLLOWING:

A. 6-inch minimum crushed gravel base course over prepared and approved subgrade.

B. 3-inch minimum compacted thickness plant mix asphalt surfacing on all streets.

C. 2-lift minimum for plant mix asphalt surfacing when final compacted pavement thickness is greater or equal to 3 inches.

3.02 BASE COURSE

A. Base for all streets shall consist of select material, as specified in Section 02 20 60.

B. Base shall be laid in accordance with Section 02 22 50.

C. Surfaces shall be true to the established grade with thickness being not less than 1/4 inch from the required layer thickness and with the surface elevation varying not more than 3/8 inch in ten feet from the true profile and cross section.

3.03 BITUMINOUS SURFACE COURSE

A. Base course shall be free of any contamination prior to laying surface course.

B. The surface course shall consist of a mixture of mineral aggregate and binder.

C. Gradation of aggregate shall conform to Section 02 50 40.

D. Regardless of the bituminous content there shall not be more than 3% voids in the aggregate.

E. Performance graded asphalt (PG) selected for temperatures found at this locality should be used (PG-58-28 or better) for public streets, city streets, and private driveways; per UDOT specifications for patches in UDOT roadways. For small patches, AC-10 or AC-15 asphalt cement conforming to the requirements of ASTM D-445 may be used. 85-100 penetration asphalt cement conforming to the requirements of ASTM M20-60 may be used when specifically approved by the Engineer.

F. The Contractor shall apply a tack coat to all existing asphalt or concrete edges and surfaces that will be in contact with the new bituminous surface course.

1. The tack coat shall be CSS-1, CSS-1H, SS-1 or SS-1H emulsified asphalt at 50% max cutback solution.

2. The application rate shall be not less than 0.9 to 0.6 gallons per square yard, as directed by the Engineer.

G. 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.

H. All existing asphalt shall be saw cut to remove and fractures or cracking asphalt.

3.04 CONSTRUCTION METHODS AND EQUIPMENT

A. 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.

B. The Contractor shall make such changes in the methods employed and in the equipment used as are necessary whenever the bituminous being produced does not meet the specification herein established.

3.05 SPREADING

A. The bituminous mixtures shall be spread with self-propelled mechanical spreading and conditioning equipment or capable of distributing at least a 12-foot width.

B. The City Engineer shall determine whether or not the bituminous surface course shall be spread in one or more courses.

C. No surface course shall be placed less than 1 inch in thickness.

D. The mixture shall be spread and struck off in such a manner that the finished surface shall result in a uniform smooth surface.

E. The longitudinal joints in any succeeding courses shall be offset at least 6 inches transversely to avoid a vertical joint through more than one course.

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

3.06 **COMPACTION**

A. After the mixture has been spread, the surface shall be rolled in longitudinal direction commencing at the outside edge or lower side and preceding to the higher side.

B. Each pass of the roller shall overlap the preceding pass at least one-half the width of the roller.

C. Rolling shall continue until 95% of the laboratory density as determined in accordance with ASTM Designation D-1559 for the bituminous mixture being used has been obtained.

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

E. Quality Control

1. The surface of the pavement, after compaction, shall be uniform and true to the established crown and grade.

2. When tested with a ten (10) foot straight edge placed parallel to the center line 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.

3. 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 imitate the surrounding area.

4. The Contractor shall be responsible to test bituminous mixtures for compaction in accordance with Section 01 45 00, Testing and Process Control.

3.07 **WEATHER LIMITATIONS**

A. No bituminous surface shall be placed when the temperature of the air or road bed 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.

B. The air temperature shall be measured in the shade, and shall be 50° and rising.

3.08 **FLAGGING**

A. Flaggers shall be required as directed to facilitate the safe control of traffic over highways and streets under construction at such locations as required and directed by the City Engineer.

B. Flagging shall be performed by certified, trained, and properly equipped flaggers.

C. All flagging shall be done as described in the Safety Orders covering flaggers of the Industrial Commission of Utah and in accordance with the MUTCD manual.

END OF SECTION

SECTION 02 51 20

RESTORATION OF SURFACE IMPROVEMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Restoration of surface improvement requirements.

1.02 GENERAL IMPROVEMENT REQUIREMENTS

A. 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 work.

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

1.03 RELATED SECTIONS

A. Section 02 20 60: Select Fill.

B. Section 02 51 00: Asphalt Paving.

C. Section 03 30 40: Portland Cement Concrete.

D. Section 03 31 00: Concrete Work.

E. UDOT specifications for HMA and Asphalt Concrete.

PART 2 PRODUCTS

F. Select Fill: In accordance with Section 02 20 60.

G. Asphalt Concrete: In accordance with Section 02 51 00

H. Concrete: In accordance with Section 03 30 40.

PART 3 EXECUTION

3.01 ROAD BASE REPAIR

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

1. The road base shall be placed deep enough to provide a minimum of 6-inches of material.

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

3. Material for use on gravel surfaces shall be obtained from sound tough durable gravel or rock meeting the requirements of Section 02 20 60.

3.02 BITUMINOUS SURFACE REPAIR

A. Within UDOT right-of-way, Contractor will conform with all UDOT Specifications.

B. Where trenches are excavated through City owned bituminous surfaced roads, driveways or parking areas, the surface shall be restored and maintained as follows:

1. Trenches shall be backfilled with granular fill, in accordance with Section 02 20 50.

2. 6" of road base will be used in accordance with Section 02 20 60.

2. Pavement restoration shall include priming of pavement edges and low density concrete surface with Type MC-70 bituminous material and placing and rolling plant mix bituminous material to the level of the adjacent pavement surfaces.

3. Native backfill is allowed upon City Engineer's approval only.

3.03 CONCRETE REPAIR

A. All concrete curbs, gutter, sidewalks, and driveways shall be removed and replaced to the next joint or scoring lining beyond the actually damaged or broken sections.

B. 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 saw cut, removed, and reconstructed to neat, plane faces.

C. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements.

D. Where necessary, lampblack or other pigments shall be added to the new concrete to obtain the desired results.

E. All concrete work shall conform to the requirements of Section 03 31 00 of these Specifications.

3.04 LANDSCAPE REPAIR

A. The Contractor is responsible to preserve and protect all landscape, including but not limited to trees, shrubs, grass, rock, etc. The Contractor shall replace any and all damaged landscape caused by the installation of main lines, service laterals and all other associated appurtenances to the satisfaction of the property owner, owner, and the City Engineer.

END OF SECTION

SECTION 02 52 80

CONCRETE DRIVEWAY, SIDEWALK, CURB AND GUTTER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials, installation and tolerances for Portland cement concrete ramps, sidewalk, curbs, gutters, and driveway approaches.

1.02 SUBMITTALS

A. Cut sheets: Curb and gutter cut sheets must be submitted to and approved by the City Engineer. See Section 00 07 00.

B. Concrete mix design and physical-chemical analysis of aggregates, in accordance with Section 03 30 40 must be submitted 48 hours before placement.

C. Test reports: Submit test reports as requested by Engineer verifying compliance with specified standards. See Section 01 45 50.

PART 2 PRODUCTS

2.01 BACKFILL MATERIALS

A. Common fill, in accordance with Section 02 20 50.

B. Select fill, in accordance with Section 02 20 60.

2.02 **MATERIALS**: Materials used in Portland cement concrete and reinforcing of Portland cement concrete shall meet the following requirements:

A. In accordance with Section 03 30 40.

B. Reinforcing Steel: All bar material used for reinforcement of concrete shall be intermediate grade steel conforming to the requirements of ASTM Designation A-15 and shall be deformed in accordance with ASTM Designation A-305.

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

2.03 FORMS

A. 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.

B. Metal forms shall be used for curb and gutter work except at curves, unless continuous lay down machine is used.

C. All edge forms for sidewalk pavements, curbs and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade.

D. 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 deviated appreciably from the arc of the curve.

E. Exposed vertical and horizontal edges of the concrete in structures shall be chamfered by the placing of moldings in the forms.

2.04 **PORTLAND CEMENT CONCRETE**

A. In accordance with Section 03 30 40.

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Examine surfaces scheduled to receive concrete form work for defects that will adversely affect the execution of the work and deviations beyond allowable tolerances for installation of concrete material.

B. Do not start work until unsatisfactory conditions are corrected.

3.02 **PREPARATION**

A. Cut Sheets: Curb and gutter cut sheets must be provided and allow for proper drainage.

B. Joining to Existing Concrete: Cut existing concrete to provide a straight line. Make all cuts at score lines or expansion joints. If existing adjacent concrete slabs not scheduled for replacement are damaged by Contractor's operation, replace concrete at no cost to City.

C. Subgrade: A soils classification, as determined by AASHTO T-27 shall be made on the proposed subgrade and the following preparation schedule shall be followed based on that classification:

Sidewalk, Curb and Gutter, and Driveway Subgrade Preparation Schedule

Soil Classification	Requirement
A-1 or A-2	The subgrade shall be moistened and compacted in accordance with Section 02 25 00.
A-3 or A-4	The subgrade shall be over excavated a minimum of 4 inches and replaced with select granular material and be moistened and compacted in accordance with Section 02 25 00.
A-5, A-6, or A-7	The subgrade shall be over excavated a minimum of 6 inches, replaced with select granular material, and be moistened and compacted in accordance with Section 02 25 00.

1. No organic material, soft clay, spongy material, or other deleterious material will be permitted in the scarified or imported subgrade layer.

2. Rough subgrades shall be shaped and graded to within a tolerance of 0.10 feet of design grade and drainage shall be maintained at all times.

D. Compaction: As indicated, in accordance with Section 02 25 00.

E. Select Backfill: Unless indicated otherwise, provide 6” minimum of select fill below curbs, gutter, driveway approaches, alley intersections, and sidewalks.

F. Reinforcement and Embedded Items

1. 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.

2. 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.

G. Site Preparation

1. Before batching and placing concrete, all equipment for mixing and transporting the concrete shall be cleaned.

2. All debris and ice shall be removed from the places occupied by the concrete.

3. Forms shall be thoroughly wetted (except in freezing weather), or oiled.

4. Masonry filler units that will be in contact with concrete shall be well drenched (except in freezing weather).

5. Reinforcement shall be thoroughly cleaned of ice or other coatings.

6. Water shall be removed from spaces to receive concrete.

3.03 CONCRETE PLACEMENT

A. Place in accordance with Section 03 31 00.

B. No concrete shall be placed until the surfaces have been inspected and approved by the City Engineer.

C. When placing concrete on earth surfaces, the surfaces shall be free from frost, ice, mud, and water.

D. 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.

E. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing.

F. 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.

G. No concrete that is partially hardened or been contaminated by foreign material shall be deposited in the work, nor shall retempered concrete be used.

H. 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 forms.

I. Placing concrete in cold weather:

1. No concrete shall be poured where the air temperature is lower than 40 degrees Fahrenheit, at a location where the concrete cannot be covered or protected from the surrounding air.

2. When concrete is poured below a temperature of 35 degrees Fahrenheit the ingredients of the concrete shall be heated so that the temperature of the mixture shall not be less than 50 degrees or more than 100 degrees Fahrenheit.

3. Before mixing, the heated aggregates shall not exceed 175 degrees Fahrenheit.

4. Cement shall not be added while the temperature of the mixed aggregates and water is greater than 100 degrees Fahrenheit.

5. When there is likelihood of freezing during the curing period, the concrete shall be protected by means of an insulating covering to prevent freezing of the concrete for a period of not less than 7 days after placing.

6. 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.

7. 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 degrees Fahrenheit.

8. The housing, covering, or other protection used shall remain in place and intact at least 24 hours after the artificial heating is discontinued.

9. For a period of five days concrete shall be kept between 40 degrees and 100 degrees F.

3.04 CONCRETE MIXING

A. Concrete mix design must be submitted 48 hours before placement.

B. The concrete shall be mixed until there is a uniform distribution of the materials.

C. 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.

D. In no case shall the quantity of water used be sufficient to cause the collection of a surplus in the forms.

E. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set forth in Tentative Specifications for Ready-Mixed Concrete (ASTM C-95).

F. Concrete shall be delivered and deposited in its final position within 90 minutes after adding the cement and water to the mixture.

G. Washing out of mixer trucks shall not be permitted within city rights-of-way.

3.05 **CONTRACTION JOINTS**

A. Sidewalks shall have contraction joints with the following requirements:

1. 5 foot intervals.

2. Approximately 3/16 inch wide.

3. Approximately one-fourth of slab thickness.

B. Curb and Gutter shall have contraction joints with the following requirements:

1. Ten (10) foot intervals.

2. Approximately 3/16 inch wide.

3. Approximately one-half of slab thickness.

3.06 **EXPANSION JOINTS**

A. One-half (½) inch expansion joints shall be provided at 50 foot intervals in addition to locations where sidewalks adjoin existing sidewalks, curbs, or driveways.

B. Material for one-half (½) inch expansion joints shall be as defined in AASHTO M-33.

C. Expansion joints shall be installed with the top approximately one-quarter (1/4) inch below the concrete surface.

3.07 **SEALING OF EXPANSION AND CONTRACTION JOINTS**

A. Where the natural or finished ground surface slopes downhill from the curb or sidewalk, a sealant shall be placed in the full length of the contraction or expansion joint to prevent leakage of surface water and erosion of soil from under the joint.

B. The sealant shall be one of the following:

1. Polysulfide polymer by Thiokol Chemical Corporation.

2. Sonolastic one-part sealant by Sonneborn-Contech Corporation.

3. Or approved equal.

C. As an alternative to the above sealant a continuous film of 4 mil thickness water-proof plastic may be placed under all concrete sidewalks, curbs and gutters on the low sides of streets.

D. Other erosion prevention measures may be used as an alternate if the developer first obtains written approval from the City Engineer concerning the types of material and procedure of installation.

3.08 **FINISHING**

A. Refer to Section 03 34 50 for finishing requirements.

B. Slabs

1. The concrete shall be brought to established grade and screeded, and then worked with a magnesium float.

2. The concrete shall be given a light broom finish.

3. Dry cement or a mixture of dry cement and sand should in no case be sprinkled on the surface to absorb moisture or hasten hardening.

4. Surface edges of all slabs shall be rounded to a radius of one-half (½) inch.

C. Curb and Gutter

1. Curb and gutter shall be slipped with a continuous curb machine where possible.

2. Where concrete must be 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.

3. While the concrete is still green and not thoroughly set, the forms shall be removed and the front and top sides shall be finished with a float or steel trowel to make a uniform finished surface.

4. 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.

5. 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 centerline of the street nor shall any part of the exposed surface present a wavy appearance.

6. The sidewalk and curb shall be stamped in the following manner, showing locations of water, sewer, and pressure irrigation stub pipes.
   a. A “w” stamp for water.
   b. A “s” stamp for sewer.
   c. A “i” stamp for pressure irrigation.

7. High back Curb and Gutter will be used unless alternative is authorized by City Engineer.

D. Sidewalk:

1. The sidewalk 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 depart more than one-fourth (1/4) of an inch from a straight edge ten (10) feet in length, placed on the sidewalk parallel to the centerline of the street nor shall any part of the exposed surface present a wavy appearance.

3.09 **CURING**

A. Apply curing compound in accordance with Section 03 31 00 unless water cure is indicated. Water cure is required if concrete surface sealing compound is to be applied.

B. As soon as the concrete has hardened sufficiently to prevent damage, the finished surface shall be sprinkled with water or covered with sand or earth and, in either case, kept wet for at least three (3) days.

C. When authorized by the City Engineer, a chemical curing agent may be used, provided it is applied in accordance with the manufacturer's specifications.

3.10 PROTECTION AND REPAIRS

A. The concrete surface must not be damaged or pitted by rain.

B. 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.

C. The Contractor shall erect and maintain suitable barriers to protect the finished surface.

D. Any section damaged from traffic or other causes occurring prior to its official final acceptance shall be repaired or replaced by the Contractor at his own expense in a manner satisfactory to the City Engineer.

END OF SECTION

SECTION 02 60 70

MANHOLES AND COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular precast concrete manhole sections with tongue-and-groove joints covers, anchorage, and accessories.

1.02 RELATED SECTIONS Not used.

1.03 REFERENCES

A. AASHTO M-105: Gray Iron Castings.

B. AASHTO M-199: Precast Reinforced Concrete Manhole Sections.

C. ASTM C-923: Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.

1.04 SUBMITTALS FOR REVIEW

A. Shop Drawings: Indicate manhole locations, elevations, piping, and sizes and elevations of penetrations.

B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 GENERAL REQUIREMENTS

A. The Contractor shall furnish and install watertight cast-in-place or precast concrete manholes at the locations shown on the Drawings approved by the City Engineer.

B. Manholes shall be furnished complete with cast iron rings and covers.

C. Manhole spacing shall not exceed 400 linear feet.

D. Manholes shall be placed at the end of a stubbed line exceeding 50 feet in length.

E. Cleanouts shall not be substituted for manholes nor installed at the end of lines greater than 150 feet in length.

F. Cleanouts on sewer laterals shall be placed ever 50 and at all bends.

G. Flow Channels

1. The flow channel through manholes shall conform to the sewer.

2. The depth of flow channels should be up to one-half to three-quarters of the diameter of the sewer.

3. Adjacent floor area should drain to the channel with the minimum slope of 1 inch per foot.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:

1. Amcor Model

2. Geneva Pipe Model

3. W.R. White Model

4. Materials and Equipment: Product options and substitutions. Substitutions: Permitted with acceptance of City Engineer.

B. Manhole Sections: Reinforced precast concrete in accordance with AASHTO M-199 with gaskets in accordance with ASTM C-923.

C. Mortar and Grout: Type S.

2.02 COMPONENTS

A. Wall and Cone Sections

1. Manhole walls shall be constructed of 48" I.D. precast sectional, reinforced concrete pipe.

2. For pipelines of 18" diameter or larger, the manholes shall be 60" minimum I.D. Both cylindrical and taper sections shall conform to all requirements of AASHTO Designation M-170 for Reinforced Concrete Culvert Pipe with the following exceptions:
   a. The throat section of the manhole shall be adjustable by use of pipe sections up to 18 inches in height.
   b. The 48-inch inside diameter pipe used in the base section shall be furnished in section lengths of 1, 2, 3 and 4 feet as required.
   c. Reinforcing steel shall consist of a circular cage with a minimum cross sectional area of three-tenths (0.3) of a square inch of steel per foot in both directions.

3. All joint surfaces of precast sections and the face of the manhole base shall be thoroughly cleaned and wet prior to setting precast sections.

4. All joints including grade rings 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, or the joints shall be sealed with butyl rubber gasket that is permanently flexible and non-shrinking, similar to Brandt No. 95 Cold Weather Vault Sealant.

B. Manhole Steps

1. 12" Copolymer Polypropylene Plastic Steps

2. Reinforcement: ½" grade 60 steel reinforcement.

3. Steps must meet requirements outlined in ASTM 2146-68 under Type II, Grade 16906 and AASHTO M-31.

C. Concrete Base Pad

1. Except as noted below, manhole bases shall be pre-cast concrete conforming to the requirements of Section 03 31 00 of these Specifications.

2. For high ground water areas, precast manholes and bases shall be required.

3. Changes to direction of flow within a manhole shall be made with a smooth curve, as large of a radius as possible, and a minimum 0.2 feet of fall.

D. Lid and Frame

1. All iron castings shall conform to the requirements of AASHTO M-105 for grey iron castings.

2. Rings and covers shall have machined bearing surfaces and a minimum cover weight of 150 pounds and minimum ring weight of 250 pounds.

3. The foundry name, year of manufacture, and "WATER", or applicable utility, shall be marked on the cover as needed.

4. All manhole rings shall be carefully set to the grade shown on the approved drawings or as directed by the Engineer.

5. The manhole covers shall be so installed to be within 1/4" from the asphalt surface.

6. Ring and covers shall be frost proof.

7. MS-18 or H-20 loading in accordance with current AASHTO standards.

2.03 **CONFIGURATION**

A. Shaft Construction: Concentric with concentric cone top section; lipped male/female joints; sleeved to receive pipe sections.

B. Shape: Cylindrical

C. Clear Inside Dimensions: 48 inch as indicated.

D. Design Depth: As required.

E. Clear Lid Opening: 26 inches (660 mm) diameter.

F. Pipe and Conduit Entry: Provide openings as indicated required.

G. Steps: 12 inches (300 mm) wide, 16 inches (400 mm) on center vertically, set into manhole wall.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 PLACING MANHOLE SECTIONS

A. Place base pad, with top surface level.

B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Cut and fit for pipe as required.

D. Grout vase of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

E. Set cover frames and covers level without tipping, to correct elevations.

F. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 DROP TYPE MANHOLES

A. A drop pipe should be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert.

B. Where the difference in elevation between the incoming sewer and manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.

C. Drop manholes should be constructed with an outside wye drop connection. If an inside drop connection is necessary, it shall be secured to the interior wall of the manhole and provide access for cleaning.

D. Due to the unequal earth pressures that would result from the backfilling operation in the vicinity of the manhole, the entire outside drop connection shall be encased in concrete.

3.05 **SCHEDULES**

A. Storm Sewer Manholes: Precast concrete sections, copolymer polypropylene plastic steps, 48 inch inside dimension, to depth indicated, with bolted lid.

END OF SECTION

SECTION 02 60 90

GREASE AND SAND INTERCEPTOR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular precast concrete grease interceptor sections with joint covers, access holes, anchorage, cast iron ring, grate, and accessories.

B. Modular precast concrete sand interceptor sections with joint covers, access holes anchorage, cast iron ring, grate, and accessories.

1.02 RELATED SECTIONS Not used.

1.03 REFERENCES

A. AASHTO M-105: Gray Iron Castings.

B. AASHTO M-199: Precast Reinforced Concrete.

C. ASTM C-923: Resilient Connectors between Reinforced Concrete Structures and Pipes.

1.04 SUBMITTALS FOR REVIEW

A. Product Data: Provide ring & covers, component construction, features, configuration, and dimensions.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 GENERAL REQUIREMENTS

A. When determined by the Building Inspection department that grease control is required, per Chapter 10 of the International Plumbing Code, one of two types of control shall be used.

1. Grease Interceptors or (outdoor, gravity):
   a. Grease interceptors are required on all new building construction or retrofits with more than eight fixtures installed in the food preparation areas unless otherwise approved by the City.
   b. A sampling manhole shall be located below the downstream outlet.

2. Grease Traps or (indoor, hydro mechanical):
   a. Grease traps may be allowed on retrofits with minimal fixtures as approved by the City Engineer.
   b. Grease traps shall NOT be allowed if commercial dishwasher is installed in facility. However, the City may allow if a standalone grease trap on dishwasher oulet prior to discharge into sewer is properly installed.
   c. Grease traps shall be installed beneath the floor. Above floor grease traps shall not be allowed.

B. The Contractor shall furnish and install watertight cast-in-place or precast concrete grease interceptors and sand interceptors as required by the City Engineer or City Officials.

C. Grease interceptors and sand interceptors shall be furnished complete with cast iron rings and covers.

D. Design of grease and sand interceptors shall to be approved by City Engineer.

E. Flow Channels

1. The flow channel through Grease interceptors shall conform with the slope of the sewer.

2. Adjacent floor area should drain to the channel with the minimum slope of 1 inch per foot.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:

1. Amcor.

2. Geneva Pipe.

3. Dura-crete.

B. Grease interceptor Sections and sand interceptor: Reinforced precast concrete in accordance with AASHTO M-199 with gaskets in accordance with ASTM C923.

C. Mortar and Grout: Type S.

2.02 COMPONENTS

A. Grease Interceptors

1. Outdoor gravity grease interceptors shall have a minimum of two compartments.

2. The minimum size for grease interceptors shall be 750 gallons.

3. Wall Sections to be designed to meet ASTM C858 with AASHTO HS-20 loading:
   a. Interceptors shall be constructed of 6" thick precast reinforced concrete. Box size to be
   3-foot by 3-foot and the height as shown on plans. Provide grade rings as needed.
   b. Grease interceptor shall be designed to meet ASTM C-875 “minimum structural design loading for underground precast concrete utility structures. Box size to be 6-foot by 3-foot with 330 gallon capacity. Provide grade rings as needed.
   c. All joint surfaces of precast sections and the face of the walls, base, and grade rings shall be thoroughly cleaned and wet prior to setting precast sections.
   d. All joints including grade rings 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, or the joints shall be sealed with butyl rubber gasket that is permanently flexible and nonshrinking, similar to Brandt No. 95 Cold Weather Vault Sealant.

4. Lid and Frame:
   a. All iron castings shall conform to the requirements of H-20 loading for grey iron castings.
   b. Rings and grates shall have machined bearing surfaces and a minimum cover weight of 150 pounds and minimum ring weight of 233 pounds.
   c. The foundry name, year of manufacture, and "GREASE TRAP" shall be marked on the cover.
   d. All Grease interceptor and clean-out box rings shall be carefully set to the grade as shown on the approved drawings or as directed by the Engineer.
   e. Grate covers shall be so installed to be within 1/4" from the finished surface.
   f. A concrete ring 6" wide and 6" thick will be poured around lid in accordance with Section 03 30 40.

B. Grease Traps

1. Grease traps shall be an indoor hydro mechanical system.

2. A flow control device shall be installed upstream of the trap unless trap inlet pipe limits flow. Gravity flow capacity of pipes flowing full at ¼" slope: 2"=20gpm, 3"=60gpm, 4"=125gpm, 5'=203gpm, 6"=375gpm.

3. The minimum size for grease traps shall be 50 gallons per minute and 100 pound capacity.

4. The storage capacity of grease traps shall be a minimum of two times the flow capacity. The density of grease is approximately 7.3 lb/gal.

5. Grease traps shall be designed for peak flow.

6. Garbage disposals require solids separator prior to grease trap

2.03 **CONFIGURATION**

A. Shape: rectangular.

B. Design Size: design criteria to be submitted to the City Engineer for review.

C. Clear Great and Lid Opening: 24 inches diameter.

D. Pipe Inlet and Outlet: Pipe inlet and outlet to be grouted to eliminate infiltration and leakage.

PART 3 EXECUTION

3.01 **PLACING CONCRETE SECTIONS**

A. Place base pad, trowel top surface level.

B. Place Grease interceptor and sand interceptor plumb and level, trim to correct elevations, anchor to base pad.

C. Cut and fit for pipe as required.

D. Grout base of shaft sections to achieve slope to exit piping.

E. Provide grade rings and needed Trowel smooth. Contour as required.

F. Set cover frames and covers level without tipping, to correct elevations.

3.02 **SCHEDULES**

A. Grease interceptors and sand interceptors: Precast concrete sections, copolymer polypropylene plastic steps, to depth indicated, with tamper proof lid.

END OF SECTION

SECTION 02 66 00

PIPELINE TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing requirements for potable and non-potable water piping systems and sanitary sewers.

1.02 DEFINITIONS

A. Leakage: The quantity of water required to maintain the specified hydrostatic test pressure after the pipeline has been filled with water and the air expelled.

B. Non-rigid Pipe: Any pipe which required bedding and backfill material for structural support.

1.03 SUBMITTALS

A. Pipeline Test Report: Include the following items:

1. Type of test.
2. Identification of pipe system.
3. Size, type, location and length of pipe in test section.
4. Test pressure and time.
5. Amount of leakage versus allowable.
6. Date of test approval.
7. Signature of test supervisor.
8. Signature of the City Engineer or City Water Superintendent witnessing and approving the test.
9. One copy of video tape.

1.04 PROJECT CONDITIONS

A. After construction of sanitary sewer lines, they shall be thoroughly cleaned and tested for leakage and alignment, according to the specifications in section 02 66 00, in the presence of the City Engineer or the City Inspector before acceptance by the City.

B. Repair pipeline system at no additional cost to City until it passes subsequent retesting.

C. Recording Equipment:

1. Supply all necessary equipment to perform pressure testing.
2. Secure City's approval of pressure gages.

3. Locate all gages and recording equipment away from affect of sunshine or other weather conditions.

4. Place, vents, pressure taps and drains for the test. Repair pipeline at the completion of the test at no cost to City.

PART 2 PRODUCTS

2.01 TESTING MATERIALS

A. Medium: Water or air, as required by test.

B. Equipment: Temporary motors, pumps, pumping apparatus, pressure gages, connections, power, etc. for making the tests.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify City Engineer or City Water Superintendent 48 hours in advance of test.

B. Carry out tests as pipeline construction progresses to ensure construction methods are producing satisfactory results.

C. Pipeline pressure and leakage testing shall be done in accordance with AWWA standards. AWWA C600-99 for ductile iron pipes and AWWA C605-94 for PVC pipes.

3.02 PRESSURE TEST

A. Test pressure may be limited by valves, or other lower pressure rated components. Such components may not withstand the required test pressure. They should be either removed, or isolated from the test section to avoid possible damage, or failure of these devices. Isolated equipment should be vented.

B. Expel all air from the pipeline before applying the specified test pressure. Provide air release taps at points of highest elevations before testing. Insert permanent plugs after test has been completed.

C. A minimum pressure 50% in excess of the maximum line operation pressure shall be maintained on the portion being tested for a minimum period of two hours, using hydraulic means to maintain the pressure.

D. Maximum leakage during the test shall not exceed 0.092 gallons per inch of diameter per 1000 feet of pipe per hour, for non-polyethylene pipe.

E. Polyethylene pipe testing:

1. For polyethylene pipe test pressure is 1.5 times the system operating design pressure, the total test time including initial expansion, and time at test pressure, must not exceed eight (8) hours. **If the test is not completed due to leakage, equipment failure, etc., depressurize the test section, then allow it to "relax" for at least eight (8) hours before bringing the test section up to test pressure again.**

2. The test procedure consists of initial expansion, and test phases. During the initial expansion phase, the test section is pressurized to the test pressure, and enough make-up liquid is added each hour for three (3) hours to return to test pressure.

3. The test phase follows immediately, and may be two (2), or three (3) hours. At the end of the test time, the test section is returned to test pressure by adding a measured amount of liquid. If the amount of make-up liquid added does not exceed the following values leakage is not indicated:

Phase Make Up Amount

Nominal Pipe Size (IPS) (in.)	Make-Up Water Allowance (U.S. Gallons/ 100 ft. Pipe)	
	2 hour test	3 hour test
1 1/4	0.10	0.16
1 1/2	0.10	0.17
2	0.11	0.19
4	0.25	0.40
6	0.6	0.9
8	1.0	1.5
10	1.3	2.1
12	2.3	3.4
14	2.8	4.2
24	8.9	13.4

4. An alternate leakage test consists of initial expansion, and test phases. For the initial expansion phase, make-up water is added as required to maintain the test pressure for three (3) hours. For the test phase, the test pressure is reduced by 10 psi. If the pressure remains steady (within 5% of the target value) for an hour, no leakage is indicated.

F. Suitable means shall be provided by the Contractor for determining water lost by leakage under the test pressure.

G. Locate and repair the defective joints and retest until the leakage is within the specified allowance.

H. Repair any noticeable leakage even if total leakage is less than allowable.

I. Flushing:

1. After pressure testing all pipelines shall be flushed.

2. Flushing shall be accomplished through hydrants or, if a hydrant does not exist at the end of the line, the Contractor shall install a tap of sufficient size to provide for a 2.5 foot per second flushing velocity in the line.

3. The following is the flow quantity required to provide a 2.5 foot per second flushing velocity:

Pipe Size (In.)	Flow (gpm)
4	100
6	220
8	390
10	610
12	880
16	1,567
24	3,525

3.03 **ALIGNMENT AND GRADE TEST**

A. No variance will be allowed from line and grade in excess of 1/32" per inch of pipe diameter or ½" maximum provided that such variation shall not result in a level or reverse sloping invert.

B. Variations in invert elevations between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surface shall not exceed 1/64" per inch of pipe diameter, or ½" maximum.

3.04 **OBSTRUCTION TEST**

A. Visually examine pipe internally for obstructions by use high power light or mirror.

B. When required by the City Engineer, a round incompressible mandrel 1" less in diameter than the internal pipeline diameter and 2 times the diameter in length will be passed through the pipeline.

3.05 **NON-RIGID PIPE DEFLECTION TEST**

A. When required by the City Engineer, test installed sections of non-rigid pipeline to ensure that circumferential deflection does not exceed 5 percent of the average inside diameter using a rigid mandrel with a circular cross section pulled through the pipe by hand.

3.06 **INFILTRATION TEST**

A. No pipe section will be accepted if the infiltration rate exceeds 100 gallons per inch diameter per mile per 24 hours.

3.07 **PIPELINE PIGGING**

A. All Sanitary Sewer lines will be pigged to clean the line and to ensure that it can be done in the future if necessary. This will be accomplished under the supervision of the City Water Department before the Sewer line will be accepted. If the line cannot be pigged, the Contractor will remedy the problem at his cost.

3.07 **FLUSHING OF SANITARY SEWERS**

A. All sanitary sewer lines shall be flushed and cleared prior to acceptance by the City.

B. Flushing

1. Laterals and trunk lines shall be flushed by water to remove all foreign material.

2. Wastewater and debris shall not be permitted to enter sewer lines in service, but shall be removed at the lowest manhole of the extension.

3. Other methods of cleaning may be used upon approval of the City Engineer.

4. After the lines have been thoroughly cleaned, they shall be tested between all manholes for displacement.

3.08 LEAKAGE TESTS FOR SANITARY SEWERS

A. General Requirements

1. The contractor shall test all sanitary sewers by means of an exfiltration test.

2. Length of the line tested at one time shall be limited to the length between adjacent manholes.

B. Testing with Water

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 of the upper manhole with stoppers.

2. The pipe and manhole shall be filled with water to a point approximately 4-feet above the invert of the sewer at the center of the upper manhole.

3. The allowable leakage will be computed by the formula:

$$E = 0.25\ D\ H$$

Where:

E = Allowable leakage in gallons per minute per 1000 feet of sewer tested.
D = Internal diameter of the pipe in inches.
H = Difference in elevation in the water surface in the upper manhole and the invert of the pipe at the lower manhole (feet).

4. Leakage from the sewer, as shown by the test, which exceeds that allowed by the formula will be corrected by the Contractor to reduce the exfiltration to within permissible limits.

5. Where the difference in elevation between inverts of adjacent manholes exceeds 10-feet, the exfiltration leakage test will be modified as directed by the City Engineer.

6. House surface laterals shall be considered part of the main sewer to which they are connected and shall be tested with the main line sewer.

C. Testing with air

1. Air pressure may be used in lieu of the water exfiltration test subject to the approval of the City Engineer.

2. The low pressure air test shall be conducted by the following method under the direction of the City Engineer or City Inspector with equipment equal to Cherne Industrial, Inc.

3. All wyes, tees, or ends of lateral stubs shall be suitably capped and braced to withstand the internal test pressures. Caps shall be easily removable for future lateral connections or extensions.

4. After a manhole to manhole section of line has been backfilled and cleaned, it shall be plugged at each manhole with pneumatic plugs. One of the plugs shall have three hose connections. Air for inflation of the triple connection pneumatic plug shall be supplied through a factory-equipped control panel. There shall be three hose connections from the control panel to the pneumatic plug. One hose shall be used for inflation of the plug. The second hose shall be used for continuously reading the air pressure in the sealed line. The third hose shall be used for introducing low pressure air into the sealed line.

5. There shall be a 3-1/2" or larger diameter, 0.30 psig gauge mounted on the control panel for reading of the internal pressure in the line being tested. Calibrations from the 0-10 psig range shall be in tenths of pounds and the 0-10 psig portion shall cover 90% of the complete dial range.

6. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe.

7. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (3.5 psig minimum pressure in the pipe), the third hose shall be disconnected from the control panel.

8. The pipe and joints shall also be considered acceptable when the time required in minutes for pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following tables:

Pipe Diameter (in Inches)		Minutes
4		2.0
6		3.0
8		4.0
10		5.0
12		5.5
15		7.5
18		8.5
21		10.0
24		11.5

9. If the installation fails to meet this requirement, the Contractor shall determine at his own expense the source of leakage.

10. The Contractor shall repair or replace all defective materials and/or workmanship.

3.09 **VIDEO TEST**

A. The video test shall be supervised and witnessed by the City Engineer or the City Inspector and shall be done as follows:

1. The lines and lateral connections will be televised at the cost of the Developer until the lines are accepted by the City.

2. Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected at the Developers expense. The maximum acceptable limits for 8 to 10 inch pipes are: 0.25 inches for joint separations, 0.5 inches for low spots, and 0.25 inches for chipped ends.

3. Any and all pipes with flat or reverse grade will not be accepted by Roosevelt City.

4. If the pipeline is found unacceptable, the problem shall be corrected by the contractor and re-televised.

5. The television inspection process shall be done immediately after running water in the pipe and no visible discharge occurs at the downstream manhole.

6. Television inspection must be scheduled at least one (1) week in advance of date inspection is required.

7. All video shall be turned over in an approved digital format and become the property of the City.

8. After cleaning and inspection have been completed and any defects are corrected and accepted, the lines shall be tested for leakage by methods discussed in Section 3.08.

3.10 PIPE TESTING SCHEDULE

A. Irrigation:

1. Alignment and grade test.

2. Pressure test.

3. Operational Testing:
   a. Perform operational testing after hydrostatic test is complete, backfill is in place and sprinkler heads adjusted to final position.
   b. Demonstrate system meets coverage requirements and automatic controls function properly.
   c. Coverage requirements are based on operation of 1 circuit at a time.

B. Sanitary Sewers:

1. Displacement test.

2. Pipeline Pigging.

3. Pressure test for gravity pipeline systems.

4. Pressure test for pressure pipeline systems.

5. Video test for sanitary sewers.

C. Subdrains:

1. Alignment and grade test.

2. Obstruction test.

3. Non-rigid pipe deflection test (if applicable)

D. Storm Drains:

1. Alignment and grade test.

2. Obstruction test.

3. Non-rigid pipe deflection test (if applicable).

4. Pressure test for pressure pipeline systems.

E. Potable Water System:

1. Obstruction test.

2. Pressure test.

END OF SECTION

SECTION 02 67 50

DISINFECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disinfection of potable water system.

B. Test and report results.

1.02 REFERENCES

A. AWWA A100: AWWA Standard for Water Wells.

B. AWWA B300: AWWA Standard for Hypochlorites.

C. AWWA B301: AWWA Standard for Liquid Chlorine.

D. AWWA C651: AWWA Standard for Disinfecting Water Mains.

E. AWWA C652: AWWA Standard for Disinfection of Water-Storage Facilities.

F. State of Utah: Public Drinking Water Regulations, Part 2, Section 12.

1.03 DEFINITIONS

A. Disinfectant Residual: The quantity of disinfectant in treated water.

B. ppm: Parts per million.

1.04 SUBMITTALS

A. Contractor's evidence of experience in disinfection.

B. Bacteriological laboratory's evidence of certification.

C. Disinfection Report: 3 copies including:

1. Date issued.

2. Project name and location.

3. Treatment contractor's name, address and phone number.

4. Type and form of disinfectant used.

5. Time and date of disinfectant injection started.

6. Time and date of disinfectant injection completed.

7. Test locations.

8. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.

9. Time and date of flushing start.

10. Time and date of flushing completion.

11. Disinfectant residual after flushing in ppm for each outlet tested.

D. Bacteriological Report: 3 copies including:

1. Date issued.

2. Project name and location.

3. Laboratory's name, certification number, address, and phone number.

4. Time and date of water sample collection.

5. Name of person collecting samples.

6. Test locations.

7. Time and date of laboratory test start.

8. Coliform bacteria test results for each outlet tested.

9. Certification that water conforms or fails to conform to bacterial standards of State of Utah public drinking water regulations.

10. Bacteriologist's signature.

1.05 **QUALITY ASSURANCE**

A. Affidavit by manufacturer that disinfectant conform to AWWA standards.

B. Bacteriological Laboratory: Certified by State of Utah.

1.06 **PRODUCT HANDLING**

A. Store and protect disinfectant in accordance with manufacturer's recommendations to protect against damage or contamination. Do not use unsuitable disinfectant.

B. Follow all instruction labeling for safe handling and storage of disinfectant materials.

1.07 **REGULATORY REQUIREMENTS**

A. Conform to State of Utah public drinking water regulations.

PART 2 PRODUCTS

2.01 **DISINFECTANT**

A. Liquid Chlorine: AWWA B301 with chlorine 99.5 percent pure by volume.

B. Sodium Hypochlorite: AWWA B300 with not less than 100 grams per liter available chlorine.

C. Calcium Hypochlorite: AWWA B300 with 65 to 70 percent available chlorine by weight in granular form.

D. Powder, tablet, or has according to manufacturer's specification.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to starting the disinfection procedure ensure the potable water system is completed, cleaned, tested in accordance with Section 02 66 00 and ready for disinfection.

B. Ensure that the pipeline to be disinfected is not connected to the existing system.

3.02 DISINFECTION OF WATER LINES

A. Use the approved methods in AWWA C651.

B. Disinfecting solutions containing chlorine should not exceed 12% active chlorine, because greater concentration can chemically attack and degrade polyethylene.

C. Chlorination shall provide a minimum of 25 ppm residual after 24-hours contact in the pipeline. In general, this residual may be expected with an application of 50 ppm although some conditions may require more.

D. Chlorine, in the form of a 1% slurry of high test calcium hypochlorite (HTH, Perchloron, Pittchlor, etc.) shall be fed into the pipeline in such a manner as to mix with the water flowing in the pipeline. (A 1% slurry results from mixing 1 pound of the calcium hypochlorite with 7.50 gallons of water.)

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

Pipe Size (In.)	Vol. Of 100 Ft. Length (gal.)	Required Amount of Slurry (gal.)
4	65	0.33
6	147	0.74
8	261	1.3
10	408	2.0
12	588	3.0
16	1044	5.2

F. During the process of chlorinating the pipeline all valves and other pipeline appurtenances shall be operated several times to provide sufficient contact with the chlorinating agent.

3.03 **DISINFECTION OF CULINARY WELLS**

A. Use one method defined under AWWA A100 as approved by City Engineer.

B. Do not start disinfection until well is thoroughly cleaned.

C. Use a disinfecting solution containing a minimum of 50 ppm residual chlorine.

3.04 **DISINFECTION OF WATER STORAGE RESERVOIRS**

A. Use one method defined under AWWA C652, as approved by City Engineer.

B. Do not start disinfection until water storage tank is thoroughly cleaned.

C. Provide and use necessary safety equipment for workers in contact with disinfectant or gasses they may produce.

3.06 **QUALITY CONTROL - BACTERIOLOGICAL TEST**

A. No samples for testing shall be taken sooner than 24 hours after system flushing.

B. Sample water at each of the following locations, as applicable:

1. Where water enters system.

2. Ends of piping runs.

3. Remote outlets.

C. Analyze water samples in accordance with State of Utah requirements.

D. If bacteriological test proves water quality to be unacceptable, repeat system treatment.

E. Water systems shall not be accepted or placed into service until a negative bacteriological test is made on water taken. Repeat dosing as necessary until a negative test is obtained. Provide a copy of the negative bacteriological test to City Engineer.

F. It shall be the developer's responsibility to submit and pay for the bacteriological test.

3.07 **FLUSHING AND DISPOSAL OF DISINFECTANT**

A. After the 24 hour retention period, flush the chlorinated water from the main until chlorine measurements show the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.

B. Legally dispose of disinfecting water and ensure no chlorine buildup or damage to the environment.

C. If the Contractor fails to flush the line as specified above, the Contractor may be required to replace all valves and gaskets within the system at the Contractor's expense.

END OF SECTION

SECTION 02 77 20

PONDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of pond site and disposal of debris and unsuitable material.

B. Materials for dike.

1.02 REFERENCES

A. AASHTO M 145: Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures of Highway Construction Purposes.

1.03 SUBMITTALS

A. Laboratory analysis report of fill to be used in dikes in accordance with the sections referenced in this section and AASHTO M 145.

1.04 PERFORMANCE REQUIREMENTS

A. Protection: Do not contaminate embankment materials with debris or unsuitable material. Protect existing improvements, trees, structures or other items from damage during construction.

B. Dust Control: Thoroughly moisten all surfaces to prevent dust being a nuisance to the public, neighborhood, and concurrent performance of separate work on site.

C. Testing: 1 density test for each 100 square yard lift of backfill compacted in the Work.

1.05 JOB CONDITIONS

A. Do not interrupt surface drainage systems at site without City Engineer's approval.

B. Correct any damage caused by runoff or erosion during construction.

PART 2 PRODUCTS

2.01 BACKFILL SOILS

A. Native Material: In accordance with Section 02 20 50.

B. Common Fill: In accordance with Section 02 20 50.

C. Select Fill: In accordance with Section 02 20 60.

D. Impermeable Embankment: A-6 (CL), or A-4 (CL) material as defined in AASHTO M 145 with a plasticity index of at least 10, and a coefficient of permeability of less than 7 x 10-6 cm/sec.

E. Obtain City Engineer's approval of the material to be supplied prior to beginning construction.

2.02 GEOTEXTILE MATERIALS

A. Nonbiodegradable sheet material that is inert to soil chemicals, resistant to molds, mildew, acids and alkalies, and within a pH range of 3 to 12.

PART 3 EXECUTION

3.01 EXCAVATION AND PREPARATION

A. In accordance with Section 02 22 50.

B. Remove and stockpile all topsoil material for later placement on the outer dike surfaces.

C. Level areas where dikes are to be constructed. Unless indicated otherwise scarify the top 12" of the base material and compact to a minimum Standard Proctor of 92 percent in accordance with Section 02 25 00.

D. Detention Ponds shall be designed to contain the minimum volume of runoff produced by the 50 year 24 hour storm. The pond shall have a designed overflow capable of safely passing a 100 year 24 hour storm.

3.02 EMBANKMENT CONSTRUCTION

A. Compact backfills to an average Standard Proctor density of 96 percent in accordance with Section 02 25 00 with no single density reading less than 92 percent.

B. Place embankment materials in lifts consistent with the compaction equipment used.

C. Do not construct embankment with frozen or unapproved material.

D. Shape dikes to the slopes indicated not steeper than 3:1 interior and 3:1 exterior slopes.

E. Top of bank shall not be less than 12' wide with a 2% slope toward pond.

F. A minimum of 2' free board shall be maintained during the storm event.

G. Overflow shall be provided to convey storm water runoff to a safe location that will not cause harm to the public.

H. Embankments in excess of 8’ higher than existing ground require geotechnical engineer’s recommendations and approval.

I. Ponds with volume in excess of 1 acre-foot shall have embankment design approval by a geotechnical Engineer.

3.03 TOLERANCES

A. Dike Surface: Plus or minus 1" from true line and grade.

B. Dike Width: Plus or minus 6" from true line and grade.

3.04 **FINISHING**

A. After dikes have been constructed to the lines and grades indicated, spread topsoil 6" deep on dikes and grade to uniform slope.

B. Pond shall be replanted with native occurring grass.

C. Dispose of excess or unsuitable materials and level all affected areas.

D. Leave site free of excess fill material and debris.

B. Pond inlets and outlets shall have trash racks or grates installed. A storm water pretreatment device, approved by the City, shall be installed upstream of the pond inlet.

3.05 **DETENTION PONDS**

A. Ponds shall be designed as attractive and usable spaces; i.e. depths 5 feet or less where feasible, appropriate landscaping, and elements that eliminate standing water and low flow impacts as required by the City Engineer.

C. Easements: Provide 20-foot easements for pipelines and access to maintain ponds. When located on private property, provide an easement over the pond area and 10 feet beyond the pond perimeter. Pond easements shown on subdivision plats shall be labeled with dimensions to facilitate relocation.

3.06 **DETENTION PONDS**

A. Retention Pond will only be allowed if adequate drainage for a Detention Pond is unavailable.

B. Retention Pond shall be designed for a minimum of a 100 year, 24 hour storm with appropriate features for maintaining water quality and percolating water into the ground. Percolation test results shall be provided and ponds shall be designed with sumps to completely drain within a 72 hour period unless otherwise approved by the City.

END OF SECTION

SECTION 02 83 20

FENCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chain Link Fence.

B. Wood Fence.

C. Construction Fence.

D. Barbed Wire Fence.

1.02 RELATED SECTIONS

A. Section 03 30 40: Concrete anchorage for posts.

B. UDOT Section 02822: Right of Way Fence and Gate.

1.03 REFERENCES

A. ASTM A116: Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.

B. ASTM A121-07: Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.

C. ASTM A121-99: Standard Specification for Zinc-Coated (Galvanized Steel Barbed Wire).

D. ASTM A123: Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM A392: Zinc-Coated Steel Chain-Link Fence Fabric.

F. ASTM A569: Commercial Grade Steel.

G. ASTM A702: Standard Specification for Steel Fence Posts and Assemblies.

H. ASTM F567: Installation of Chain-Link Fence.

I. ASTM F573: Residential Zinc-Coated Steel Chain Link Fence Fabric.

J. ASTM F1083: Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

K. ASTM F1234: Protective Coating on Steel Framework for Fences.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM F567.

PART 2 PRODUCTS

2.01 CHAIN LINK FENCE MATERIAL AND COMPONENTS

A. Framing (Steel): ASTM F1083 Schedule 40 galvanized steel pipe, welded construction, coating conforming to ASTM F1234 Type A on pipe exterior and interior.

B. Fabric Wire (Steel): ASTM A392 zinc coated wire fabric.

C. Concrete: Type specified in Section 03 30 40.

D. Line Posts: 1.9 inch O. D. galvanized pipe at 2.72 lbs per foot.

E. Corner, Gate, Pull, and Terminal Posts: 2.4 inch O.D. galvanized pipe at 2.65 lbs. Per foot.

F. Top Rail: 1.4 inch diameter, plain end, sleeve coupled.

G. Brace Rail: Minimum 1.6 inch O.D. galvanized pipe and adjustable 3/8 inch truss

H. Tension Wire: 7 gage, Bottom only.

2.02 WOOD FENCE MATERIAL AND COMPONENTS

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

B. Bottom and top rail: Minimum 2x4x8 cedar stud.

C. Corner, Gate, End, or Line Posts: Minimum size 4x4 cedar wood post.

D. Concrete: Type specified in Section 03 30 40.

2.03 CONSTRUCTION FENCE MATERIAL AND COMPONENTS

A. Material:

1. Fabric to be wire mesh which shall conform to AASHTO Designation M-279, 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.

2.04 BARBED WIRE FENCE MATERIAL AND COMPONENTS

A. Angles, posts, braces and wire shall be steel. Bolts, hardware and other parts shall be steel, malleable iron or ductile iron.

B. Wire:

1. Barbed wire shall conform to the requirements of ASTM A121 with a Class I coating. Barbed wire shall consist of two strands of No. 12-1/2 gauge copper-bearing steel wire with large four point hard temper round barbs spaced approximately 5 inches apart.

2. Tie wires for fastening barbed wire to steel posts shall be No. 12 gauge copper-bearing steel wire. Tie wires shall be heavily galvanized by the hot-dip process.

3. Stays shall be No. 9-1/2 gauge copper-bearing steel wire conforming to the requirements of ASTM A116. Stays shall be 42 inches long.

C. Angles, Posts and Braces: Angles and braces shall be fabricated from rail, billet or commercial grade steel which conforms to the requirements of ASTM A569. T-beam section posts shall be fabricated from rail, billet or commercial grade steel which conforms to the requirements of ASTM A702. Angles and braces shall be galvanized by the hot-dip process after fabrication. Angles and braces conforming to ASTM A569 shall be triple coated with a minimum of 0.9 ounces per square foot of zinc, 15 micrograms per square inch of chromate and 0.3 mils of polyurethane finish. T-beam section line posts conforming to ASTM A702 shall be painted with three (3) coats of an anti-corrosive aluminum paint or suitable substitute to prevent corrosion.

1. Corner and intermediate brace posts and braces shall be angles of the dimensions and length indicated on the Standard Drawings.

2. Line posts shall have a minimum weight of 1.33 pounds per foot excluding the anchor plates. Line posts shall be T-beam sections of the length indicated on the Standard Drawings. Line posts shall have corrugations, ribs or notches spaced at approximately one inch on center to hold the fence wire in the spacing designated on the Standard Drawing. Anchor plates shall have a minimum of 18 square inches of area and shall weigh not less than 2/3 pounds each. They shall be welded or riveted to the section so as to prevent displacement when the posts are driven.

D. Fittings: Fittings, hardware and appurtenances for fences shall be commercial quality steel, malleable iron or wrought iron which shall be galvanized in accordance with ASTM A153.

E. Gates: Gate frames shall be nominal 1-1/2 inch, 1.900 inch O.D. galvanized high carbon-welded tubing with internal bracing of nominal 1-1/4 inch, 1.660 inch O.D., galvanized high carbon-steel tubing welded at all joints to provide rigid water-tight construction. Gate fabric shall be No. 11 gauge copper bearing open-hearth steel wire, woven in a 2-inch mesh, and heavily galvanized by the hot-dip process after weaving. Gates shall be 4-feet high and shall be furnished with pivot-type hinges and center stop. Gates shall provide clear openings as shown on drawings. Latches are required only if called out for in the contract.

F. Gate Posts: Gate posts shall be nominal 2-1/2 inch, 2.875 inch O.D. galvanized steel pipe.

PART 3 EXECUTION

3.01 CHAIN LINK FENCE INSTALLATION

A. Line Pole Spacing, Straight run, tangents or curves:

1. Uniform spacing. Maximum 10 feet.

2. 100-foot radius or less, maximum 5 feet.

3. 100 to 200 foot radius, maximum 6 feet.

4. 200 to 500 foot radius, maximum 8 feet.

B. Set posts plumb, in concrete footings with top of footing 2 inches above finished grade. Slope top of concrete for water runoff.

C. Line Post Footing: Minimum 6 inches of concrete below bottom of post, 8 inches in diameter.

D. Corner, Gate, Pull, and Terminal Post Footing: Minimum 6 inches of concrete below bottom of post, 10 inches in diameter. Changes in line of more than 30 degrees shall be considered as corners.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

F. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

G. Do not stretch fabric until concrete foundation has cured 7 days.

H. Stretch fabric between terminal posts or at intervals of 500 feet maximum, whichever is less.

I. Position bottom of fabric 2 inches above finished grade and on a straight grade between posts. Excavate if necessary, fill only with approval of City Engineer.

J. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

K. Fence fabric shall be placed on road side of posts unless otherwise indicated.

3.02 WOOD FENCE INSTALLATION

A. 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.

B. The maximum distance between posts in any section shall not exceed eight (8) feet. The top and bottom railing 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.

C. 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 depression 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 railing shall be done with two (2) galvanized nails and screw at both the top and bottom rail.

3.03 CONSTRUCTION FENCE INSTALLATION

A. Construction Methods:

1. Metal fence posts shall be a spaced a maximum interval of sixteen (16) feet. Posts 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.

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

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

4. 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.

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

3.04 BARBED WIRE FENCE INSTALLLATION

A. Preparation

1. The Contractor shall perform all clearing and grubbing necessary to construct the fence in the required alignment and at the required grade prior to fence construction.

B. Erection

1. Fence erection, including all connections shall be done in accordance with the Manufacturer's written instructions.

C. Concrete: Concrete foundations for intermediate brace posts and corner posts shall be circular in horizontal section, not less than the angle dimension plus 9 inches in diameter and 3'-6" deep. Concrete foundations for braces shall be circular in horizontal section, not less than 24 inches in diameter and 12 inches deep. Where the Standard Drawings require that posts and braces be embedded in concrete, the Contractor shall install temporary guys or braces such that posts and braces will be held in the proper position until the concrete has set sufficiently to hold them in the proper position. No materials shall be installed on posts and braces set in concrete and no strain shall be placed on guys or bracing until seven days have elapsed from the time of placing the concrete. The Contractor shall insure that the concrete has sufficiently cured prior to pulling the wire. Excavation for footings and anchors shall be to the dimensions required to place concrete in the dimensions indicated herein.

D. Posts: All corner posts, line posts and intermediate brace posts shall be set plumb and shall be spaced in the line of the fence not to exceed 16-foot centers. All posts shall be set or driven to a depth not less than 36 inches.

1. Metal line posts may be driven.

2. Corner and intermediate brace posts shall be set in concrete.

3. Intermediate brace posts shall be placed at intervals not less than 100 feet and not more than 600 feet and shall be spaced evenly between corner and gate posts.

E. Barbed Wire: Fence wire shall be stretched by mechanical stretcher or other devices designed for this use. Stretching by motor vehicle will not be permitted. The length between pull posts shall not exceed 100 feet.

F. Stays: Stays shall be twisted into place in accordance with the manufacturer's written instructions at the spacing indicated in the Standard Drawings.

G. Bolts and Hardware: All nuts, bolts and tie wires shall be securely fastened to preclude surreptitious removal and shall be placed to assure visual evidence of tampering.

H. Painting: Surfaces that have been cut or filed or surfaces where the galvanized coating has been broken or damaged shall be painted with three coats of an anti-corrosive aluminum paint or suitable substitute to prevent corrosion.

I. Clearance: Provide suitable closures approved by the Engineer at irregularities in grade such as curbs or ditches. Vertical posts shall not exceed 6 inches open space to the adjacent post or solid structure.

END OF SECTION

SECTION 02 97 00

PETROLEUM CONTAMINATED SOILS HANDLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification of petroleum contaminated soils.

B. Provisions for excavation, segregation, and disposal of petroleum contaminated soils encountered in excavation.

C. Pipe material and gasket requirements.

D. Backfill and compaction operations.

1.02 REFERENCES

A. Not Used.

1.03 DEFINITIONS

A. Petroleum Contaminated Soils: Native soils which contain petroleum products including, but not limited to: gasoline, heating oil, kerosene, diesel fuel, jet fuel, lubricating oils, motor oils, greases, and other fractions of crude oil. These materials may or may not be classified as hazardous waste. Characterization of materials will be performed at the direction of Engineer.

1.04 STORAGE AND HANDLING

A. Contaminated soils shall be segregated from uncontaminated soils and promptly removed from the project site to an approved storage site until disposal is arranged.

B. All contaminated soils shall be covered during transport or storage with waterproof tarpaulins to prevent runoff or spillage.

PART 2 PRODUCTS

2.01 PIPE AND GASKET MATERIALS FOR CONTAMINATED SOIL AREAS

A. Pipe material shall be Ductile Iron as specified in Section 15 00 00 Water Transmission and Distribution Systems.

B. Pipe and Valve Gaskets to be Nitrile gaskets per Section 15 05 20 Basic Piping Materials and Methods.

2.02 FLOWABLE FILL BEDDING

A. In presence of contamination, piping shall be bedded with Flowable Fill per Section 02 24 50 and as indicated in Plans.

PART 3 EXECUTION

3.01 IDENTIFICATION

A. Promptly notify Engineer when contaminated soils are encountered in excavation.

B. Testing and sampling may be required by Engineer for positive identification and classification.

3.02 DISPOSAL

A. Dispose of contaminated soils at a location approved by Engineer or the County landfill with approval by Duchesne County.

B. Cover soils in trucks during transport or storage with waterproof tarpaulins to prevent runoff or spillage.

3.03 OPERATIONS

A. In sections of trench which encounter contaminated materials, trench backfill, pipe materials, and compaction shall conform with Sections 02 20 50, 02 20 60, 02 22 50, 02 25 00.

END OF SECTION

SECTION 02 97 50

ASBESTOS CEMENT PIPE DEMOLITION AND DISPOSAL OR ABANDONMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Demolition and disposal, or abandonment of asbestos cement pipe (ACP) conducted in a safe work environment. ACP pipe is also known as transite pipe.

B. Anticipated existing ACP pipe locations are including but not limited to (these are best guess from old Roosevelt City Records):

1. 200 North – 500 West to 100 East.

2. 300 West – 200 North to 300 North.

3. 200 West – 100 North to 300 North.

4. 100 West – 100 North to 300 North.

1.02 REFERENCES

A. Except as otherwise indicated, the current editions of the following apply to the work of this Section.

1. AWWA C400 – Asbestos-Cement Transmission Pipe 4 inch through 16 inch for Water and Other Liquids.

2. Controlling Government Regulation A - OSHA's Construction Industry Standard for Occupational Exposure to Asbestos Subpart Z, 29 CFR 1926.1101 Asbestos, with the ACP pipe removal being done utilizing a valid Negative Exposure Assessment (NEA).

3. Controlling Government Regulation B – National Emissions Standards for Hazardous Air Pollutants (NESHAP)

PART 2 PRODUCTS

2.01 GENERAL

A. ACP installations, shall not be considered.

PART 3 EXECUTION

3.01 GENERAL

A. Prior to commencing any preparation of the work areas for asbestos disturbance, the Contractor shall post all required documents, warning signs, and as necessary, erect physical barriers to secure the work area.

B. The Contractor has sole and primary responsibility for the "means and/or methods" of the work, for the inspection of the work at all stages, and for the supervision of the performance of the work.

C. The Contractor shall be responsible for site safety and for taking all necessary precautions to protect the Contractor's workers, City of Roosevelt personnel, and the public from asbestos exposure and/or injury. The Contractor shall be responsible for maintaining the integrity of the work area.

D. The Contractor shall confine operations at the site to the area requiring disturbance of ACP and the general site area associated with the proximity of the project. Portions of the site beyond areas, in which the indicated work is required, are not to be disturbed. The Contractor shall not unreasonably encumber the site with materials or equipment. If ACP to be disposed is required to be stored overnight, it shall be properly labeled, secured, and containerized to preclude unauthorized disturbance of the waste materials.

E. Prior to commencing the demolition and removal of the ACP pipe, the Contractor is required to conduct an Initial Exposure Assessment (IEA) test plan or baseline report, which complies with the criteria in Paragraph (f)(2)(iii) of the above referenced controlling government regulations (section), and which demonstrates that the employees' exposure to airborne asbestos fibers during removal of the Asbestos-Cement (ACP) pipe is expected to be consistently below the Permissible Exposure Levels (PELs) i.e… exposure must be less than 0.1 fiber/cubic centimeter (cc) of air for an eight (8) hour time-weighted average limit (TWA), and less than 1.0 fiber/cc of air as averaged over a sampling period of thirty (30) minutes, all as determined by the method prescribed in Appendix A to the referenced section, or by an equivalent method, and therefore, the employer intends to do the ACP pipe removal through the use of Negative Exposure Assessments (NEAs).

F. Prior to commencing the demolition and removal or abandonment of the ACP pipe, the Contractor must have trained at least one worker as a "Competent Person", who is capable of identifying existing asbestos hazards at the work place, determining if a NEAs exist, is qualified to train other workers, and has the authority to take prompt corrective measures to eliminate a hazardous exposure.

G. At all times when the work of removing pipe is not in progress, all openings into the pipe and the ends of the existing pipe in the trenches shall be kept tightly closed to prevent the entrance of animals and foreign materials.

H. Any ACP water line(s) being abandoned shall be abandoned in place unless otherwise noted.

3.02 ABANDONMENT OR REMOVAL/DISPOSAL

A. The Contractor shall remove, abandon, seal, transport and dispose of all ACP compliance with all current Federal, State, and local regulations, laws, ordinances, rules, standards and regulatory agency requirements. Asbestos disturbance and/or removal activities shall be conducted by properly trained, accredited, and licensed personnel using proper personal protective equipment.

B. PREPARATION

1. Establish a regulated work area (RWA) using barricade tape.

2. Provide a hand/face wash station at the entry point to the RWA.

3. Post asbestos-warning signs at the RWA entry point.

4. Establish a waste load-out area attached to the RWA.

5. Once RWA is established and work begins, no access should be permitted without the required personal protective equipment.

C. AIR MONITORING AND SAMPLING OF EXPOSURE TO AIRBORNE ASBESTOS FIBERS

1. As the work begins the competent person must conduct and record objective data to confirm the Initial Exposure Assessment (IEA), and that the specific job-site work activity confirms the findings of the IEA, and that the PELS are not being exceeded for this work activity.

2. The Contractor shall provide, as a minimum, personal air monitoring on each worker who is cutting, (wet) sawing, breaking, or repairing ACP. All workers performing this type of work are required to wear respirators.

3. Area Air Monitoring: At any time that visible airborne fibers are generated or that wet work procedures are not used, all work shall immediately cease until air monitoring by a TriCounty Health Department (TCHD) licensed Asbestos Consultant, or licensed Asbestos Consulting Agency has started. The Contractor's on-site Competent Person shall be responsible for making this determination; however, periodic, random site visits by the Owner's representative will field-verify the objectivity of the Competent Person in these matters. Once initiated, the sampling and frequency of the area air monitoring shall be dependent upon on the specific work practices being used by the workers at that time. However, the area air monitoring shall include, as a minimum, samples collected inside the regulated area, and upwind and downwind of the regulated area. The TCHD licensed Asbestos Consultant Agency hired by the Contractor shall determine the need for additional samples and shall amend the Health and Safety Plan to include sampling protocols. A copy shall be provided to the Owner's Representative.

4. Area air monitoring shall be conducted in accordance with applicable Federal, State, and local requirements. The cost of area air monitoring due to failure to use adequate wet work procedures shall be borne by the Contractor. Copies of all results shall be provided to the Owner's Representative.

5. Area air sampling shall be mandatory in high density areas such as schools, residential areas, and certain other locations as determined by the Owner's Representative and dictated by the bid documents/plans.

D. EXCAVATION

1. Machine excavate to expose ACP pipe.

2. Hand excavate areas under pipe where cuts/breaks are planned.

3. Excavation operations should be carefully executed so that pipe damage does not occur prior to removal.

E. PIPE REMOVAL

1. If it is necessary to remove any abandoned ACP line(s) and/or appurtenances to accommodate improvements, the ACP line(s) and/or appurtenances shall be removed and salvaged if requested by the ENGINEER; otherwise, ACP shall be removed and disposed of in accordance with all applicable laws.

2. All work involved in the removal, salvage or disposal of ACP shall be the responsibility and at the expense of the CONTRACTOR.

3. Protective clothing and equipment shall consist of at a minimum…steel toe boots, hard hats, safety glasses, rubber or leather gloves.

4. All pipe cutting or breaking operations require adequate wetting with potable water to prevent ACP materials from being crumbled by hand pressure and the asbestos fibers becoming air-borne (friable).

5. The Contractor shall provide adequate respirators to each worker who is cutting, (wet) sawing, breaking, repairing, or handling ACP in anyway.

6. Plan pipe cuts/breaks as necessary to accommodate the size/weight of pipe being removed.

7. Use a hammer or wheel-type pipe cutter (or equivalent tool) to make the initial cut and drain pipe of residual liquids.

8. Remove pipe sections at joint collars by breaking them with a sledgehammer, or cutting them with a wheel-type pipe cutter (soil-pipe cutter).

9. Where pipe re-connection is required, trim pipe ends with a wheel-type pipe cutter. Wet, wrap and seal pipe ends in a min. 6-mil poly film wrap that is securely fastened and taped to close the pipe end. Wetting is required to prevent ACP materials from becoming friable.

10. When applicable, remove pipe sections from trench in an "intact" condition. Wet and containerize waste materials as you go. Using lifting straps and methods that do not damage the pipe.

11. Identify ACP materials and stock-pile the waste in a designated load-out area with the following label warnings:

DANGER
Contains Asbestos Fibers
Avoid Creating Dust
Cancer and Lung Disease Hazard

#1. Note: The label must also identify the generator of the ACP waste.

Refer to *Attachment No. 1 for a list of safety consultants, who may be of assistance to your firm in providing additional information and field services for compliance with OSHA's Subpart Z, 29 CFR 1926.1101

#2. Check all local jurisdiction (county) requirements for any regulations. Contractors should check with IEPA that you are performing this work. When work is over 260' in length this contractor must notify IEPA in writing (See IEPA website for "Notification" procedures or call 312 886-3006).

F. The Contractor shall be responsible for the transport and disposal of ACP scrap material to a duly licensed landfill facility permitted to accept asbestos waste, and non-friable asbestos containing materials.

G. Waste manifests shall be used to transport the ACP

H. The Bluebench Landfill will accept asbestos-containing material contingent to compliance to the terms and conditions of "Utah Administrative Code Rule 315-315-2, Asbestos Waste".

1. Regulated asbestos-containing material to be disposed of shall be handled, transported, and disposed of in a manner that will not permit the release of asbestos fibers into the air and must otherwise comply with Code of Federal Regulations, Title 40, Part 61, Section 154.

2. The contractor shall be responsible for all fees associated with disposal of asbestos-containing material.

I. The completed Generator copy (yellow) manifest shall be returned to the ENGINEER.

1. The Contractor shall notify Owner's Representative at least 72 hours in advance prior to beginning removal and/or disturbance of ACP.

2. Time is of the essence in removing ACP from the project area. All work must be completed within the time period specified.

3. All required notifications to State regulatory agencies shall be made by the Contractor with copies provided to Owner's Representative.

4. The Contractor shall have an on-site supervisor, who is an OSHA Competent Person, present on the job site at all times the work is in progress. This supervisor shall be thoroughly familiar and experienced with asbestos disturbance and other related work, and shall be familiar with and shall enforce the use of all safety procedures and equipment. The supervisor shall be knowledgeable of all applicable Environmental Protection Agency (EPA), OSHA, NESHAP, air monitoring, and TCHD requirements and guidelines.

3.03 SITE SECURITY

A. The Contractor shall demarcate the area of ACP disturbance ("regulated area") with barrier tape and warning signs, as per OSHA regulation 29 CFR 1926.1101. Access to the regulated area shall be limited only to authorized personnel. Authorized personnel shall have asbestos awareness training, respiratory training, etc., including City of Roosevelt personnel.

B. Entry into the work area by unauthorized individuals shall be reported immediately to the Owner's Representatives by the Contractor.

C. A logbook shall be maintained immediately outside the regulated area. Anyone who enters the regulated area must record name, affiliation, time in, and time out for each entry.

3.04 PERSONEL PROTECTIVE EQUIPMENT

A. All work which will or may disturb ACP shall be accomplished utilizing, as a minimum, disposal suits with protective head cover, gloves, boots, eye protection, proper respiratory protection, decontamination by HEPA vacuuming and/or wet methods, and wet wiping all equipment. The Contractor shall provide hard hats and/or other protection as required for job conditions or by applicable safety regulations. Disposal suits consisting of material impenetrable by asbestos fibers shall be provided to all workers and authorized visitors in sizes adequate to accommodate

movement without tearing. Workers shall be provided protective clothing from the time of first disturbance of ACP until final cleanup is completed.

B. The Contractor's Competent Person shall ensure use of the appropriate respiratory protection for the work being performed. For minimum legal respiratory requirements, see OSHA Standards 29 CFR 1910.134, 29 CFR 1910.1001, and 29 CFR 1926.1101. All respiratory equipment, such as respirators, filters, etc., shall be certified by National Institute for Occupational Safety and Health (NIOSH) for use in asbestos contaminated atmospheres.

3.05 EMPLOYEE TRAINING

A. Training shall be provided by the Contractor to all employees or agents who may be required to disturb ACP for ACP handling and auxiliary purposes, and to all supervisory personnel who may be involved in the planning, execution or inspection of such projects. The training shall be in accordance with OSHA Standard 29 CFR 192.1101 for "Class II asbestos work".

B. At a minimum, Contractor's employees who will be potentially exposed to asbestos shall have completed within the last 12 months, an 8-hour Asbestos Awareness training course taught by a licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos and work practices related to the handling of ACP.

C. The Contractor's Competent Person shall have completed within the last 12 months, a 40-hour Asbestos Contractor Supervisor training course taught by a licensed Asbestos Training Provider. The training course shall cover topics including, but not be limited to: the health effects of asbestos, employee personal protective equipment, medical monitoring requirements for workers, air monitoring procedures and requirements for workers, work practices for asbestos abatement, personal hygiene procedures, special safety hazards that may be encountered, and other topics as required.

3.06 ACP HANDLING

A. GENERAL

1. The Contractor shall properly remove, abandon, handle, transport and dispose all ACP specified in the bid documents/plans for this project. All work involving ACP and other ACP products shall be addressed in the Health and Safety Plan documents submitted to the Owner's Representative. The Contractor shall hire a licensed Asbestos Consultant to provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety Plan documents are to include provisions for the discipline of any worker failing to use wet work procedures or failing to use designated personnel protective equipment.

2. The Contractor shall remove ACP with wet methods or by other controlled techniques approved by the EPA and OSHA, and in accordance with these specifications and the Contractor-provided Health and Safety Plan. Alternative removal methods will be considered at the time of the Contractor's submittals. The Contractor shall take special care to prevent damage to structures and materials not requiring demolition to access the ACP.

3. The Contractor shall limit work to the area indicated. Access to the work area shall be controlled by the Contractor. All electrical equipment, etc., shall have ground limit circuit interrupter (GFCI) protection. The Contractor shall properly demarcate, barricade, and contain the work and/or regulated areas.

4. The ACP work consists of providing GFCI protection, using approved equipment with engineering controls, sufficiently wetting the ACP using a surfactant or lock-down encapsulant, removing the ACP, HEPA vacuuming the work area, wet wiping the work area, double-bagging/double-wrapping the waste, and removing carefully as indicated herein and in accordance with the Contractor-provided Health and Safety Plan.

B. EQUIPMENT

1. Equipment used to cut, break, or otherwise disturb ACP and associated ACP may include, but are not limited to: wet-cutting saws, saws equipped with point of cut ventilator (saw equipped with a water mister) or enclosures with HEPA filtered exhaust air, snap cutters, manual field lathes, and pressure and non-pressure tapping devices.

2. Equipment used to control visible emissions of fibers, contain the work area, or facilitate the clean-up of debris may include, but are not limited to: airless spray equipment, pump-up sprayers, surfactant, lock-down encapsulant, HEPA vacuums, brushes, brooms, shovels, disposable rags, polyethylene sheeting of 6-mil thickness, moisture resistant duct tape, asbestos warning signs, notices, and barrier tape. Alternative dismantling equipment may be substituted for the materials indicated herein, but must be approved by the Owner's Representative.

C. PROHIBITITED WORK PRACTICES AND ENGINEERING CONTROLS

1. The following work practices and engineering controls shall not be used for work related to asbestos or for work that disturbs ACP, regardless of asbestos exposure or the results of Initial Exposure Assessments:

   a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

   b. Other high-speed abrasive tools, such as disk sanders.

   c. Carbide-tipped cutting blades.

   d. Electrical drills, chisels, and rasps used to make field connections in ACP.

   e. Shell cutters used to cut entry holes in ACP.

   f. A hammer and chisel used to remove couplings or collars on ACP.

   g. Compressed air used to remove asbestos or ACP, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud generated by the compressed air

   h. Dry sweeping, dry shoveling, or other dry clean-up of dust and debris containing ACP.

   i. Employee rotation as a means of reducing employee exposure to asbestos.

D. GENERAL REMOVAL WORK PRACTICES

1. ACP has been identified as a non-friable ACP with the potential to become friable ACP. The material is classified as non-friable unless broken, at which time its classification changes to friable. NESHAP guidelines apply to projects when at least 260 linear feet or 35 cubic feet or 160 square feet of ACP becomes or will become "regulated asbestos containing material" or RACP. Therefore, if at least 260 linear feet of ACP is crushed, crumbled, or pulverized, then the project is subject to NESHAP. During the disjoining operation of ACP removal, only the portion that has become RACP shall be counted toward the threshold amount, if the debris caused by the disjoining operation is cleaned up so that it does not contaminate a greater length of pipe. If the generated ACP debris is not properly cleaned up, however, then the ACP shall be considered contaminated and the whole length is treated as ACP. If the scope of this project involves the threshold amount (260 linear feet or greater), then a Demolition/Renovation Notification Form shall be sent to TCHD by the Contractor. This form shall be post-marked no later than 11 working days prior to the start of any asbestos disturbance.

2. All ACP projects require that NESHAP and OSHA guidelines be met and/or exceeded in areas where ACP is to be disturbed. Therefore, all ACP disturbances require a third party licensed Asbestos Consultant and Asbestos Contractor on-site during ACP disturbance. An asbestos abatement work plan shall be provided to the Owner's Representative by both the licensed Asbestos Consultant and the Asbestos Contractor. Upon completion of the ACP project, an air monitoring abatement report shall be prepared by the Contractor's Asbestos Consultant. Copies of the final abatement report shall be submitted to the Owner's Representative by the Contractor's consultant. During any ACP disturbance, OSHA requires that, regardless of amount, the asbestos worker(s) be properly protected during potential asbestos exposure, 29 CFR, Subpart *Z,* 1910.1101.

3. The Contractor shall be responsible for developing and implementing an asbestos removal work plan in accordance with NESHAP, OSHA, and State requirements. As such, Contractors submitting bids for the project shall have a licensed Asbestos Consultant provide detailed asbestos specific safety and work plans for ensuring worker and community protection. Health and Safety Plans for working with ACP shall address the requirements of these specifications.

E. A sufficient supply of disposable rags for work area decontamination shall be available.

F. Disposal bags for RACP shall be of true 6-mil polyethylene, pre-printed with labels as required by EPA regulation 40 CFR 61.152 (b)(i)(iv) or OSHA requirement 29 CFR 1926.1101 (k)(8).

G. Stick-on labels identifying the Generator's name and address, and the project site location shall be applied to any asbestos waste bags that contain RACP, as per EPA or OSHA requirements.

H. WORK AREA PREPARATION

1. The Contractor shall post warning signs and barrier tape meeting the specification of OSHA 29 CFR 1910.1001 and 40 CFR 61 at any location and approaches to a location where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far from the work area to permit an employee to read the sign and to take the necessary protective measures to avoid exposure. The Contractor shall maintain constant security against unauthorized entry past warning signs and barrier tape. Signs shall be post in both English and Spanish at the site.

I. PERSONNEL EXIT PROCEDURES

1. Before leaving the work area, all personnel shall remove gross contamination from the outside of respirators and protective clothing by brushing and/or wet wiping procedures. Small HEPA vacuums with brush attachments may be utilized for this purpose. Adequate washing facilities shall be provided and utilized on-site.

2. Upon completion of the work, contaminated gloves shall be disposed as Asbestos Containing Waste Material (ACWM). Disposable cloth gloves may be substituted for leather gloves, at the Contractor's discretion. Rubber boots shall be decontaminated at the completion of the project.

J. SPECIFIC REMOVAL WORK PRACTICE REQUIREMENTS

1. The Contractor has sole and primary responsibility for the "means and/or methods" of the work, for inspection of the work at all stages, and for supervision of the performance of the work.

2. The Contractor shall isolate the regulated area with barrier tape and asbestos warning signs.

3. The Contractor shall lay and secure 6-mil polyethylene sheeting on the ground on both sides of the ACP for the length of the work area.

4. Working within the regulated area and using wet removal methods, the Contractor shall thoroughly soak each section of ACP to be disturbed, prior to any removal activity, with a surfactant or lock-down encapsulant. The Contractor shall use equipment capable of producing a "mist" application to reduce the potential for release of fibers. The Contractor shall take care to use as much encapsulant or surfactant as needed to lockdown possible fallout debris from edges and joints during removal. Continuous wetting of the materials throughout the entire removal process shall be provided. The Contractor shall take care to limit the breakage of ACP and to remove these materials as intact as possible.

5. Any ACP debris on adjacent surfaces shall be removed. The Contractor shall promptly clean up asbestos wastes and debris following ACP disturbance. All visible accumulations of ACP and asbestos contaminated debris shall be removed and containerized by hand. Asbestos debris mixed with soil shall be picked up with shovels. The contaminated soil shall be containerized as a regulated ACWM. Clean-up activities may also involve vacuum cleaners equipped with HEPA filtration or wet-wiping surfaces with disposable rags. Contaminated rags shall be containerized as regulated ACWM.

6. After disturbance and clean-up activities but prior to removal of the ACP from the regulated area, the Contractor shall encapsulate damaged and exposed areas and ends of the ACP with a lock-down encapsulant.

7. The Contractor shall then remove the Category II non-friable ACP "that is not in poor condition and is not friable," as defined in NESHAP regulations. The Contractor shall remove all ACP "intact" and in whole complete sections by carefully lifting the ACP to the disposal container using approved equipment. The Category II non-friable ACP shall not be made "friable" (crumbled, pulverized, or reduced to a powder). The Contractor shall not drop, break and/or otherwise make the ACP susceptible to releasing asbestos fibers. If these procedures are followed and debris is cleaned up properly, then the Category II non-friable ACP shall be disposed as non-regulated ACP.

8. Pieces of ACP debris shall be handled as RACP waste. The debris shall be placed in two 6-mil asbestos bags or double wrapped, with proper labeling.

K. ABANDONMENT

1. Abandonment of AC water mains/pipes.

   a. The Contractor shall be responsible for isolating the existing mains to remain in service by capping, plugging, and blocking as necessary. The opening of an abandoned AC water main and all other openings or holes shall be blocked off by manually forcing cement grout or concrete, into and around the openings, in sufficient quantity to provide a permanent watertight seal. Abandonment of old, existing AC water mains shall be considered subsidiary to the required work and no direct payment shall be made.

2. Abandonment of valves that contain ACP.

   a. Valves to be abandoned in the execution of the work shall have the valve box and extension packed with sand to within 8-inches of the street surface. The remaining 8-inches shall be filled with 2,500 psi concrete or an equivalent sand-cement mix, and finished flush with the adjacent pavement or ground surface. The valves covers shall be salvaged and return to Roosevelt City. The abandonment of valves containing ACP shall be considered subsidiary to the required work and no direct payment shall be made.

3. Verification of Removal & Clean-up Procedures: The Contractor's on-site Competent Person shall inspect the work area and ensure that all surfaces are free of ACP dust and debris.

L. DIPOSAL PROCEDURES

1. If a dumpster/trailer is used for temporary storage, it shall be secured and closed at all times except when loading. It shall be properly marked and critical barrier tape shall be in place.

2. ACP debris and asbestos-contaminated items shall be properly double bagged; labeled; loaded in a fully enclosed, lined, locked, placard-identified transport container; transported; and disposed in compliance with all regulatory requirements as RACP.

3. After being removed from the regulated area, Category II non-friable ACP shall be transferred to a polyethylene-lined container. The Contractor shall remove all containers as soon as practical, but no later than the end of the work shift.

4. When a dumpsters/trailer is full, it shall be hauled away to the closest EPA approved landfill for proper disposal. The Contractor may dispose of Category II non-friable ACP waste material as non-regulated waste in a municipal solid waste landfill, as defined in the NESHAP and by Utah DEQ. Prior to disposal, written approval to transport and to accept the Category II non-friable material shall be obtained from a pre-approved transporter and landfill, and shall be submitted to the Owner's Representative.

5. The Contractor shall submit copies of all transport manifests, trip tickets, and disposal receipts for all ACWM removed from the work area during the project to the Owner's Representative. The Contractor shall sign manifests as the generator of the ACP and provide copies to Owner's Representative for final payment.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED SECTIONS

A. Section 03 20 00 - Concrete Reinforcement.

B. Section 03 30 40 - Portland Cement Concrete.

C. Section 03 31 00- Concrete Work

1.03 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 347 - Recommended Practice for Concrete Formwork.

D. PS 1 - Construction and Industrial Plywood.

1.04 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 standards.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for design, fabrication, erection and removal of formwork.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

2.02 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal adjustable length, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture.

C. Corners: Chamfered, 2 inch size; maximum possible lengths. Chamfer all exposed corners

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

E. Waterstops: Polyvinyl chloride, minimum 2,000 psi tensile strength, minimum 50 degrees F (46 degrees C) to plus 175 degrees F working temperature range, 1 inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

2.04 WATERSTOP

A. Manufacturer: Greenstreak Plastic Products, Model Ribbed with Centerbulb.

B. Waterstop shall be installed in concrete joints where indicated on the Plans and on the Typical Details. Waterstop shall be polyvinyl chloride.

C. All vertical joints in waterbearing structures shall have waterstops, whether indicated on the Plans or not.

D. All waterstops shall be continuous.

E. Waterstops in the walls shall be carried into lower slabs and shall join the waterstops in the slabs with appropriate types of fittings.

F. Waterstops: Polyvinyl Chloride:

Property	Test Method	Recommended Limits
Water Absorption	ASTM D 570	5% max
Tear Resistance	ASTM D 624	285 lf/in
Ultimate Elongation	ASTM D 638	360%
Tensile Strength	ASTM D 638	2,000 psi min
Low Temperature Brittleness	ASTM D 746	No Failure @-35EF/-37EC
Stiffness in Flexure	ASTM D 747	600 psi min
Specific Gravity	ASTM D 792	1.4 max
Ozone Resistance	ASTM D 1149	No failure
Volatile Loss	ASTM D 1203	0.50% max
Hardness, Shore A/15	ASTM D 2240	65 to 80
Tensile Strength After Accelerated Elongation	CRD-C 572	1,600 psi min
Elongation After Accelerated Extraction	CRD-C 572	300% min
Effect on Alkali After 7 Days	CRD-C 572	-0.1% to 0.25%

2.05 NEOPRENE BEARING PAD

A. Neoprene pads shall be of dimensions and hardness shown on the drawings and shall be made by approved manufacturer.

B. The material for 40 durometer neoprene pads shall conform to ASTM D-200 M2BC414A14C12F17 and the material for the 30 durometer neoprene pads shall conform to ASTM D-200 M2BC10A14C12F17.

C. Unless otherwise specified on the drawings, neoprene pads shall be 40 durometer.

2.06 CLOSED CELL NEOPRENE PAD

A. Closed cell neoprene pads, shall be used as a filler material in the flexible joints between the wall and wall-footing and between the wall and roof connection in the areas not taken up by the solid neoprene bearing pads and waterstops.

B. The material shall be medium grade closed cell neoprene conforming to 2A3 of ASTM D 1056-85.

C. Rubatex R431N or R423N, or Cypress Sponge 431N or 423N, or approved equal.

2.07 **SOFT MASTIC**

A. Soft mastic shall be installed in all voids and cavities around the bearing pads, waterstop and seismic cable sleeves. Such material shall be installed with a consistency that will not adversely affect the quality of pvc and neoprene materials.

B. Sikaflex 1A, or Select Seal U-230, or approved equal.

2.08 **INSTALLATION OF BEARING AND FILLER PADS**

A. Bearing and filler pads shall be installed as indicated on the drawings.

B. Bearing and filler pads shall be glued to the concrete with an approved rubber cement material to prevent uplift of the pads during concrete pouring. In addition, all pads shall be held down with approved plastic shim plates placed under reinforcing steel.

C. Nailing down pads will not be permitted.

D. All voids and cavities between bearing and filler pads, waterstop and seismic cable sleeves shall be filled with soft mastic.

E. Contractor's workmanship shall be such that no cement grout or concrete seepage will occur through the bearing and filler pad area resulting in a restraint of radial wall movements.

F. A continuous neoprene pad and one or more filler pads are required between the top of the wall and the underside of the roof. Any void area between such pads shall be caulked and sealed to prevent any cement from the roof pour to come in contact with the wall top.

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 **EARTH FORMS**

A. Earth forms are not permitted.

3.03 **ERECTION - FORMWORK**

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on external corners.

G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

H. Coordinate this section with other sections of work which require attachment of components to formwork.

I. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops in accordance with manufacturer's instructions, continuous without displacing reinforcement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drains to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.08 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspection and testing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads **(minimum of seven days)**.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric or rod mats for cast-in -place concrete.

B. Support chairs, bolsters, bar supports, and spacers for supporting reinforcement.

1.02 RELATED SECTIONS

A. Section 03 10 00 – Concrete Formwork.

B. Section 03 30 40 - Portland Cement Concrete.

C. Section 03 31 00 - Concrete Work

1.02 REFERENCES

A. AASHTO M 32: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. AASHTO M 55: Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

C. AASHTO M 254: Standard Specification for Corrosion Resistant Coated Dowel Bars.

D. ACI 301: Specifications for Structural Concrete for Buildings.

E. ACI 315: Details and Detailing of Concrete Reinforcement.

F. ACI 318: - Building Code Requirements for Reinforced Concrete.

G. ASTM A 706: Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

H. AWS D1.1: Structural Welding Code Steel.

I. AWS D1.4: Structural Welding Code Reinforcing Steel.

J. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.

1.03 SUBMITTALS

A. Manufacturer's Certificate: Submit mill test certificates of supplied concrete reinforcement, indicating physical and chemical analysis.

B. Welder's certification.

C. Shop drawings.

1. Indicate sizes, spacings, locations, and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting, and spacing devices.

2. When required by Engineer, prepare shop drawings by an engineer who complies with Utah licensing law and is acceptable to Engineer.

1.04 **QUALITY ASSURANCE**

A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice.

B. Comply with ACI 301.

C. Welders: AWS D1.1 or AWS D1.4 as applicable.

PART 2 PRODUCTS

2.01 **MATERIALS**

A. Reinforcing Steel: In accordance with ASTM A 615 or ASTM A 706 deformed bars, grade and type as indicated, including supplementary requirements S1, either uncoated or as indicated. When no grade is indicated use 60 grade steel. Use ASTM A 706 steel if welding is indicated or allowed.

B. Welded Steel Wire Fabric: In accordance with ASTM A 185 plain type; in flat sheets or coiled rolls either uncoated or as indicated.

C. Stirrup Steel: In accordance with ASTM A 82.

D. Plain Dowel Bars for Expansion Joints: In accordance with ASTM A 615, Grade 60.

1. Provide metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section. Design caps with 1 end closed.

2. Provide for movement equal to joint width plus ½".

3. For load transfer bars, paint with 1 coat of lead or tar paint conforming to AASHTO M 254 and coat ½ with grease.

E. Epoxy Coating: When epoxy coating of reinforcing is required, the coating materials and process, the fabrication, handling, and the repair of any damaged coating material that occurs during fabrication and handling shall conform to the requirements of AASHTO M 284 (ASTM D 3963).

F. Deformed Bar Anchors: Deformed bar anchors, which are welded to plates and structural shapes, shall be made from cold drawn wire conforming to requirement ASTM A496. Tensile requirement of deformed bar anchors, as determined by test of the finished anchor and shall conform to the following:

Minimum tensile	80,000 psi
Minimum yield	70,000 psi

(Yield strength is determined at an extension of 0.005 inch per inch of specimen length.)

2.02 **ACCESSORY MATERIALS**

A. Tie Wire: Minimum 16 gage annealed type or a patented system accepted by Engineer.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions. Bar supports shall be located in accordance with CRSI Manual of Standard Practice and placed in accordance with CRSI 65. Concrete block supports shall be provided for footings and slabs or grade. Standard steel supports shall be provided for other work.

2.03 **FABRICATION**

A. Fabricate reinforcement in accordance with ACI 318, providing for the concrete cover specified in Section 03 30 40.

B. Locate reinforcing splices not indicated on drawings at points of minimum stress. Indicate location of splices on shop drawings.

C. Weld reinforcing bars in accordance with AWS D1.4.

PART 3 EXECUTION

3.01 **GENERAL**

A. As provided in the General Conditions, the Owner is defining the quality of concrete reinforcement by specifying in this part some of the means, methods, techniques, sequences and procedures for installation of concrete reinforcement. The Contractor, without relinquishing authority and responsibility for supervision and direction of the work, agrees to follow the specified means, methods, techniques, sequences and procedures.

3.02 **FABRICATION**

A. Reinforcing steel shall not be bent or straightened in a manner which will injure the material. Bars with kinks or with bends not shown shall not be used. Bars shall not be welded at the bend. Tack welding of cross bars is not acceptable.

3.03 **PLACING**

A. All reinforcement to be free of loose mill scale, loose or thick rust, dirt, paint, oil or grease.

B. Place, support and secure reinforcement against displacement. Do not deviate from required position.

C. Do not displace or damage vapor barrier.

D. Accommodate placement of formed openings.

E. Place all reinforcement in the exact position indicated. With tie wire, tie bars together at all intersections except where spacing is less than 12" in each direction, in which case tie alternate intersections.

F. Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers, or other approved devices. Placing and fastening of reinforcement in each section of the Work must be approved by Engineer before concrete is placed.

G. Overlap sheets of metal mesh one square plus 6" to maintain a uniform strength. Securely fasten at the ends, edges, and support to maintain clearances.

H. Support reinforcing steel of formed flat slabs with metal chairs, precast concrete blocks or other slab bolsters. Size chairs or bolsters to position the steel in the exact location indicated. Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 5 feet on centers in each direction. Plastic or epoxy coat that portion of the metal support in contact with the forms to prevent rust. Tie down deck steel to beams or forms at regular intervals of not more than 5 feet on centers along the beams or forms to prevent movement of the steel during placement of the concrete.

I. Unless otherwise indicated on the Plans, reinforcement shall be placed so as to provide the thickness of protective concrete covering as indicated on the Typical Details. If not indicated on the Plans or Typical Detail protective covering shall be in accordance with ACI 318.

3.04 SPLICING

A. Furnish all reinforcement in the full lengths indicated unless otherwise permitted. Splicing of bars, except where indicated is not permitted without written approval from Engineer. Stagger splices where possible.

B. Unless indicated otherwise, overlap reinforcing bars a minimum of 30 diameters to make the splice. In lapped splices, place the bars and wire in such a manner as to maintain the minimum distance for clear spacing to the surface of the concrete.

C. Do not use lap splices on bars greater in diameter than No. 11 unless approved by Engineer.

D. Weld reinforcing steel only if indicated or if authorization is made by Engineer in writing. Weld in conformance to AWS D1.4.

E. Do not bend reinforcement after embedding in hardened concrete, unless permitted by City Engineer.

F. Do not permit reinforcement or other embedded metal items bonded to the concrete, to extend continuously through any expansion joint, except dowels in floors bonded on only one side of joints.

3.05 PLACING EMBEDDED ITEMS

A. Place all sleeves, inserts, anchors and embedded items prior to concrete placement. Fill voids in embedded items temporarily with readily removable material to prevent entry of concrete.

B. Give all trades whose work is related to the concrete section ample notice and opportunity to introduce and/or furnish embedded items before concrete placement.

3.06 CLEANING

A. Reinforcing steel shall be cleaned of mill rust scale, dried concrete, or other coatings that may reduce bond. Reinforcement reduced in section is not acceptable. When concrete placement is delayed, reinforcement shall be cleaned by sandblasting.

END OF SECTION

SECTION 03 30 40

PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement concrete material requirements.

B. Mix design requirements.

1.02 REFERENCES

A. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

B. ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

C. ACI 211.3: Standard Practice for Selecting Proportions for No-Slump Concrete.

D. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete.

E. ACI 306: Cold Weather Concreting.

F. ASTM C 33: Standard Specification for Concrete Aggregates.

G. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

H. ASTM C 94: Standard Specification for Ready-Mixed Concrete.

I. ASTM C 150: Standard Specification for Portland Cement.

J. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.

K. ASTM C 289: Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).

L. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.

M. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

N. AASHTO T 26: Standard Method of Test for Quality of Water to be Used in Concrete.

O. AASHTO M-157: Standard Specification for Ready-Mix Concrete.

P. AASHTO M-85: Standard Specification for Portland Cement.

Q. AASHTO M-152: Standard Specification for Air-Entraining Admixtures for Concrete.

R. AASHTO M-194: Standard Specification for Chemical Admixtures for Concrete.

S. AASHTO M-295: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.03 **DEFINITIONS**

A. Average Strength (f_{cr}): The required average strength for 30 consecutive strength tests which statistically assures no more than the permissible proportions of tests will fall below specified strength.

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

1.04 **SUBMITTALS**

A. Mix Design: Submit each proposed mix design 48 hours prior to use in the Work. Indicate whether mixes have been designed for pumping. Include the report the following information.

1. Water-cement ratio.

2. Proportion of materials in the mix.

3. Source and type of cement.

4. Analysis of water to be used.

5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used.

6. Slump, air content and temperature of samples.

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

8. Date and time of batch

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

C. Ready-mixed concrete plant quality control chart which complies with ACI 214 and shows the following.

1. Specified strength (f_c').

2. Required average strength (f_{cr}).

3. Compressive strength versus date of sample.

D. Aggregate Test Report: Submit for each aggregate source.

1. Date of test analysis.

2. Sieve analysis.

3. Organic impurities.

4. Sodium sulfate soundness test.

5. Reactivity of aggregate.

E. Batch Delivery Ticket: Submit for each batch delivered to site. Include the following information.

1. Date.

2. Producer and plant.

3. Job.

4. Name of contractor.

5. Serial number of ticket.

6. Truck number and time dispatched.

7. Volume of concrete.

8. Reading of revolution counter at first addition of water.

9. Signature or initials of ready-mix representative.

10. Type and brand of cement.

11. Amount of cement.

12. Total water content. (W/C ratio).

13. Water added by receiver of concrete and his initials.

14. Admixture types and amounts.

15. Maximum size of aggregate.

16. Separate weights of fine and coarse aggregate.

17. Indication that all ingredients are as previously certified or approved.

1.05 **QUALITY ASSURANCE**

A. Use the same source and type of cement, air-entraining agent, water reducing agent, other admixtures, and aggregate.

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

C. Do not change the quantity of cement per cubic yard.

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

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

F. Testing Concrete: In accordance with Section 01 45 00 and ASTM C39.

1.06 **PRODUCT STORAGE AND HANDLING**

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

B. Stockpile aggregate to avoid segregation and prevent contamination.

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

PART 2 PRODUCTS

2.01 **CEMENT**

A. Type II (moderate), in accordance with ASTM M-185. Type I may be used in above grade structure if approved by City Engineer.

2.02 **WATER**

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

B. Clean, non-staining and not detrimental. Comply with AASHTO T 26.

2.03 **AGGREGATES - GENERAL**

A. Gravel, crushed slag, crushed stone, or other inert material, composed of hard, strong, durable particles free of injurious coatings.

B. The materials passing the No. 200 sieve shall not exceed 1.75 percent by weight in the combined coarse and fine aggregate.

2.04 **COARSE AGGREGATE**

A. Sieve Analysis: Graded in accordance with ASTM C 33, as follows.

COURSE AGGREGATE				
Sieve Sizes	Percent Passing (By Weight)			
	1" Aggregate		3/4" Aggregate	
		Max	Min	Max
1-1/2"	100	--	100	--
1"	95	100	100	--
3/4"	---	--	90	100
½"	25	60	--	--
3/8"	--	--	20	55
No. 4	0	10	0	10

These limitations may be changed if, in the judgement of the City Engineer, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids and the maximum aggregate size does not exceed the following requirements:

1. 1/5 of narrowest dimension between forms.

2. 1/4 of depth of slabs.

3. 3/4 of minimum clear spacing between reinforcing bars.

B. Deleterious substances: Maximum percentage by weight.

1. Soft Fragments: 2.0 percent.

2. Coal and Lignite: 0.3 percent.

3. Clay Lumps: 0.3 percent.

4. Other Deleterious Substances: 2.0 percent.

2.05 **FINE AGGREGATE**

A. Sieve Analysis: Graded in accordance with ASTM C 33, as follows.

FINE AGGREGATE		
Sieve Size	Percent Passing (By Weight)	
	Min	Max
3/8"	100	--
No. 4	95	100
No. 16	45	80
No. 50	10	30
No. 100	2	10

B. Deleterious Substances: Maximum percentage by weight.

1. Coal and Lignite: 0.3 percent.

2. Clay Lumps: 0.5 percent.

3. Other Deleterious Substances: 2.0 percent.

2.06 SOUNDNESS AND REACTIVITY OF AGGREGATE

A. Determine suitability of fine and coarse aggregate sources for soundness in accordance with ASTM C 88. Weight loss; not exceeding 16 percent by weight when subject to 5 cycles of sodium sulphate.

B. Determine alkali-silica reactivity in accordance with ASTM C 289. Do not use aggregates determined either potentially or actually deleterious.

2.07 ADMIXTURES

A. Air Entrainment: pH 2.0 maximum type in accordance with ASTM C 260.

B. Water Reducing and Water Retarding Agents: In accordance with ASTM C 494.

1. Type A: Water reducing.

2. Type B: Retarding.

3. Type C: Accelerating.

4. Type D: Water reducing and water retarding.

5. Type E: Water reducing and accelerating.

6. Type F: High range water reducing (super plasticizer). *

7. Type G: High range water reducing and retarding. *

*The relative durability factor of water reducing admixtures shall not be less than 90 and the chlorides content (as Cl-) shall not exceed 1 percent by weight of the admixtures.

C. Calcium Chloride: None allowed.

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

1. Do not replace more than 15 percent of the Portland Cement.

2. The ratio of replacement by weight of Pozzolan to cement shall be 1.25 to 1.0.

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

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

5. All other requirements of this section still apply.

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

E. Fly Ash: maximum 15% fly ash will be allowed.

F. Fiber Mesh: A.G. 0.90, Tensile Strength 70-11 ksi, Lengths of 0.5", 0.75, 1.5", & 2.0".

2.08 ENTRAINING AGENT

A. An air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to AASHTO designation M-152.

2.09 ACI MIX DESIGN

A. The amount by which the average strength of a concrete mix exceeds the specified strength shall be based upon no more than 1 in 100 random individual strength tests falling below the specific strength.

B. Proportion the materials in accordance with ACI 211.1, 211.2 or 211.3 as applicable to produce concrete having the following properties or limitations:

CONCRETE MIX PROPERTIES				
Class	**A**	**B**	**C**	**D**
Properties	5000	4000	3000	2500
Specified Compressive Strength f'_c at 28 days, psi	5000	4000	3000	2500
Compressive Strength at 7 days, psi (a)	3335	2350	2000	1675
Cement content (94 lb. Sacks of cement per cubic yard of concrete)	7	6	5.5	5
Fiber Mesh	1.5#/CY	0	0	0
Superplasticizer	12 oz./100# cement	0	0	0
Water	30 gal/C.Y.	As Reqr	As Reqr	As Reqr
Crushed Rock	3/4"-#4/60-65%	As Reqr	As Reqr	As Reqr
Sand	35-40%	As Reqr	As Reqr	As Reqr
Entrained air content, (% by volume)	6% +/- 1%	4 to 6	5 to 7	5 to 7
Slump Range, in. (b)	5"	2 to 4	2 to 4	2 to 6

(a) Used for monitoring purposes only.
(b) Not more than 8" after adding high range water reducer admixture (super-plasticizer) to verified 2" to 3" slump concrete.

C. The use for each class of concrete is as follows:

1. Class A (5000 psi): Concrete Tank

2. Class B (4000 psi): All other reinforced structural concrete

3. Class C (3000 psi): Sidewalks, curb and gutter, cross gutters, pavements and unreinforced footings and foundations.

4. Class D (2500 psi): Thrust blocks, anchors and mass concrete.

5. All other concrete, unless specified or otherwise indicated on the Drawing use Class B concrete.

D. Water

1. Sufficient water shall be added to produce concrete with the minimum practicable slump.

2. The slump of mechanically vibrated concrete shall not exceed 4 inches.

3. No concrete shall be placed with a slump in excess of 5 inches.

2.10 **HAND MIXING**

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

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

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

2.11 **HEATING, WATER AND AGGREGATE**

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

B. Heat aggregate and mixing water to 150 degrees F. maximum. Heat aggregates uniformly.

C. Maintain mixed concrete temperature at time of placement between 60 and 90 degrees F.

D. Do not mix cement with water or with mixtures of water and aggregate greater than 90 degrees F.

PART 3 EXECUTION

3.01 **DELIVERY**

A. Slump: Do not transport concrete to the work location if slump is greater than permissible slump.

B. Discharge: After the introduction of mixing water to the cement and aggregates at the batch plant, discharge concrete from truck mixer within 90 minutes.

1. Less than 80 degrees F.: 1-1/2 hours.

2. 80-90 degrees F.: 75 minutes.

3. 90+ degrees F.: 1 hour maximum.

3.02 **RE-TEMPERING**

A. Adding Water: When concrete arrives at site with slump below specified, water may be added if neither the maximum approved water/cement ratio no the maximum slump is exceeded provided that:

1. The approved mix design has allowed for on-site addition of water.

2. The amount of water added at the site is accurately measured to $\pm$1gallon of the desired added amount.

3. That water addition is followed by 3 minutes of mixing at mixing speed prior to discharge.

4. That additional standard cylinder samples are taken form all trucks receiving water after addition of water at no additional cost to Owner.

5. That the person authorized to add water is mutually approved of in writing by Engineer, Contractor, and ready-mix vendor.

B. Super-plasticizer: Premeasure and add high range water reducers (super-plasticizer) in accordance with manufacturer's instructions. Add super-plasticizer at site using truck-mounted power injection equipment capable of rapidly and uniformly distributing the admixture to the concrete. Mix for a minimum of 3 minutes prior to discharge.

C. Re-tempering after delivery time with super-plasticizer is prohibited.

3.03 **CONCRETE PLACEMENT**

A. In accordance with Section 03 31 00.

END OF SECTION

SECTION 03 31 00

CONCRETE WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete placement operations for slabs on grade, slabs on fill, structural building frame, and other concrete components.

1.02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Formwork.

B. Section 03 20 00 – Concrete Reinforcement.

C. Section 03 30 40 – Portland Cement Concrete.

D. Section 03 34 50 – Concrete Finishing.

E. Section 03 37 00 – Concrete Curing.

1.03 REFERENCES

A. AASHTO M-182: Standard Specification for Burlap Cloth Made from Jute or Kenaf.

B. ACI 301: Specifications for Structural Concrete for Buildings.

C. ACI 305: Hot Weather Concreting.

D. ACI 306: Cold Weather Concreting.

E. ACI 309: Standard Practice for Consolidation of Concrete.

F. ACI 315: Details and Detailing of Concrete Reinforcement.

G. AASHTO M-148: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

H. ASTM C-642: Standard Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

1.04 RELATED WORK

A. Manufacture of Portland cement concrete and its delivery to site, in accordance with Section 03 30 40.

1.05 **SUBMITTALS**

A. Record of Placed Concrete: Record date, location of pour, quantity, air temperature, and test samples taken.

B. Product name, type, and chemical analysis of the following as applicable:

1. Curing compound.

2. Sealing compound.

3. Chemical hardener.

1.06 **QUALITY ASSURANCE**

A. Rejection: Concrete work which fails to meet one or more of the following requirements, and which cannot be brought into compliance shall be rejected. Engineer shall determine appropriate modifications or payment adjustments to be made.

1. Appearance: Concrete exposed to view with defects which adversely affect appearance of specified finish.

2. Strength: Strength of concrete fails to comply with any of the following requirements.
   a. Low compressive or flexural strength.
   b. Reinforcing steel size, quantity, strength, position, damage, or arrangement at variance with requirements.
   c. Concrete which differs from required dimensions or location in such a manner as to reduce its strength or load carrying capacity.
   d. Inadequate protection of concrete from extremes of temperature during the early stages of hardening and strength development.
   e. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.
   f. Workmanship likely to result in deficient strength.

3. Slab Tolerance: Field quality control as specified herein.

4. Material Sources: In accordance with Section 03 30 40.

1.07 **WARRANTY**

A. Repair or replace defective or damaged work at no additional cost to Owner.

PART 2 PRODUCTS

2.01 **ACCESSORIES**

A. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.

B. Vapor Retarder: 10 mil thick clear polyethylene sheet. Type recommended for below grade application.

C. Forms: In accordance with Section 03 10 00 and ACI 315.

D. Reinforcement: In accordance with section 03 20 00.

E. Covering: Waterproof paper, polyethylene sheet or burlap cloth complying with AASHTO M 182, Class two.

F. Waterstop: In accordance with section 03 10 00.

2.02 CONCRETE SURFACE CURING COMPOUND

A. Liquid membrane, in accordance with AASHTO M-148.

B. Type of Compound: Engineer to select.

1. Type 1, clear or translucent without dye.

2. Type 1-D, clear or translucent with red fugitive dye.

3. Type 2, white pigmented.

C. Class of Vehicle: Class A, no restrictions.

D. Performance Criteria of Compound: Compatible with sealing compound, if sealing compound is to be applied over concrete curing compound.

2.03 EPOXY INJECTION SYSTEM

A. Liquid membrane, in accordance with AASHTO M-148

B. Type of Compound: Engineer to select.

1. Type 1, clear or translucent without dye.

2. Type 1-D, clear or translucent with red fugitive dye.

3. Type 2, white pigmented

2.04 CONCRETE SURFACE SEALING COMPOUND

A. Manufacturer certified properties as follows.

1. Flash point: 120 degrees F. maximum.

2. Substance Type: Poly-siloxane (Alkyl-Alkoxy Siloxane).

3. Water Solubility: Less than 1 percent.

4. Color: Clear or slightly opalescent.

5. Vehicle: Chloro-aliphatic solvents.

B. Performance criteria of sealant, when tested according to ASTM C 642.

1. Weight Gain: 70 to 85 percent reduction of water absorption when compared to untreated test sample.

2. Scaling resistance: Weight loss less than 2.0 percent when subjected to 40 cycles of freeze-thaw.

2.05 CHEMICAL HARDENER

A. Colorless, aqueous solution containing a blend of magnesium flousilicate and zinc flousilicate combined with a wetting agent.

B. Not less than 2 pounds flousilicate per gallon.

C. Provide materials which do not react with, inhibit, or otherwise interfere with adhesives and bonding of finishes.

PART 3 EXECUTION

3.01 PREPARATION

A. All exposed corners shall be chamfered (3/4" x 3/4").

B. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not impede placing concrete.

C. Do not allow construction loads to exceed member capacity.

D. Prepare previously placed concrete by cleaning with steel brush and applying bonding compound. Apply bonding compound in accordance with manufacturer's instructions.

E. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

F. Do not disturb reinforcement, inserts, embedded parts, and formed joints.

G. Do not break or interrupt successive pours such that cold joints occur.

H. Honeycomb or embedded debris in concrete is not acceptable.

3.02 CONCRETE PLACEMENT

A. Notify Engineer minimum 24 hours prior to commencement of concrete placement operations.

B. Place concrete in accordance with ACI 301.

C. Hot Weather Placement: In accordance with ACI 305. Use set-retarding admixture or fog spray if evaporation approaches 0.2 lb./ft.^{2}/hr.

D. Cold Weather Placement: In accordance with ACI 306. Use non-chloride accelerating admixture in concrete work placed at ambient temperatures below 50 degrees F. Use of admixtures will not relax cold weather placement requirements.

E. Do not disturb reinforcement, inserts, embedded parts, and formed joints.

F. Do not break or interrupt successive pours such that cold joints occur.

G. Honeycomb or embedded debris in concrete is not acceptable.

H. Deposit concrete as close as possible to its final position, without allowing it to flow laterally in the form any considerable distance. Do not use vibrators to flow concrete laterally.

I. Limit placement duration to 45 minutes.

J. When placing concrete with a concrete pump, use a pump that produces a continuous stream of concrete without air pockets. Do not add water to the concrete in the pump hopper.

K. Use high frequency internal vibrators to compact all concrete. Supply enough vibrators (two minimum) to compact concrete within 15 minutes after it is deposited in forms. Do not allow vibrators to penetrate layers of concrete that have taken an initial set.

L. Do not allow the free fall of concrete to exceed 5-feet without the use of a tremmie or metal spout.

3.03 WATERTIGHTNESS OF CONCRETE WORK

A. Provide concrete work and grout of homogeneous structure, which when hardened will have the required strength, watertightness, and resistance to weathering.

B. Construction, contraction, and expansion joints have been positioned in structures, and curing methods specified, for the purpose of reducing the number and size of these expected cracks, due to the normal expansion and contraction expected from the specified concrete mixes. Class A concrete shall be watertight. Cracks which develop in walls or slabs shall be repaired. Cracks which show any signs of leakage shall be repaired until all leakage is stopped.

C. Visible cracks, other than hairline cracks and crazing, in the following areas shall be pressure grouted with low viscosity epoxy as specified herein as Epoxy Injection System for floors and walls of water bearing structures.

D. Walls or slabs, as above, that leak or sweat because of porosity or cracks too small for successful pressure grouting, shall be sealed on the water or weather side by coatings of a surface sealant system, as specified elsewhere herein.

E. Grouting or sealing as specified above shall be continued until the structure is watertight and shall remain watertight.

3.04 JOINTS

A. As far as practicable the concrete work shall be constructed as a monolith. The locations of contraction, construction, and other joints are indicated on the Plans or specified herein. Where not specified or indicated otherwise, all slabs and walls shall have construction joints at intervals not greater than 30 feet. In order to preserve the strength and watertightness of the structures, no other joints shall be made except as the Engineer may authorize.

B. At construction joints, the concrete in place shall be thoroughly cleaned of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter by means of a brush, hammer or heavy sandblasting, after which the surfaces shall be washed just prior to the succeeding concrete placement.

C. Immediately prior to resuming concrete placing operations, a bed of grout not less than 2 inch in thickness nor more than 1 inch in thickness shall be thoroughly spread over the horizontal joint surfaces.

D. Keyways in joints shall be provided as indicated on the Plans. Material for keyways shall be steel, plastic or lumber treated with form release coating, applied in accordance with the manufacturer=s published instructions.

E. Construction joints shall be washed free of sawdust, chips, and other debris after forms are built and immediately before the concrete placement. Should formwork confine sawdust, chips, or other loose matter in such a manner that it is impossible to remove them by flushing with water, a vacuum cleaner shall be used for their removal, after which the cleaned surfaces shall be flushed with water. A cleanout hole shall be provided at the base of each wall and column for inspection and cleaning.

F. In any case where it is necessary to repair concrete by bonding mortar or new concrete to concrete which has reached its initial set, the surface of the set concrete shall first be coated with epoxy bonding agent Concressive No. 1001 LPL as manufactured by Adhesive Engineering; Sikadur HiMod as manufactured by Sika Chemical Corporation; or equal. This material shall be applied in accordance with the manufacturer=s published instructions.

G. Expansion, contraction, and construction joints shall be constructed where and as indicated on the Plans. Waterstops, expansion joint material, synthetic rubber sealing compound, and other similar materials, shall be as specified elsewhere herein.

H. The Contractor shall schedule the placing of concrete in such a manner as to complete any single placing operation to a construction, contraction, or expansion joint. Special care shall be taken to insure that concrete is well consolidated against waterstops and that waterstops are secured in the proper position.

I. Saw cut patterns where indicated. Saw cut control joints without raveling of the concrete. Sawing shall be done a minimum of 4 hours and a maximum of 24 hours after pouring the concrete.

3.05 **CAULKING**

A. All caulking where indicated on the Plans or as specified, except for masonry construction and where specified otherwise, shall be done with synthetic rubber sealing compound.

B. Concrete must be thoroughly cured prior to caulking. All surfaces to be caulked shall be dry, clean, and free from dirt, grease, curing compounds, and other residue which might interfere with adhesion of the caulking compound. Concrete surfaces shall be cleaned and primed in strict accordance with the manufacturer's recommendations prior to caulking. Sponge rubber filler materials may be used as backing for caulking, if acceptable to the City Engineer. Filler material, when used, shall be compressible and untreated.

C. Caulking shall be applied with a pneumatic caulking gun. Nozzles of the proper shape a size shall be used for the application intended. A continuous bond shall be maintained between the caulking and the sides of the joint to eliminate gaps, bubbles, or voids and to fill the joint in a continuous operation without layering of the compound. All joints and seams shall be caulked by experienced applicators in a neat workmanlike manner.

D. No caulking shall be applied when the surface temperature exceeds 120 degrees F to avoid sponging or bubbling of compound. To hasten curing of the compound when used on wide joints subject to movement, the Contractor shall apply heat with infra-red lamps or other convenient means.

E. Excess caulking shall be removed by soaking and scrubbing before caulking has cured with Chem Seal CS9900; equivalent product of Products Research and Chemical Corporation; or equal. Excess cured material shall be removed by sanding with No. 80 grit paper.

3.06 CONSOLIDATION

A. In accordance with ACI 309.

B. Keep spare vibrator available during concrete placement operations.

3.07 FINISHING

A. Do not add water or retemper concrete unless Engineer's approval is secured.

B. Slab Finishing Tolerance:

1. Class A finish: 1 in 1000.

2. Class B finish: 1 in 500.

3. Class C finish: 1 in 150.

C. Finishes: In accordance with Section 03 34 50. When type of finish is not indicated, use following finishes as applicable:

1. Sidewalks, garage floors, and ramps: Broom or belt finish.

2. Exterior concrete pavement: Broom or belt finish.

3. Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials: Nonslip finish.

4. Surfaces intended to receive bonded applied cementitious applications: Scratched finish.

5. Surfaces intended to receive roofing, except future floors, waterproofing membranes, and roof surfaces which are future floors or sand bed terrazzo: Floated finish.

6. Floors and roof surfaces which are floors intended as walking surfaces or to receive floor coverings: Troweled finish.

7. Unpainted concrete surfaces not exposed to public view: Smooth as-cast form finish.

8. Unpainted concrete surfaces exposed to public view: Rubbed finish.

9. Concrete surfaces to receive paint or plaster: Grout cleaned finish.

D. Chemical Hardener: After completion of curing, apply chemical hardener in accordance with manufacturer's instructions to all interior floor slabs which are exposed in finished work and elsewhere as indicated. After final coat of chemical hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water. Do not place liquid floor hardener on floor areas scheduled to receive synthetic matrice terrazzo, or setting beds for tile, terrazzo, vinyl flooring, or like items.

3.08 **CURING**

A. Curing: In accordance with Section 03 37 00.

B. General: Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete. Cure concrete by applying curing and sealing compound, by moisture curing, by moisture-retaining cover curing, or by combinations thereof.

C. Curing Compounds:

1. Apply curing compound to concrete slabs within 2 hours of completing final finishing operations. Apply uniformly in continuous operation. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Should side forms be removed before expiration of 7 days from start of curing, coat exposed surfaces with curing compound.

2. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Engineer.

D. Moisture Curing: Provide either of the following methods.

1. Keep concrete surface continuously wet by covering with water or continuous water-fog spray.

2. Cover concrete surface with absorptive cover, thoroughly saturated with water and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

E. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material with waterproof tape.

F. Formed Surface Curing: Cure formed concrete surfaces, including undersides of beams,

supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods indicated above, as applicable.

G. Unformed Surface Curing: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.09 SEALING

A. Surface Preparation: If necessary to remove curing compound, sandblast concrete surface. Clean surface free of dirt, oil, grease and other contaminants. If necessary use proprietary cleaning compounds (not raw acids) followed by thorough water rinsing. Use high pressure water equipment providing 1,200-2,000 psi to remove detergent residues. Do not attempt application when condensation is present.

B. Application: Spray with low pressure (20 psi) airless spray equipment. Saturate the surface to the point of rejection. On vertical surfaces apply 2 coats.

C. Coverage Rates: In accordance with manufacturer's recommendation.

D. Paint Adhesion: Always test to verify compatibility between sealant and other proposed surface treatments.

E. Warning: Remove inadvertent splashes before the solution has dried on the surface. If sealant is a hazardous material, allow use only by professional applicator.

3.10 METHOD OF INJECTION OF EPOXY

A. Adequate surface seal shall be applied to the crack or joint to prevent escape of the epoxy. Entry points shall be established at a distance along the seal not less than the thickness of the cracked member.

B. A 100 percent solid epoxy adhesive as specified shall be forced into the crack at the first port with sufficient pressure to advance the epoxy to the adjacent port. The original port shall be sealed and entry shifted to the port at which the epoxy appears. This manner of port-to-port injection shall be continued until each joint has been injected for its entire length.

C. Before processing, the space in the vicinity of a crack location receiving epoxy shall have been swept and left in generally clean condition. All joints receiving epoxy under this section shall be cleaned free from dirt, laitance, and other loose matter.

D. Pump unit used for injection shall be a positive displacement type with interlock to provide an in-line mixing and metering system for the two-component epoxy. The pressure hoses and injection nozzle shall be of such a design as to allow proper mixing of the two components of epoxy. The presence of a standby injection unit may be required.

E. For small amounts, or where excessive grout pressure developed by a pump unit might further damage the structure, premixed material and a hand caulking gun may be used if acceptable to the Engineer.

F. Seal all ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out. Any condition other than normal shall be reported to the Engineer. Solvents may not be used to thin the epoxy system introduced into the cracks or joints. All work under this Specification shall be performed and conducted in a neat orderly manner.

3.11 DAMPPROOFING

A. Surfaces to be dampproofed shall be cured, dry and free of all frost, loose material and dirt.

B. The surface which is to be protected by dampproofing shall be thoroughly cleaned before the primer is applied. The surface shall then be brush or spray painted with two coats of asphalt for primer treatment at a rate of 1/8 gallon per square yard for each coat. After the primed surface has dried one application of asphalt dampproofing material shall be applied by brush, at a rate of 1/10 gallon per square yard.

C. Care shall be taken to prevent discoloration of other parts of the structure not to be dampproofed, by the dripping or spreading of asphalt.

3.12 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required levels, lines, details, and elevations.

B. Structural analysis and additional testing may be required at no additional cost to Owner when the strength of a structure is considered potentially deficient.

C. Patch imperfection. Refer to Section 03 34 50 requirements.

3.13 PROTECTION AND REPAIRS

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Random Cracks in Pavement Slabs on Grade: When cracks occur within 2 feet of expansion of construction joints, remove and repair, otherwise grout with approved epoxy grout. Use saw cuts and dowels in all cut planes.

3.14 PLACING CONCRETE IN COLD WEATHER

A. No concrete shall be placed where the air temperature is lower than 40 degrees Fahrenheit, at a location where the concrete cannot be covered or protected from the surrounding air.

B. When concrete is placed below a temperature of 35 degrees Fahrenheit the ingredients of the concrete shall be heated so that the temperature of the mixture shall not be less than 50 degrees or more than 100 degrees Fahrenheit.

C. Before mixing, the heated aggregates shall not exceed 175 degrees Fahrenheit.

D. Cement shall not be added while the temperature of the mixed aggregates and water is greater than 100 degrees Fahrenheit.

E. When there is likelihood of freezing during the curing period, the concrete shall be protected by means of an insulated covering to prevent freezing of the concrete for a period of not less than 7 days after placing.

F. 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.

G. 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 100 degrees Fahrenheit.

H. The housing, covering, or other protection used shall remain in place and intact at least 24 hours after the artificial heating is discontinued.

I. For a period of five days the concrete shall be kept above 40 degrees F and below 100 degrees F.

3.15 PROTECTION AND REPAIRS

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Random Cracks in Pavement Slabs on Grade: When cracks occur within 2 feet of expansion of construction joints, remove and repair, otherwise grout with approved epoxy grout. Use saw cuts and dowels in all cut planes.

D. All concrete curbs, gutter, sidewalks, and driveways shall be removed and replaced to the next joint or scoring lining beyond the actually damaged or broken sections.

E. In the event that joints or scoring lines do not exist or are five or more feet from the removed or damaged section, the damaged portions shall be saw cut, removed, and reconstructed to neat, plane faces.

F. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements.

G. Where necessary, lampblack or other pigments shall be added to the new concrete to obtain the desired results.

H. The concrete surface must not be damaged or pitted by rain.

I. 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.

J. The Contractor shall erect and maintain suitable barriers to protect the finished surface.

K. Any section damaged from traffic or other causes occurring prior to its official final acceptance shall be repaired or replaced by the Contractor at his own expense in a manner satisfactory to the City Engineer.

L. Concrete surface repair method as per City Engineer’s discretion.

M. Concrete shall not spall or show signs of spalling before the warranty expiration. All concrete with spalling shall be removed and replaced by the Contractor or Owner at his own expense. Concrete with spalling may be repaired by an approved method. The approved method must be a five step process which includes a muriatic acid wash, pressure wash with orbital nozzle, application of approved grout & cement modifier (Duraset 1000 Modified Acrylic Resin and G100 Pro-Series Grout Mix and Liquid Colorant or equal), and application of approved solvent based sealer (SuperSeal 2000 Solvent Based Acrylic Sealer or equal).

N. Curb & gutter damage shall be repaired according to the following criteria.

1. Removal and replacement of the entire section of curb and gutter is required for chips and gouges greater than ¾" deep and 3" longcracks over ¼" wide, or any damage which will result in the failure of the curb & gutter, unless an acceptable epoxy based patch is approved by the City Engineer.

2. Epoxy based patching compounds may be used as an alternative to removal and replacement for curb & gutter chips and gouges smaller than ¾" deep and 3" long. Patches shall match surrounding surface of concrete.

3. Alternative methods of repair shall be approved by the City Engineer.

O. Broken or damaged sidewalk shall be repaired according to the following criteria.

1. Epoxy based patching may be used for chips or gouges in sidewalk greater than 1/2 inch in depth but less than 3 inches in depth.

2. Removal and replacement of the entire concrete section* is required for the following types of damage:
   a. Chips and gouges in or along sidewalks greater than three inches deep.
   b. Cracks over ¼" in nominal width regardless of running direction.
   c. Multiple cracks where the cracks are less than a sidewalk width apart.
   d. Cracks that converge creating small isolated pieces of sidewalk.
   e. Cracks that generally run parallel to the length of the sidewalk.
   f. Cracks that circle back to the original side creating a "half moon" piece of broken concrete.
   g. Cracks that allow the concrete to move vertically from the adjoining piece or section in excess of ¼" or which the inspector deems as a tripping hazard.
   h. Any damage which in the inspectors' opinion was clearly the result of negligence on the part of the builder. Or damage which appears will result in failure of the sidewalk or gutter and its intended function.

*Sections may be cut and the damaged portions removed, provided no remaining or new section(s) are less than 5 feet in length. (Cut lines are considered as section lines.)

P. All concrete work shall conform to the requirements of this section.

Q. Concrete sidewalk and curb & gutter which is defective due to settlement, uneven joints, or tripping hazards may be corrected by "Concrete Lifting" as approved by Engineer. Concrete lifting shall conform to the following:

1. Concrete repair by lifting shall only be performed by a licensed contractor specializing in concrete lifting.

2. Concrete lifting shall be completed by drilling strategically placed holes in concrete. A grout, sand, Portland cement, and water mixture shall be used proportioned to harden without settlement and to sufficiently fill voids beneath the concrete. Holes shall be placed to allow for pumping the cement mixture under the concrete to lift the settled areas. Additional holes shall also be drilled to allow for filling voids created by the lifting procedure.

3. The proportion of Portland cement shall be a minimum of 5 percent by weight of dry mixture.

4. The use of the concrete lifting technique may be attempted to correct uneven adjoining sections of concrete or correct areas of defective drainage. If concrete lifting does not correct the defective concrete to the Engineers satisfaction, the concrete shall be removed and replaced.

3.16 **TESTS**

A. Arrange for and perform all testing required for qualification of proposed materials and the establishment of mix designs, in determining strengths for early form removal, for cylinder tests after the addition of water, and other needs of Contractor.

B. Two slump tests, one before and one after the addition of super-plasticizer.

C. Standard cylinder samples of concrete from trucks receiving water after addition of water.

END OF SECTION

SECTION 03 34 50

CONCRETE FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Application procedure for concrete surface finishes.

1.02 PROJECT CONDITIONS

A. Allow concrete to cure not more than 72 hours before commencing surface finish operations, unless otherwise acceptable to Engineer.

B. Protect adjacent materials and finishes from dust, dirt and other surface or physical damage during finishing operations. Provide protections as required and remove from site at completion of Work.

C. For surfaces to be blast finished, perform abrasive blasting within 24 to 72 hours after casting. Coordinate with formwork construction, concrete placement schedule, and formwork removal to ensure that surfaces are blasted at same age for uniform results.

PART 2 EXECUTION

2.01 PATCH FINISHING

A. Repair surface defects immediately after form removal.

B. Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial and obtain a good color match with concrete when both patch and concrete are cured and dry.

1. Mix white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint

2. Use a minimum amount of mixing water

3. Mix patching mortar in advance and allow to stand without frequent manipulation, without addition of water, until it has reached stiffest placeable consistency

4. After initial set, dress surfaces of patches manually to obtain same texture as surrounding surfaces.

C. Repair defective areas.

1. Remove honeycomb and defective concrete down to sound concrete.

2. Make edges perpendicular to surface or slightly undercut.

3. Featheredges are not permitted.

4. Dampen area to be patched and at least 6" surrounding it to prevent absorption of patching mortar water.

5. Prepare bonding grout.

6. Mix to consistency of thick cream.

7. Brush into surface.

D. After surface water has evaporated from patch area, brush bond coat into surface.

1. When bond coat begins to lose water sheen, apply patching mortar.

2. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface.

3. Leave undisturbed for at least 1 hour before final finish.

4. Keep patched area damp for 72 hours or apply curing compound.

5. Do not use metal tools in finishing an exposed patch.

E. Tie Holes: Unless indicated otherwise, after being cleaned and thoroughly dampened, fill the hole solid with patching mortar.

F. Where as-cast finishes are indicated, total patched area my not exceed 1 in 500 of as-cast surface. This is in addition to form tie patches, if ties are permitted to fall within as-cast areas.

G. In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate.

1. Outer 1" of patch shall contain same aggregates as surrounding concrete.

2. For aggregate transfer finish, patching mixture shall contain same selected colored aggregates.

3. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

2.02 SLAB FINISHING

A. Broom or Belt Finish: After concrete has been placed, consolidated, struck-off, and leveled to the required tolerance, roughen surface transversely with stiff brushes, rakes, or burlap belt before final set.

B. Float Finish: After concrete has been placed, consolidated, struck-off, and leveled, do not work further until ready for floating.

1. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation.

2. During or after first floating, check planeness of entire surface with a 10 feet long straightedge applied at 2 or more different angles.

3. Cut down high spots and fill low spots to the required tolerance.

4. Refloat slab immediately to a uniform sandy texture.

C. Trowel Finish:

1. Float finish surface.

2. Power trowel.

3. Hand trowel as required to provide surface. Do not apply water to retemper concrete in finishing operations.

4. First troweling after power floating shall produce smooth surface relatively free of defects but which may still show some trowel marks.

5. Second trowel by hand after surfaces has hardened.

6. Leave finished surface essentially free of trowel marks, uniform in texture and appearance.

7. On surfaces intended to support floor coverings, grind off defects which would show through floor covering.

2.03 AS-CAST FORMED FINISHING

A. Rough: Patch defects, chip or rub off fins exceeding 1/4" height.

B. Smooth: Patch tie holes and defects and remove fins completely.

1. When surface texture is impaired and form joints misaligned, grind, bushhammer, or correct affected concrete as directed by Engineer.

2. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.

3. Repair major mortar leakage as a defective area.

4. When in opinion of Engineer, workmanship is less than acceptable standard, provide one of rubbed finishes at no additional cost to Owner.

2.04 RUBBED FINISHING

A. Produce following finishes on concrete with a smooth form finish.

B. Smooth Rubbed: Remove forms and perform necessary patching as soon after placement as possible.

1. Finish newly hardened concrete no later than 24 hours following form removal.

2. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.

C. Grout Cleaned: Undertake no cleaning operations until all contiguous surfaces are completed and accessible.

1. Wet surface of concrete sufficiently to prevent absorption of water from grout.

2. Apply grout uniformly.

3. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids.

4. While grout is still plastic, remove excess grout by working surface with rubber float or sack.

5. After-surface whitens from drying, rub vigorously with clean burlap.

6. Keep damp for at least 36 hours after final rubbing.

D. Cork Floated: Remove forms within 2 to 3 days of placement where possible.

1. Remove ties.

2. Remove all burrs and fins.

3. Dampen wall surface.

4. Apply mortar with firm rubber float or with trowel, filling all surface voids.

5. Compress mortar into voids.

6. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer.

7. Produce final texture with cork float using a swirling motion.

2.05 UNFORMED FINISHING

A. After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces.

B. Float to texture which is reasonably consistent with formed surfaces.

C. Continue final treatment on formed surfaces uniformly across uniformed surfaces.

END OF SECTION

SECTION 03 37 00

CONCRETE CURING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Initial and final curing of horizontal and vertical concrete surfaces.

1.02 RELATED SECTIONS

A. Section 03 30 40 – Portland Cement Concrete.

B. Section 03 31 00 – Concrete Work.

1.03 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 302 - Recommended Practice for Concrete Floor and Slab Construction.

C. ACI 308 - Standard Practice for Curing Concrete.

D. ASTM C171 - Sheet Materials for Curing Concrete.

E. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

F. ASTM D2103 - Polyethylene Film and Sheeting.

PART 2 PRODUCTS

2.01 MATERIALS

A. Membrane Curing Compound Type 1: ASTM C309 Type 1 acrylic type, clear without fugitive dye.

B. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate conditions under provisions of Section 03 31 00.

B. Verify that substrate surfaces are ready to be cured.

3.02 **EXECUTION - HORIZONTAL SURFACES**

A. Cure floor surfaces in accordance with ACI 308.

B. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.

C. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

3.03 **EXECUTION - VERTICAL SURFACES**

A. Cure surfaces in accordance with ACI 308.

B. Spraying: Spray water over surfaces and maintain wet for 7 days.

C. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

3.04 **PROTECTION OF FINISHED WORK**

A. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 15 00 00

WATER DISTRIBUTION AND TRANSMISSION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water distribution and transmission system identification, valves, boxes, service connections and accessories.

B. This section is applicable to potable water pressure systems, but may be used to specify not-potable water pressure systems.

1.02 REFERENCES

A. Applicable water company requirements.

B. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

C. AWWA C800: AWWA standard for Underground Service Line Valves and Fittings.

D. AWWA C900: AWWA Standard for PVC Pressure Pipe.

E. AWWA C905: AWWA Standard for PVC Pressure Pipe and Fabricated Fittings.

1.03 PERFORMANCE REQUIREMENTS

A. A vertical minimum clearance of 10" and a horizontal minimum clearance of 36" shall be maintained from any other underground facility or structure, unless authorized otherwise by Engineer.

B. Depth of Cover:

1. Culinary Water System
   a. 60” minimum for service lines.
   b. 60” minimum for main lines (72” under gravel roads and gravel driveways)
   c. If City Engineer authorizes less cover, provide additional protection to withstand frost and external loads.

2. Secondary Water System
   a. 24" minimum for service lines.
   b. 24" minimum for main lines.
   c. If Engineer authorizes less cover, provide additional protection to withstand external loads.

C. Piping Testing Schedule: In accordance with Section 02 66 00. Conduct test after thrust blocks have sufficiently hardened. Provide signs and types of equipment connections and fittings which match pipe materials when pressure testing systems.

D. Remove any section of pipe already placed by Contractor which is found to be defective or damaged. Relay or replace without additional cost to City.

E. Disinfection of Potable Water System: In accordance with Section 02 67 50.

1.04 **SUBMITTALS**

A. Product Data: Manufacturer's technical product data and installation instruction.

B. Test Reports: Submit testing data indicated in Section 02 67 50.

C. Operating and Maintenance: Include maintenance data, parts lists, product data, and shop drawings.

1.05 **PROJECT CONDITIONS**

A. Minimize neighborhood traffic interruptions and barricade stockpiles in accordance with the latest version of the MUTCD manual.

B. Secure acceptance of pipeline lateral tie-in work.

C. Repair public and private facilities damaged by Contractor.

D. Clearly identify and promptly set aside defective or damaged pipe.

PART 2 PRODUCTS

2.01 **PIPES AND FITTINGS**

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities indicated.

B. Where not indicated, provide proper selection as determined by installer to comply with installation requirements.

C. Provide sizes and types of equipment connections for fittings of materials which match pipe materials used in pressure piping systems. Where more than one type of material or product is indicated, selection is installer's option.

D. Provide pipe fittings and accessories of same material and weight or class as pipe, with joining method indicated or recommended by manufacturer.

2.02 **VALVES**

A. As indicated and in accordance with Section 15 11 00.

B. Locate on tee, at each intersection, and not more than 1,000 feet between valves.

2.03 **VALVE BOX**

A. Markings: On cover of valve box, cast the following as applicable; "WATER" or "IRRIG"

2.04 **VALVE CHAMBER**

A. Basin: Cast-in-place concrete, with base riser section or precast base riser section with integral floor.

B. Steps: Plastic, cast into valve chamber sidewalls greater than 4 feet deep.

C. Top: Flat slab concrete.

D. Frame and Cover: Asphalt coated, heavy duty ductile iron with flat top design and "Water" (or other applicable utility) lettering. Shape and size as indicated.

2.05 **MORTAR AND CONCRETE**

A. Mortar: Portland cement.

B. Concrete:

1. Cast-in-place, Class 3000 minimum, in accordance with Section 03 30 40.

2. Precast, Class 4000 minimum.

2.06 **TAPPING SADDLES**

A. For tapping saddles, provide Ford Single Strap Brass Saddle or approved equal.

B. Provide tapping saddles that have a minimum rated working pressure of 300 psi, neoprene Buna N gaskets, and bronze tapered threads.

2.07 **ACCESSORIES**

A. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.

B. Corporation Stops: All bronze with taper threads.

C. Valves: In accordance with Section 15 11 00.

D. Hydrants: In accordance with Section 15 12 00

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Verify trench cut is ready to receive Work, and excavations, dimensions, and elevations are as indicated.

B. Beginning of installation means acceptance of existing conditions.

3.02 **PREPARATION**

A. Hand trim excavations to required elevations. Correct over excavation in accordance with Section 02 22 00.

B. Remove large stones or other hard matter which could damage pipe or impede backfilling or compaction.

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

D. Clearly identify and promptly set aside defective or damaged pipe.

E. Use machine pipe cutting tool acceptable to pipe manufacturer.

3.03 **PIPE AND FITTING INSTALLATION**

A. Ductile-iron Pipe: Install in accordance with AWWA C600.

B. Polyethylene Pipe: For 3" and smaller pipe follow AWWA C901. Install all other sizes in accordance with manufacturer's installation instructions.

C. Copper Tube: Install in accordance with CDA “Copper Tube Handbook”.

D. Polyvinyl Chloride Pipe: Install in accordance with AWWA C900.

3.04 **SETTING VALVES AND VALVE BOXES**

A. Install valves plumb with stems pointing up.

B. Set valve box over valve; adjust to finish grade and plumb.

C. Clean any dirt or foreign material from inside of box.

3.05 **SERVICE CONNECTIONS**

A. Apply for and pay for applicable permits from the City for the indicated size and location of tap to water main. Comply with all connection requirements of the City.

B. Make all service taps with a tapping machine acceptable to the water company. Use teflon tape on all taps unless indicated otherwise.

C. Locate service taps in the upper quadrant of the main line, approximately at 45 degrees. The minimum distance between taps is 24", with a 5 degree stagger. Do not make service taps within 24" of the end of the main line.

D. Service saddles are required on all taps unless indicated otherwise.

E. Install service lines to property line or as directed by Engineer.

3.06 **CONCRETE THRUST BLOCKS**

A. Do not make hydrostatic tests until thrust block concrete has set.

B. Provide thrust blocks, or metal tie rods and clamps or shackles, on plugs, caps, tees, and bends deflecting 22-1/2 degrees or more either vertically or horizontally.

C. Unless otherwise indicated or directed by Engineer, place the base and bearing sides of thrust blocking directly against undisturbed earth.

D. Sides of thrust blocking not subject to thrust may be placed against forms. Place thrust blocking so the fitting joints will be accessible for repair.

E. Poly FM No. 1 grease and 8 mil vinyl wrap fittings and spools.

3.07 **LOCATION OF STUB PIPES**

A. The location of each sewer stub shall be marked by placing a 2 x 4 marker at the end of the pipe and extending vertically from the end of the pipe to approximately 15 inches above the ground surface.

B. The portion of the 2 x 4 extending above ground, shall be painted as follows:

1. Blue - indicating water

C. The sidewalk and curb shall be stamped in the following manner, showing locations of water, sewer, and pressure irrigation stub pipes:

1. A “w” stamp for water.

2. A “i” stamp for pressure irrigation

D. Meter can for the culinary water shall be installed by the developer/contractor.

E. A meter/valve box shall be installed for pressure irrigation by the developer/contractor.

3.08 LOCATING POTABLE WATER PIPE

A. Locate potable water pipe at least 10 feet horizontally, from sewer pipe (pipe edge to pipe edge). Where bottom of water pipe will be at least 18" above top of sewer pipe, locate water pipe at least 6 feet horizontally from sewer pipe.

B. Where potable water pipe cross under gravity-flow sewer lines, fully encase the sewer pipe in concrete for a distance at least 10 feet each side of the crossing, or provide pressure pipe with no joint located within 36" of the crossing.

1. Encase water lines where water line is placed within 24" of a sewer force main or inverted syphon.

2. Encase in concrete those joints in the sewer main which are horizontally closer than 36" to the crossing.

C. Do not place potable water lines in the same trench with sewer lines, storm drains or electric wires.

D. 16” lines will not be tapped, without written approval.

3.09 BACKFILLING

A. Trenches, in accordance with Section 02 22 50.

3.10 CLEANING

A. Flush all pipelines after pressure testing.

B. Flush lines through hydrants or, if a hydrant does not exist at the end of the line, install a tap of sufficient size to meet requirements of Section 02 66 00.

END OF SECTION

SECTION 15 05 20

BASIC PIPING MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Basic piping materials and methods.

B. Related Sections:

1. Section 02 66 00 - Pipeline Testing.

2. ***Utah State Division of Drinking WaterR309-545-11. ANSI/NSF International, Standard 61.***

ANSI/NSF Standard 61 Certification.
All interior surfaces or coatings shall consist of products which are certified by laboratories approved by ANSI and which comply with ANSI/NSF Standard 61 or other standards approved by the Executive Secretary. This requirement applies to any pipes and fittings, protective materials (e.g. paints, coatings, concrete admixtures, concrete release agents, concrete sealers), joining and sealing materials (e.g. adhesives, caulks, gaskets, primers and sealants) and mechanical devices (e.g. electrical wire, switches, sensors, valves, submersible pumps) which are located so as to come into contact with the drinking water.

3. Section 02 97 00 – Petroleum Contaminated Soil Handling

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM):

1. A 106 - Specification for Seamless Carbon Steel Pipe for High Temperature Service.

2. D 2240 - Test Method for Rubber Property - Durometer Hardness.

3. A 536 – 84(2009) Standard Specification for Ductile Iron Castings.

4. F 1674-96 – Standard Test Method for Joint Restrain Products for Use with PVC Pipe.

5. D3359 – Standard Test Methods for Measuring Adhesion by Tape Test.

6. B-117 – Salt Spray (Fog) Testing.

B. American Water Works Association (AWWA)

1. ANSI/AWWA C111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

2. AWWA C909-02 – Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in through 12 in. (100 MM through 600 MM), for Water Distribution.

1.03 **DEFINITIONS**

A. Aboveground Piping: Piping within buildings, tunnels, or other structures without regard to elevation of piping, or exposed piping outside buildings and structures.

B. Underground Piping: Piping actually buried in soil or cast in concrete.

1.04 **INTENT OF DRAWINGS AND SPECIFICATIONS**

A. Except in details, piping is indicated diagrammatically. Sizes and locations are indicated on the Drawings. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings.

B. Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other type of obstructions that cannot be removed or changed.

1. Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Time.

1.05 **SYSTEM DESCRIPTION**

A. Performance Requirements:

1. Venting Piping Under Pressure:
   a. Lay piping under pressure flat or at a continuous slope without air traps, unless approved by City Engineer.
   b. Install plug valves as air bleeder cocks at high points in piping. Provide one inch plug valves for water lines, and 2 inch plug valves for sewage and sludge lines, unless otherwise indicated on the Drawings.
   c. Provide additional pipe taps with plug cocks and riser pipes along piping as required for venting during initial filling, disinfecting, and sampling.
   d. Before piping is placed into service, close plug valves and install plugs.

2. Restraining Piping:
   a. Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends.
      1) When piping is underground, use concrete thrust block or mechanical restraints.
      2) When piping is aboveground or under water, use mechanical or structural restraints.
      3) Determine thrust forces by multiplying the nominal cross sectional area of the piping by design test pressure of the piping.
   b. Provide restraints with ample size to withstand thrust forces resulting from test pressures.
      1) During testing, provide suitable temporary restraints where piping does not require permanent restraints.
   c. Place concrete thrust blocks against undisturbed soil. Place concrete so piping joints, fittings, and other appurtenances are accessible for assembly and disassembly.
   d. Grease bolts and wrap all fittings with plastic.
   e. Provide underground mechanical restraints where specified in the Piping Schedule.

3. Connections to Existing Piping:
   a. Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings.
      1) Protect domestic water supplies from contamination.
         a) Make connections between domestic water supply and other water systems in accordance with requirements of public health authorities.
         b) Provide devices approved by owner of domestic water supply system to prevent flow from other sources into the domestic supply system.
   b. Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.
   c. Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.

4. Connections of Dissimilar Metals:
   a. Connect ferrous and nonferrous metal piping, tubing, and fittings with dielectric couplings especially designed for the prevention of chemical reactions between dissimilar metals.
   b. Nonferrous metals include aluminum, copper, and copper alloys.

PART 2 PRODUCTS

2.01 LINK SEAL

A. Manufacturers: One of the following or equal:

1. Calpico, Inc.

2. Thunderline Corporation.

B. Characteristics.

1. Modular mechanical type, consisting of interlocking neoprene or synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.

2. Assemble links solely with stainless steel bolts and nuts to form a continuous rubber belt around the pipe.

3. Provide a stainless steel pressure plate under each bolt head and nut. Isolate pressure plate from contact with wall sleeve.

2.02 GASKETS

A. Gaskets for Ductile Iron and Steel Piping:

1. Suitable for pressures equal to and less than 200 pounds per square inch gauge, temperatures equal to and less than 100 degrees Fahrenheit, and raw sewage service.

2. Neoprene with minimum durometer hardness value of 70 when tested in accordance with ASTM D 2240, Type A; minimum 3/32 inch thick for less than 10 inch pipe; minimum 1/8 inch thick for 10 inch and larger pipe. Provide gaskets with inserted 13 ounce nylon fabric cloth for pipes 20 inch or larger.

3. Manufacturers: One of the following or equal:
   a. Garlock, Style 8798
   b. John Crane.

B. Gaskets for Flanged Joints in Polyvinyl Chloride, High Density Polyethylene, Chlorinated Polyvinyl Chloride, Ductile Iron, or Steel Water Piping:

1. Suitable for hot or cold water, pressures equal and less than 150 pounds per square inch gauge, and temperatures equal and less than 160 degrees Fahrenheit.

2. Material: Teflon ring; or teflon envelope with nonasbestos filler.

3. Manufacturers: One of the following or equal:
   a. Garlock.
   b. Bluegard.
   c. John Crane.

C. Gaskets for Flanged Joints in Polyvinyl Chloride, Chlorinated Polyvinyl Chloride, Ductile Iron, or Steel Water Piping:

1. Suitable for hot or cold water, pressures equal and less than 250 pounds per square inch gauge, and temperatures equal and less than 160 degrees Fahrenheit.

2. Material: Teflon ring; or teflon envelope with nonasbestos filler.

3. Manufacturers: One of the following or equal:
   a. Garlock.
   b. Bluegard.
   c. John Crane.

D. Gaskets for Ductile Iron Piping in **Contaminated Soils**:

1. Suitable for pressures equal to and less than 250 pounds per square inch gauge, temperatures between 400 degrees and -100 degrees Fahrenheit.

2. Aramid fibers with Nitrile Binder gasket tested in accordance with ASTM F-104; Fluid services to include water, aliphatic hydrocarbons, oils, and gasoline.

3. Manufacturers: One of the following or equal:
   a. Garlock, Style 2500.

2.03 SERVICE CONNECTIONS

A. Provide and install according to standard drawings.

B. Service Connections.

1. Install branch saddle reducing tee electrofusion tapping tee or socket fusion joint into HDPE pipe. No extrusion welding will be allowed.

2. Central Double-O-Seal Transition Fittings with IPS threaded or approved equal will be required to connect to corporation stop.

3. Mueller Corporation Stop or approved equal CTS COMX MIP w/ Ford insert stiffener will be required next to distribution line.

4. Provide single length (no splices) of HDPE PE 3408 DR-9 Blue-Stripe pipe (CTS) with compression fittings.

5. Locate service taps in the upper quadrant of the main line, approximately at 45 degrees. The minimum distance between taps is 24", with a 5 degree stager. Do not make service taps within 24" of the end of the main line.

6. Meter Boxes: Plastic or asphalt-dipped corrugated metal fiber meter boxes are not acceptable. Provide a meter box with ring and cover of sufficient strength to withstand loadings in vehicular traffic areas without breaking.

7. Meter Boxes will not be placed in driveways.

2.04 PIPE SUPPORTS

A. Floor stands and stanchion saddles with U-bolt hold down yokes.

1. Manufacturer, one of the following or equal:
   a. Grinnell Figure 259.
   b. Bergen-Patterson, Figure 125.

B. Riser Supports.

1. All elbows to be supported from the floor shall be furnished and installed as base elbows, whether so indicated on the Plans or not. Supports for the base fittings shall be adjustable metal supports or concrete piers as shown on the Plans, or as directed by the Engineer.

2. Riser clamps manufacturer, one of the following or equal:
   a. Grinnell Figure 261.
   b. Elcen, Figure 29.

2.05 COMPRESSION FITTINGS

A. All Compression Fittings shall be for Polyethylene CTS Pipe.

B. All Compression Fittings shall by Mueller fittings or approved equal.

2.06 THREAD FITTINGS

A. All threaded fittings used for service connections shall be brass, with the exception of the 1" PVC cap on the end of the service.

2.07 **MAGNETIC MARKING TAPE**

A. All utilities will have magnetic marking tape buried with the pipe.

B. 12” directly above the center line of the utility.

C. The color of the tape will be based on the type of utility according to the following:

1. Culinary water: blue
2. Sewer: green
3. Pressurized Irrigation: purple
4. Gas: yellow
5. Buried cables: red

D. The wording on the tape should be appropriate for the utility.

2.08 **LOCATOR WIRE**

A. Wire shall be 16 AWG solid UF/TWU cable.

B. Wire shall pass UL Standard 493 and CSA 22.2 No. 75

C. Stranding shall be Solid.

D. Insulation Material shall be PVC.

E. Insulation Thickness shall be 0.061" Nominal.

F. Insulated Conductor Diameter shall be 0.186" Nominal.

G. Insulation Color shall be according to service as follows:

1. Culinary Water: blue
2. Sewer: green
3. Pressurized Irrigation: purple
4. Gas: yellow
5. Buried cables: red

H. Wire shall be corrosion resistant.

2.09 **SERVICE SADDLES**

A. Saddles shall be FORD S91 XX4 Single Strap Brass Saddle, or approved equal.

2.10 JOINT RESTRAINTS

A. Joint restraints shall be mega-lug or approved equal for sized larger than 12.

B. Joint restraints shall be Romac Industries, Inc. Grip Ring Pipe Restrainer or approved equal for sizes 4 through 12.

1. The Romac Grip Ring is used for the restraint of mechanical joint pipe, valves, fittings, and fire hydrants in water distribution and fire protection lines. Grip Rings replace costly concrete thrust blocks, corrodible steel tie rods and clamps, and fittings using radial bolts or pads. Not for use on plain end mechanical joint fittings or Molecularly Oriented Polyvinylchloride (PVCO) AWWA C909-02.

2. Grip Rings may be used on most Ductile Iron, Cast Iron, PVC. See Grip Ring Pipe Restrainer Application Chart for specific applications. Chart is on the back of the Grip Ring Installation Instructions or in the current Romac catalog under restraint system.

3. Gland (Follower): Ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-465-12.

4. Ring: Ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-45-12. Heat treated using a proprietary process to assure proper penetration of rigid pipe materials.

5. Gap Cap: Heavy gauge 304 stainless steel (10 and 12 inch only).

6. Gasket A standard MJ gasket is used with this fitting. See ANSI/AWWA C111/A21.11 for specifications. Transition gaskets may be used for steel (IPS) pipe size PVC.

7. Bolts and Nuts: Standard MJ tee-bolts and nuts are used with this fitting. See ANSI/AWWA C111/A21.11 for specifications.

8. Coatings and Colors: Shop coat applied to the castings for corrosion protection in transit. Glands are yellow to distinguish them from standard MJ fittings. Rings are color coded BLACK for Ductile Iron size and RED for IPS.

9. PERFORMANCE: May be used up to the pressure rating of the pipe when used on Ductile Iron, CI, and PVC pipe. See catalog and installation instructions.

10. FM Approved: FM approved for cast iron and ductile iron pipe at 175 psi working pressure (4 : 1 test). Also approved for PVC C900 pipe at the pressure rating of the pipe.

11. UL Listed: UL listed for cast iron and ductile iron pipe at 350 psi working pressure. Also listed for PVC C900 pipe at the pressure rating of the pipe. UL reference number is 6M46.

12. Uni-Bell UNI-B-13-92: UNI-B-13-92 is now governed by ASTM F 1674-96. The Grip Ring meets the requirements of F 1674-96.

2.11 ROMAC R BLUE FASTENER COATING OR APPROVED EQUAL

1. Romac R Blue fastener coating to prevent corrosion.

2. Product Used: Xylan 1424 polytetrafluoroethylene (PTFE) a dry-film protective coating and lubricant.

3. Product Manufacturer: Whitford Corporation.

4. Xylan 1424: A VOC compliant, resin bonded, PTFE based coating formulated for use on fasteners to prevent corrosion and facilitate make up torque.

5. Color: Blue - Pantone 647C.

6. Base coat: Zinc plating.

7. Surface Prep: Degrease / grit blast.

8. Application: Spray.

9. Physical Properties.

a.	Tensile Strength:	2,000 to 4,000 psi.
b.	Coating thickness:	1.5 – 2.0 mils.
c.	Service Temperature:	up to 350° F.
d.	Coefficient of friction:	0.02 to 0.10.
e.	Adhesion:	5A Rating per ASTM D3359.
f.	Corrosion resistance:	1000 hrs in salt fog per ASTM B-117.

2.12 **EXCHUTCHEONS**

A. Dearborn Brass Company, Model Number 5358.

B. Keeney Manufacturing Company, Model Number 102 or Number 105.

C. Beaton and Corbin, Model Number 1 or Number 13.

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Verification of Existing Conditions:

1. Locate and expose existing structures, piping, conduits, and other facilities and obstructions which may affect construction of underground piping before starting excavation for new underground piping and appurtenances.

2. Verify sizes, elevations, locations, and other relevant features of existing facilities and obstructions. Determine conflicts for the construction of the new underground piping and appurtenances.

3. Make piping location and grade adjustments to resolve conflicts between new piping and existing facilities and obstructions.

3.02 **BURIED PIPING**

A. Bury piping with minimum 5 foot cover without air traps, unless otherwise indicated on the Drawings or by City Engineer. Bolts and Nuts: ANSI/ASME B 16.1 or when connecting all underground Flanged, Mechanical Joint or restrained joints use Type 304 or Type 316 stainless steel; cut and finished to project a maximum of 1/4 inch beyond nut when joints are assembled.

B. Where 2 similar services run parallel to each other, piping for such services may be laid in the same trench. Lay piping with sufficient room for assembly and disassembly of joints, for thrust blocks, for other structures, and to meet separation requirements of public health authorities having jurisdiction.

C. Laying Piping, as specified herein.

1. Lay piping in finished trenches free from water or debris. Begin at the lowest point with bell ends up slope.

2. Place piping with top or bottom markings with markings in proper position.

3. Lay piping on an unyielding foundation with uniform bearing under the full length of barrels.

4. Where joints require external grouting, banding, or pointing, provide space under and immediately in front of the bell end of each section laid with sufficient shape and size for grouting, banding, or pointing of joints.

5. At the end of each day's construction, plug open ends of piping temporarily to prevent entrance of debris or animals.

3.03 **PIPING ALTERNATES**

A. Provide piping in accordance with this Section, unless indicated on the Drawings or specified otherwise.

B. Valves in Piping Sections: Capable of withstanding specified test pressures for piping sections and fabricated with ends to fit piping.

3.04 **WALL AND SLAB PENETRATIONS**

A. Provide sleeves for piping penetrations through aboveground masonry and concrete walls, floors, ceilings, roofs, pilasters, columns, piers, and beams.

B. For piping 1 inch in nominal diameter and larger, provide sleeves with minimum inside diameters of 1 inch plus outside diameter of piping. For piping smaller than 1 inch in nominal diameter, provide sleeve of minimum twice the outside diameter of piping.

1. Arrange sleeves and adjacent joints so piping can be pulled out of sleeves and replaced without disturbing the structure.

2. Cut ends of sleeves flush with surfaces of concrete, masonry, or plaster.

3. Conceal ends of sleeves with escutcheons where piping runs through floors, walls, or

ceilings of finished spaces within buildings.

4. Seal spaces between pipes and sleeves.

C. Cast couplings or wall pieces in walls for penetrations of buried rigid piping including cast iron, ductile iron, reinforced concrete, and vitrified clay through structures.

1. Provide couplings or wall pieces with mechanical push-ons, or similar flexible joints, at outside faces of walls.

2. Provide additional similar joints in piping at transition points between trenches and structure excavations.

D. Link Seal: Use 2 link seals where seal is used to seal at wet wall sleeves. Mount one seal on the inside face of the wall and the other on the outside face of the wall. Coordinate the inside diameter of the wall sleeve with the size of the seal to provide watertight sealing.

3.05 INSTALLATION - SERVICE CONNECTIONS

A. The City Engineer, or approved City Staff, must inspect the installation before burying or backfilling.

B. Lids shall be flush with top of existing ground.

3.06 CLEANING

A. Piping Cleaning:

1. Upon completion of installation, clean piping interior of foreign matter and debris. Perform special cleaning when required by the Contract Documents.

3.07 PIPING SCHEDULE

A. Abbreviations

1. Abbreviations to designate piping include the following:

CI	Cast iron
Cl	Class, followed by the designation
DIP	Ductile iron piping
RCP	Reinforced concrete piping
Sch.	Schedule, followed by the designation
PVC	Poly Vinyl Chloride
HDPE	High Density Polyethylene

END OF SECTION

SECTION 15 06 10

DUCTILE IRON PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Ductile iron piping, joints, fitting, cleanouts, poly-rap covering and pipe lining and coating.

B. Related Sections:

1. Section 15 05 20 - Basic Piping Materials and Methods.

1.02 REFERENCES

A. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME):

1. B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. American Society for Testing and Materials (ASTM):

1. A 47 - Ferritic Malleable Iron Casting.

2. A 536 - Ductile Iron Castings.

C. American Water Works Association (AWWA):

1. C 104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. C 110 - Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches, for Water and Other Liquids.

3. C 111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

4. C 115 - Flanged Ductile-Iron Pipe with Threaded Flanges.

5. C 150 - Thickness Design of Ductile-Iron Pipe.

6. C 151 - Ductile-Iron Pipe, Centrifugally Cast for Water or other Liquids.

7. C 153 - Ductile-Iron Compact Fittings, 3 Inches through 24 Inches, and 54 Inches through 64 Inches, for Water Service.

8. C 600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

9. C 606 - Joints Grooved and Shouldered Type.

1.03 **SUBMITTALS**

A. Layout Drawing: Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, and connections to structures.

B. Thrust Restraint Systems: Layouts and supporting calculations for restrained joint thrust restraint systems.

C. Product Data: Photographs, drawings, and descriptions of fittings, gaskets, couplings, grooving of pipe and fittings, poly-wrap covering for corrosive soils and pipe lining.

D. Test Reports: Manufacturer's test reports for polyethylene lining certifying successful performance of the wet sponge spark tests.

1.04 **DELIVERY, STORAGE, AND HANDLING**

A. Block piping material for shipment, prevent damage to castings and linings.

B. Carefully handle piping material during loading, unloading, and installation. Do not drop piping material from cars or trucks. Lower piping material by mechanical means. Do not drop or pound pipe to fit grade.

C. Repair damaged pipe lining to match quality, thickness, and bonding of original lining. When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.

1.05 **THRUST RESTRAINT SYSTEM DESIGN**

A. Assume responsibility for the restrained joint thrust restraint system design.

PART 2 PRODUCTS

2.01 **MATERIALS**

A. Ductile Iron Piping:

1. Type, Typical: AWWA C 150 and AWWA C 151 with minimum pressure class 350 wall thickness.

2. Type with Screw-On Flanges: AWWA C 115 with minimum Class 53 wall thickness.

B. Joints:

1. Flanged Joints:
   a. Flanges: One of the following with diameter, thickness, drilling, and other characteristics in accordance with ANSI B 16.1:
      1) Cast integrally with the pipe.
      2) Screw-on: Comply with the following:
         a) Ductile iron
         b) Long hub, threaded, and specially designed for ductile iron pipe.

c) After attaching to pipe, machine flange face to make pipe end and flange even and perpendicular to the axis of the pipe.

b. Bolt Holes: Two-holed and aligned at both ends of pipe.

c. Cap Screw or Stud Bolt Holes: Tapped.

d. Bolts and Nuts: ANSI/ASME B 16.1 or when connecting flanges, mechanical joints and restrained joint fittings underground, in concrete pipe valve boxes, or underwater, use Type 304 or Type 316 stainless steel; cut and finished to project a maximum of 1/4 inch beyond nut when joints are assembled.
   1) Romac Blue Bolts will also be allowed.

e. Gaskets: As specified in accordance with Section 15 05 20.

2. Mechanical Joints: AWWA C 111/ANSI A 21.11

3. Restrained Mechanical Joints: Manufacturers: One of the following or equal:
   a. American Cast Iron Pipe Company, LOK-Fast or Lugged Fastite.
   b. Pacific States Cast Iron Pipe Company, Restrained Tyton or Lock Mechanical.

4. Push-On Rubber Gasket Joints: AWWA C 11/ANSI A 21.11.

5. Restrained Push-On Joints:
   a. Manufacturers: One of the following or equal:
      1) United States Pipe and Foundry Company, TR Flex, comprised of ductile iron locking segments inserted through slots in the bell face, providing positive axial lock between the bell interior surface and a retainer weldment on the spigot end of the pipe, or a retainer weldment through a boltless system, providing a positive restraint against joint separation; with a safety factor of 2 under a pressure equal to the specified test pressure; capable of easy disassembly without cutting or burning of the gasket.
   b. Manufacturers: One of the following or equal: Suitable for the following working pressures:
      1) For 4 through 24 inch Pipe: 350 pounds per square inch gauge.
      2) For 30 through 54 inch Pipe: 250 pounds per square inch gauge.

6. Grooved Joints: AWWA C 606, as complemented and modified below, radius-cut type, with following components:
   a. Couplings: Rigid type, cast from ductile iron in accordance with ASTM A 536, Grade 65-45-12 or malleable iron in accordance with ASTM A 47, Grade 32510.
   b. Bolts and nuts in accordance with ASTM A 183, Grade 2.
   c. Gaskets: Capable of being applied on surface of piping with cavities to provide for an improved seal with the internal piping pressure; material for following services:
      1) For Liquid Service: Halogenated butyl.
      2) For Air Service: Fluoroelastomer.
      3) For Hot Water Service: EPDM
   d. Fittings: AWWA C 606, rigid radius-cut groove.
      1) Center-to-Center Dimensions: AWWA C 110/ANSI A 21.10.
      2) Wall Thickness and Other Characteristics: AWWA C 153.
   e. Flanged Unit Connections: Flanged to grooved joint adapters or a long enough spool with 1 end flanged and the other grooved to prevent interference with the operation of adjacent valves, pumps, or other items.

2.02 **ACCESSORIES**

A. Fittings: AWWA C 110/ANSI A 21.10 or AWWA C 153/ANSI A 21.53 with the same pressure rating and joint configuration as that of the associated piping.

B. Flexible Couplings: As shown on the Drawings.

C. Cleanouts: As shown on the Drawings.

2.03 **PIPE LININGS**

A. Cement-Mortar Lining and Coating: AWWA C 104/ANSI A 21.4, applied on clean bare metal surfaces; extended to faces of flanges, ends of spigots, and shoulders of hubs; painted with bituminous material.

1. Coating on Cement-Mortar Coating: Bituminous material, or none when specified to receive another coating.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. General:

1. Install ductile iron piping in accordance with AWWA C 600, modified as specified in Section 15052.

2. Lay mechanical joint or bell and spigot pipe with 1/8 inch space between the spigot and shoulder of the pockets.

3.02 **JOINTS**

A. Install types of joints as specified in piping schedule in Section 15 05 20.

3.03 **GROOVED JOINTS**

A. Assemble grooved joints in accordance with manufacturer's published instructions.

B. Support grooved-end pipe in accordance with manufacturer's published instructions. Install at least 1 support between consecutive couplings.

C. Install flanged or grooved joints where flanged joints are scheduled, except under the following conditions:

1. In underground and underwater installations.

2. In piping subject to test pressure of 150 pounds per square inch gauge or more.

3. When wall thickness of pipe is less than the minimum recommended in published instructions by the manufacturer of the grooved end coupling.

D. Make connections to flanged valves, pumps and piping appurtenances by either:

1. Flanged-to-grooved joint adapters.

2. Flanged-by-grooved end pipe spool of sufficient length to prevent interference with the operation of adjacent valves, pumps or other items.

3. Integrally cast flanged-by-grooved end pipe fittings.

3.04 FIELD QUALITY CONTROL

A. Test ductile iron piping as specified in Section 15 05 20.

B. Do not test sections longer than 2 mile in total pipe length.

END OF SECTION

SECTION 15 06 20

STEEL PIPING (IRRIGATION)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Steel piping, joints, fittings, pipe lining and coating, and fabricated steel piping fittings and specials.

B. Related Sections:

1. Section 15 05 20 - Basic Piping Materials and Methods.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

1. Standard H-2.

B. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME):

1. B 16.1- Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.

2. B 16.3 - Malleable-Iron Threaded Fittings, Classes 150 and 300.

3. B 16.5 - Pipe Flanges and Flanged Fittings.

4. B 16.9 - Factory-Made Wrought Steel Buttwelding Fittings.

5. B 16.12 - Cast Iron Threaded Drainage Fittings.

C. American Society for Testing and Materials (ASTM):

1. A 47 - Ferritic Malleable Iron Casting.

2. A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

3. A 105 - Forgings, Carbon Steel, for Piping Components.

4. A 106 - Seamless Carbon Steel Pipe for High-Temperature Service.

5. A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

6. A 183 - Carbon Steel Track Bolts and Nuts.

7. A 536 - Ductile Iron Castings.

8. D 297 - Steel Casting, Iron-Chromium and Iron-Chromium-Nickel, Heat-Resistant, for General Application.

9. C 150 - Portland Cement.

10. D 395 - Rubber Property-Compression Set.

11. D 977 - Emulsified Asphalt.

12. D 471 - Rubber Property-Effect of Liquids.

13. D 573 - Rubber Property-Deterioration in an Air Oven.

14. D 412 - Rubber Properties in Tension.

15. D 429 - Rubber Property-Adhesion to Rigid Substrates.

16. D 2000 - Classification System for Rubber Products in Automotive Applications.

17. D 2240 - Rubber Property-Durometer Hardness.

D. American Water Works Association (AWWA):

1. C 200 - Steel Water Pipe 6 Inches and Larger.

2. C 205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4 Inches and Larger-Shop Applied.

3. C 206 - Field Welding of Steel Water Pipe.

4. C 207 - Steel Pipe Flanges for Waterworks Service-Sizes 4 Inches Through 144 Inches.

5. C 208 - Dimensions for Fabricated Steel Water Pipe Fittings.

6. C 606 - Grooved and Shouldered Joints.

7. M 11 - Design Manual.

E. National Association of Corrosion Engineers (NACE):

1. RP0274-74 - Standard Recommended Practice.

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design Criteria For Pipe And Pipe Fittings: In accordance with AWWA Manual M11 with the following modifications:
   a. Wall Thickness: As designed or minimum 1/4 inch for pipe from 12 inches in diameter to, and including, 72 inches in diameter or minimum 5/16 inch for pipe larger than 72 inches in diameter, whichever is thicker.
   b. Inside Diameter Of Unlined Pipe: Nominal.

c. Inside Diameter of Lined Pipe: As measured from face to face of liner, but not less than nominal.
d. Deflection of Underground Pipe Inside Diameter: Maximum 2 percent under trench load of H-20 live load in accordance with AASHTO specifications.
e. Working Stress Of Steel: Maximum 50 percent of yield stress.

1.04 **SUBMITTALS**

A. Shop Drawings: Details of fittings and specials showing thickness and dimensions of plates, detail of welds, and materials; listing of proposed services and locations for use of grooved joint type piping; tabulated layout schedules for cement-mortar lined and coated steel pipe.

B. Product Data: Details of fittings and specials showing thickness and dimensions of plates, detail of welds, and materials; grooved joint piping fittings, gaskets, couplings, grooving of pipe and fittings, and pipe lining and coating.

C. Certificates Of Compliance: Cement-mortar lined and coated steel pipe.

D. Design Calculations: Wall thicknesses for external loading, special loading and internal pressure.

E. Mill Certificates.

F. Test Reports: Rubber gaskets.

1.05 **QUALITY ASSURANCE**

A. Applicable Standards:

1. Cement-mortar lined and coated steel pipe shall conform to the following standards, as complemented and modified herein:
   a. Steel Pipe: AWWA C 200.
   b. Cement-Mortar Lining and Coating: AWWA C 205.
   c. Fittings and Specials: AWWA C 208.
   d. Reinforcement of Fittings and Specials: AWWA M 11.

PART 2 PRODUCTS

2.01 **MATERIALS**

A. Steel Pipe: All pipe shall be designed for a minimum of 250 psi working pressure.

1. Type, Pipe 4 Inches and Smaller: ASTM A 53, black or galvanized, seamless or straight seam electric resistance welded. Minimum Schedule 40.

2. Type, From 4 to 12 Inches: ASTM A 53, black, seamless.

3. Type, Larger than 12 Inches: AWWA C 200, without butt strap, riveted, or swaged joints; wall thickness as specified in Article 1.03.

4. Type, 24 Inches and Larger, with Grooved Type Couplings and Wall Thickness Less than 1/2 Inch: Provided with stub ends, sized as follows, for grooves.
   a. Thickness: As recommended by coupling manufacturer, but not less than 1/2 inch.
   b. Length: Width of coupling plus 1 inch, but not less than 6 inches.

B. Steel Pipe Fittings:

1. Screwed Fittings:
   a. Malleable Iron: ANSI B 16.3, 150 pounds; galvanized in accordance with ASTM A 153 where used with galvanized pipe.
   b. Cast Iron Drainage: ANSI B 16.12; galvanized in accordance with ASTM A 153 where used with galvanized pipe.

2. Flanged Fittings:
   a. Type for 12 Inch and Smaller Pipe: AWWA C207, Class E; or ANSI B 16.5, steel, galvanized in accordance with ASTM A 153 where used with galvanized pipe.
   b. Type for Larger than 12 Inch Pipe: ANSI B 16.5, steel, 150 pounds; galvanized in accordance with ASTM A 153 where used with galvanized pipe; or AWWA C 207 and AWWA C 208, fabricated from flanges and steel pipe, respectively.
   c. Companion Flanges for 4 Inches and Smaller Pipe: AWWA C207, Class E; ANSI B 16.5, steel, 150 pounds, slip-on or welding neck; or ammonia type for use on chlorine liquid or gas piping.
   d. Companion Flanges for Larger than 4 Inch to and Including 12 Inch Pipe: ANSI B 16.5, slip-on or welding neck type.
   e. Companion Flanges for Larger than 12 Inch Pipe: ANSI B 16.5, steel, 150 pounds; galvanized in accordance with ASTM A 153 where used with galvanized pipe; or AWWA C 207, steel plate or raised hub type.
   f. Weld flanges to pipe or fittings before applying lining.
   g. Machine flanges or provide tapered filler for changes in grade or to slope lines for drainage.
   h. Flange Bolts: ANSI B 16.1 for typical applications; or Type 304 or 316 stainless steel, or Everdur for underground or underwater applications.
      1) Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face or nut after assembly.
      2) Tap holes for cap screws or stub bolts when used.
   i. Gaskets: In accordance with Section 15 05 20.

3. Welding Fittings:
   a. Welding Fittings for Piping 8 Inches and Less in Nominal Diameter: Butt-welding fittings in accordance with ANSI B 16.9, standard wall or standard weight.
   b. Welding Fittings for Piping Larger than 8 Inches in Nominal Diameter: Butt-welding fittings in accordance with ANSI B 16.9, or, at the option of the Contractor, made up out of sections of pipe welded together, except where smooth bends are indicated for air lines.
   c. Fittings made up of sections of pipe welded together shall be made of pipe of at least the same wall thickness as the pipe with which used, and bends shall be miter bends, fabricated in accordance with AWWA C 208 and as supplemented by AWWA Manual M 11. Welding of these made-up fittings shall be in accordance with AWWA C 206.

1) Design and fabricate outlets and 4 branch fittings in accordance with AWWA Manual M 11.
2) Bends may be welded to adjacent pipe sections.
a) Bends shall be manufactured of the following number of pieces:
(1) Bends from 0 to 30 degrees angle, 2 pieces.
(2) Bends from 30 to 45 degrees angle, 3 pieces.
(3) Bends from 45 to 67-1/2 degrees angle, 4 pieces.
(4) Bends from 67-1/2 to 90 degrees angle, 5 pieces.

4. Grooved Joint Fittings:
a. Fittings for Grooved Joint Steel Piping: Rigid-grooved type, and as follows:
1) Grooves: Cut; rolled grooves are not acceptable.
2) Couplings: Cast in 2 or more segments of ductile iron conforming to ASTM A 536, Grade 65-45-12 or malleable iron conforming to ASTM A 47, Grade 32510.
3) Bolts And Nuts: ASTM A 183, Grade 2.
4) Gaskets: Composition water-sealing designed so that the internal piping pressure serves to increase the seal's watertightness.
a) Gaskets for water service and oil-free air systems at temperatures less than 230 degrees Fahrenheit shall be made of ethylene propylene diene monomers (EPDM) in accordance with ASTM D 2000 Line Call Out 2CA615A25B24.
b) Gaskets for use with cement-mortar lined steel piping shall be captured between the ends of the pipe to protect exposed metal from corrosion, and shall be made of nitrile in accordance with ASTM D 2000, Line Call Out 2CA615A25B24.
5) Perform grooving of the pipe wall only on standard or heavier schedule weight pipe.
a) For pipe with wall thickness less than standard weight, weld a shouldered end on the pipe in accordance with AWWA C 606.
b) Fabricated pipe, pipe conforming to AWWA C 200, shall have shouldered ends welded onto the pipe.
c) Shoulder: Type B or D in accordance with AWWA C 606.
6) Couplings and Grooving: As manufactured by Gustin-Bacon Piping Products, Victaulic Company of America, or equal.
b. Fittings for Grooved Joint Piping: Ductile iron conforming to ASTM A 536, Grade 65-45-12, or malleable iron conforming to ASTM A 47, Grade 32510, and as follows:
1) Where cast fittings are not made, standard fittings including large diameter elbows shall be made of forged steel conforming with ASTM A 105, Grade B with 0.375 inch wall thickness, or shall be standard segmentally welded fittings fabricated of Schedule 40 carbon steel pipe.
a) Grooves: As specified in the preceding Subparagraph 1.f.
2) Fittings for grooved joint piping shall be furnished by the manufacturer of the grooved joint material.
3) Fittings for grooved joint piping shall be for rigid-grooved type joints.

4) Connection to flanged units shall be by means of flange to grooved joint adapters.

a) Where the flanged to grooved joint adapters interfere with the operation of adjacent valves, pumps, or other items, the connection shall be by means of a spool with one end flanged and the other grooved, long enough to prevent interference with adjacent valves, pumps, or other items.

C. Steel Pipe Lining and Coating:

1. General:

a. Except where otherwise specified in the Specifications and indicated on the Drawings, lining and coating for steel pipe shall be as specified hereinafter.

b. Pipe Coating:

1) Except as otherwise specified or indicated on the Drawings, provide underground steel piping with one of the coatings specified hereinafter.

2) Extend pipe coating for underground piping 6 inches above finish grade or finish floor, and neatly terminate.

3) Field paint aboveground steel pipe as specified in Part 3 of this Section.

2. Cement-Mortar Lining and Coating:

a. Lining: EPOXY COATINGS

1) Epoxy coatings for submerged metal shall be applied where specified or noted on the Painting Schedule. Epoxy shall be a colored polyamide cured epoxy consisting of not less than 49 percent solids by volume. Coatings and pigments used on potable water service shall have FDA approval and shall be approved for use with potable water. Painting systems shall be as follows or equal applied to dry film thickness of not less than 10 mils. The finish coat color shall be white. The system shall be a two or three coat system consisting of a prime coat and two topcoats. The paint systems shall be as indicated in this section. All surfaces receiving this paint system shall have a near white blast surface preparation of SSPC - SP10.

This product shall meet or exceed the following test requirements established:

Abrasion: Method: ASTM D 4060, CS-17 Wheel, 1,000 grams load.
Requirement: No more than 120 mg. loss after 1,000 cycles.

Adhesion: Method: ASTM D 4541.
Requirement: Not less than 950 psi pull, average of three tests.

Method: ASTM D 3359 Method B, Crosshatch adhesion.
Requirement: Not less than a rating of 5, (no removal), average of three tests.

Fresh Water: Method: Coating system applied to SSPC-SP10 cleaned hot-rolled steel, cured 7 days prior to testing and immersed in aerated tap water at 77 F.
Requirement: No blistering, delamination or other loss of film integrity after 4 years exposure.

Salt Spray (FOG): Method: ASTM B 1176 applied to SSPC-SP10 cleaned hot rolled steel.
Requirement: No blistering, cracking or delamination of film. No more than 1/16 in. rust creepage at scribe, and no more than two percent rusting at edges after 1,000 hours exposure.

Dielectric Strength: Method: ANSI/ASTM D 149 (short-term test).
Requirement: No less than 1,050 volts/mil, average of five tests.

TNEMEC: Three or more coats of Series 20 - Pota-Pox to attain the required thickness.

b. Coating:
1) Cement-mortar coating for steel pipe exterior: In accordance with AWWA C 205, modified as follows:
a) Portland cement: ASTM C 150, Type II, low alkali.
b) Sand: AWWA C 205 except that the total percentage of deleterious material shall not exceed 3 percent.

D. Fabricated Steel Piping Fittings and Specials:

1. General: Specified herein are the design and fabrication of fabricated steel piping fittings and specials, which include elbows, branches, nozzles, manifolds, headers, heads, collars, stiffeners, reinforcements, and other steel fabrications relating to steel piping, but shall not include steel pipe.

2. Design:
a. Contractor shall design and detail fittings and specials.
1) Design: In accordance with the recommended procedures in AWWA Manual M 11, as complemented and modified herein.
2) Nozzles: Reinforced in conformance with recommended practice in AWWA M 11, Steel Pipe Manual.
3) Design reinforcing for fittings and specials for the specified test pressure.
4) Fittings shall conform in dimension to AWWA C 208, complemented with the provisions specified herein.
5) The working stress for steel used for fabrication of pipe shall not exceed 50 percent of the yield stress.
b. The thickness of pipe, large elbows, and headers, except header nozzles, shall be the thicker of:
1) The thickness designed in accordance with the design methods specified in the preceding Subparagraph 1.
2) The thickness indicated on the Drawings.
3) The thickness specified in the following Subparagraphs 1) and 2).
a) For Pipes Smaller than 72 Inches in Diameter: Minimum 1/4 inch.

b) For Pipes 72 Inches in Diameter and Larger: Minimum 5/16 inch.

c. Elbows shall be of the number of pieces specified in Paragraph 2.02-C., Welding and Fittings, and thickness of material shall conform to thickness of pipe or manifold shells specified.

d. Ends of fittings to be welded to pipe shall be beveled for welding.

3. Fabrication:

a. Shop fabricate steel piping fittings and specials in units as long as practicable for safe hauling and installation. Minimize number of field welds.

b. Fabricate fittings and specials to uniform lengths with proper end clearance for the specified types of joint or attachment.

c. Fabricate fittings and specials to allow field assembly without cutting or special work.

d. Where specified in the Piping Schedule in Section 15 05 20 - Pipes and Pipe Fittings, or indicated on the Drawings, the inside of fabricated steel manifolds and other fittings and specials shall receive a cement-mortar lining in accordance with AWWA C 205.

1) Reinforce lining for piping 24 inches in diameter and larger with wire fabric.

e. Do not weld flanges to nozzles until the nozzles and reinforcements are completely welded to the header.

1) Accurately space and align flanges so that when connections have been made there will be no stress on the header, piping, or equipment. Properly locate and align equipment.

4. Dished Heads:

a. Dished heads on 84 inch diameter and smaller manifolds: 1 piece (seamless) spherically dished (torispherical) heads.

1) Larger heads may be seamed.

b. Dish radius: Same dimension as the outside diameter of the head measured at skirt.

c. Skirt face length: Not less than 3 inches.

d. Design heads in conformance with recommended practice in AWWA M 11, Steel Pipe Manual.

5. Testing: No shop testing will be required for manifolds or piping connected thereto.

PART 3 EXECUTION

3.01 INSTALLATION

A. Joints:

1. Steel pipe joints shall be screwed, welded, flanged, grooved, or made with flexible joints. The type of joint for piping is specified in the Piping Schedule in Section 15 05 20.

2. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, and other types of joints or means necessary to allow ready assembly and disassembly of the piping.

3. Unless otherwise indicated on the Drawings or specified in the Piping Schedule in Section 15 05 20, pipe joints shall be as follows:
   a. Pipe smaller than 2 inches in nominal diameter shall have screwed joints or flexible couplings.
   b. Pipe 2 inches to 4 inches in nominal diameter shall have screwed joints, flanged joints, welded joints, or joints made with flexible couplings.
   c. Pipe larger than 4 inches in nominal diameter shall have flanged joints, welded joints, or joints made with flexible couplings.

B. Screwed Joints:

1. Perform threading with clean, sharp dies.
   a. Wavy, rough, or otherwise defective pipe threads are not acceptable.

2. Make screwed joints tight and clean with an application of Teflon tape or approved paste compound applied to the male threads only, except as follows:
   a. Make up liquid and dry chlorine lines, and liquefied petroleum gas lines, with litharge and glycerine.

3. Provide railroad type unions with bronze-to-iron seat, galvanized where used with galvanized pipe.
   a. Flanged joints may be used instead of unions.

C. Flanged Joints:

1. In flanged joints, flanges shall come together at the proper orientation with no air gaps between the flanges after the gaskets are in place.

2. Attach slip-on flanges to pipe by two fillet welds, in accordance with AWWA C 207.

3. Secure welding neck flanges with full penetration butt welds without backing rings.
   a. After welding in place, the faces of flanges shall be perpendicular to the axis of the pipe, or, in the case of fittings, at the proper angle to each other, and bolt holes shall be in proper alignment.

D. Welded Joints:

1. Welded joints shall be electric welded in accordance with AWWA C 206.

2. Welders shall be qualified pursuant to the provisions of AWWA C 206.
   a. Welders' testing shall be at the Contractor's expense, including cost of test nipples, welding rods, and equipment.

3. Do not weld galvanized pipe.

E. Grooved Joints:

1. Piping with grooved joints shall be installed where indicated on the Drawings and may be installed in place of flanged piping and screwed piping, except that grooved joint piping shall not be used in the following installations:
   a. In underground and underwater installations.
   b. In piping subject to test pressures of 150 pounds per square inch gauge, or more.
   c. In steam and gas piping.

2. Assemble in accordance with manufacturer's published instructions.

3. Support grooved-end pipe in accordance with manufacturer's recommendations. In addition, provide at least 1 support between consecutive couplings.

F. Lining and Coating:

1. Field applied cement-mortar lining shall be of the same density, smoothness, and thickness as shop applied lining, and shall conform to applicable portions of AWWA C 602.

2. Protect lining of fabricated steel piping fittings and specials during hauling, installation, and operation.

3. Finish joints of fabricated steel piping fittings and specials as specified for pipe lining after field welding is done.

4. After final field welding of fabricated steel piping fittings and specials, complete the lining and exterior painting at and near the welded connections.
   a. Repair or replace lining damaged as a result of welding heat, handling, or other causes.

5 Underground Metals
   a. All exposed underground metals shall be coated.
   b. Underground valves and valve boxes shall be coated with not less than two coats of asphalt varnish in accordance with AWWA C 500.
   c. Underground pipe flanges (excluding pipe), corrugated metal pipe couplings, flexible pipe couplings and miscellaneous underground metals not specified otherwise to receive a protective coating, shall be coated with not less than 20 mils of T.C. Mastic manufactured by the Tapecoat Company; Bitumastic No. 50 manufactured by the Koppers Company, Inc.; or equal.

6 Coating Metal Pipe
   a. Color coded metal pipe shall be coated with a high gloss alkyd system as indicated on the Paint Schedule and specified below. Colors for color coating of pipe shall be as specified above. Metal pipe shall be power tool cleaned SP-3 or commercial blast cleaned SP-6.
   b. ALKYD SYSTEM: The alkyd system shall consist of two or more finish coats applied over a primer to a total dry film thickness of not less than 6 mils. Paint shall consist of not less than 42 percent solids by volume and 32 percent pigment by weight.
   c. The product system shall meet or exceed the following requirement. (Published literature or test data showing conformance to these tests shall be submitted.
      1) Adhesion: Not less than a rating of 4.5, average of 3 trials. (ASTM D 3359 Method B, Crosshatch Adhesion).
      2) Exterior Exposure: No less than a gloss reading of 25 as measured with a 60-degree gloss meter after 12 months exposure. (Exposed at 45 degrees facing south, South Florida marine).
      3) Flexibility: No less than 30 percent elongation. (Passes 1/8" mandrel) (ASTM D 522).

4) Salt Spray (Fog): No blistering, cracking or delamination of film; no more than 1/16 in. rust creepage at scribe and no more than 2 percent rusting at edges after 500 hours exposure (ASTM B 117).

d. Finish systems shall be the following or equal.

1) Tnemec: Apply one coat of Series 37 Alkyd-Phenolic rust-inhibited primer. Apply two or more top coats of Series 2H Hi-Build Alkyd Enamel.

END OF SECTION

SECTION 15 06 30

PLASTIC PIPING AND TUBING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Plastic pipe, tubing, and fittings.

B. Related Sections:

1. Section 15 05 20 - Basic Piping Materials and Methods

2. Section 15 06 10 - Ductile Iron Piping.

1.02 REFERENCES

A. American National Standards Institute (ANSI):

1. B 16.12 - Cast Iron Screwed Drainage Fittings

B. American Society for Testing and Materials (ASTM):

1. D 648 - Test Method for Deflection Temperature of Plastics Under Flexural Load.

2. D 1248 - Specification for Polyethylene Plastics Molding and Extrusion Materials.

3. D 1784 - Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride)(CPVC) Compounds.

4. D 1785 - Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

5. D 2661 - Standard Specification for Acrylonitrile-Butadiene - Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

6. D 1869 - Specification for Rubber Rings for Asbestos-Cement Pipe.

7. D 2412 - Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

8. D 2466 - Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings Schedule 40

9. D 2467 - Specification for Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings Schedule 80.

10. D 2564 - Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

11. D 2665 - Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe Fittings.

12. D 3261 - Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

13. D 3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.

14. D 4101 - Specification for Propylene Plastic Injection and Extrusion Materials.

15. F 439 - Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

16. F 441 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

17. F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

18. F 483 - Method for Total Immersion Corrosion Test for Aircraft Chemicals Maintenance

19. F 493 - Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

20. F 645 - Guide for Selection, Design and Installation of Thermoplastic Water Pressure Piping Systems.

21. F 714 - Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

22. D2241 *Performance Requirements*- Specification for Poly (Vinyl Chloride)(PVC) Pressure-Rated Pipe (SDR Series).

23. D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

C. American Water Works Association (AWWA):

1. C 900.

2. C 905.

3. C 909.

D. Code of Federal Regulations:

1. Title 49.

E. United States Department of Transportation:

1. Materials Transportation Bureau.

1.03 **ABBREVIATIONS**

A. ID: Inside diameter of piping or tubing.

B. PVC: Polyvinyl Chloride.

C. PVCO: Molecularly Oriented Polyvinyl Chloride.

D. SDR: Standard dimension ratio.

E. PE: Polyethylene Pressure Pipe.

A. NFS: National Sanitation Foundation

1.04 **SUBMITTALS**

A. Product Data: Describe materials and installation equipment including fusion machine.

B. Manufacturer's Published Installation Instructions.

C. Certificates:

1. Submit manufacturer's certificate attesting that plastic pipe, tubing, and fitting types meet specified requirements.

2. Manufacturer's certification of date of manufacture of plastic pipe and tubing for each lot delivered.

1.05 **QUALITY ASSURANCE**

A. All Materials which may contact drinking water, including pipes, gaskets, lubricants, and O-Rings, shall be ANSI-certified as meeting the requirements of NSF Standard 61, Drinking Water System Components - Health Effects. Provide pipe, tubing and other materials that bear the NSF seal, except for drainage piping.

B. Mark plastic pipe with nominal size, type, class, schedule or pressure rating, and manufacturer.

1. Pipe markings shall include the following, marked continuously down the length:
   a. Manufacturer’s Name
   b. Nominal Size
   c. Class Pressure Rating
   d. NSF Logo
   e. Identification Code

1.06 **DELIVERY, STORAGE, AND HANDLING**

A. Protect piping materials from sunlight, scoring, and distortion.

B. Do not allow surface temperatures on pipe and fittings to exceed 120 degrees Fahrenheit.

PART 2 PRODUCTS

2.01 PVC MATERIALS

A. Extruding and Molding Material: Virgin material containing no scrap, regrind, or rework material except where permitted in the referenced standards.

B. Fittings 4" and smaller: Same material as pipe and equal or greater pressure rating.

C. Fittings larger than 4": Ductile Iron per Section 15 06 10

D. Unions 2-1/2 inches and smaller: Socket end screwed unions. Make unions 3 inches and larger of socket flanges with 1/8 inch full face soft rubber gasket.

2.02 PVC PIPING, CLASS TYPE

A. Materials:

1. PVC pipe of 14-inch through 36-inch diameter shall meet the requirements of ASTM D 2241 except that the pipe shall have outside diameters of ductile iron pipe sizes instead of iron pipe sizes and shall meet the requirements of AWWA C-905 with DR of 18 or as indicated on the Drawings. PVC pipe shall withstand without failure the impact of a falling 12 pound missel with a 2-inch radius hose, when tested in accordance with ASTM D 2444 at an energy level of 120 ft-lbs at a temperature of 73 degrees Fahrenheit.

   Provisions shall be made for contraction and expansion at each joint with a rubber ring and integral thickened bell as part of each joint. The rubber ring shall meet the requirements of ASTM D 1869. The bell section shall be at least as strong as the pipe barrel.

   At least 85 percent of the total footage of pipe shall be furnished in standard lengths of 20 feet. The remaining footage of pipe may be in random lengths of not less than 10 feet long.

2. PVC pipe of 4-inches through 12-inches shall meet the requirements of ASTM D 2241 except that the pipe shall have outside diameters of ductile iron pipe sizes instead of iron pipe sizes and shall meet the requirements of AWWA C 900 with DR of 14 or 18 as indicated on the Drawings. PVC pipe shall withstand without failure the impact of a falling 12 pound missel with a 2-inch radius hose, when tested in accordance with ASTM D 2444 at an energy level of 120 ft-lbs at a temperature of 73 degrees Fahrenheit.

   Provisions shall be made for contraction and expansion at each joint with a rubber ring and integral thickened bell as part of each joint. The rubber ring shall meet the requirements of ASTM D 1869. The bell section shall be at least as strong as the pipe barrel.

   At least 85 percent of the total footage of pipe shall be furnished in standard lengths of 20 feet. The remaining footage of pipe may be in random lengths of not less than 10 feet long.

3. PVCO (molecular oriented Poly (Vinyl Chloride))

a. Material: PVCO shall be manufactured from Rigid Poly (Vinyl Chloride) compound, with a cell classification of 12454-B in conformance with ASTM D1784. The gasketed joint system shall conform to ASTM D3139.
b. Classification PVCO pipe will be made from standard PVC plastic pipe starting stock having a Hydrostatic Design Basis (HDB) of 4000 psi. The finished PVCO pipe shall have an HDB of 7100 psi.
c. PVCO pipe shall be manufactured with ductile pipe O.D.'s in all sizes. The pipe shall be joined by means of an integral bell and rubber ring joint conforming to ASTM D3139. Spigot ends will be chamfered by the manufacturer.

4. Fittings: Cast or ductile iron fittings as specified under Section 15061, sized for the dimensions of the pipe being used.
   a. Fittings for joining pipe 4 inches in diameter and larger: Push-on rubber gasket or mechanical joint type.

5. Gaskets: Meeting the requirements of ASTM D 1869 or ASTM F 477.

6. PVC pipe for use as pressure irrigation piping shall be colored purple.

2.03 POLYETHYLENE TUBING

Pipe for the transmission of irrigation water from main to service box shall be Polyethylene CTS (Copper Tube Size) tube. Polyethylene CTS tube shall be manufactured in accordance with the standard specification for Polyethylene (PEP plastic tubing as issued by the American Standard for Testing and Materials under ASTM D 2737 and AWWA C901).

A. Material: Polyethylene PE 3408.

B. Plastic Extrusion Compound: Type III, Class C, Grade 34, as defined by ASTM D 1248.

C. Standard pipe dimension ratio DR 9, 200 psi pressure rating.

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

E. All tubing shall be Vanguard PE 3408 or approved equal.

2.04 SOURCE QUALITY CONTROL

A. PVC Piping, Class Type:

1. Test pipe to withstand, without failure, 600 pounds per square inch, gauge, hydrostatic pressure for a minimum of 5 seconds.

2. Test integral bell with the pipe.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: The following will be required when installing pipe:

1. The bottom of the trench shall be cut flat, true and even to provide uniform bearing for the full length of the pipe barrel.

2. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with adjoining pipe to prevent sudden offsets.

3. Pipe bedding and trench backfill shall be as defined in the previous sections.

4. As work progresses, interior of pipe shall be cleared of dirt and other superfluous materials.

5. Trenches shall be kept free from water until pipe jointing has been completed and pipe shall not be laid when condition or trench or weather is unsuitable for such work.

6. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no water, earth, or other substance will enter pipe or fittings.

7. The joining of mechanical joint and push-on rubber gasket joint pipe shall be in accordance with recommendation of the pipe manufacturer.

8. Culinary water pipe shall have a minimum of 5 feet of cover.

9. Pressurized irrigation pipe shall be laid to grade and have a minimum of 3 foot of cover.

10. Pressure tests will be required on both culinary and pressure irrigation lines, in accordance with Section 02 66 00.

11. Where not otherwise specified, install piping in accordance with ASTM F 645, or manufacturer's published instructions for installation of piping, as applicable to the particular type of piping.

12. Provide molded transition fittings for transitions from plastic to metal or IPS pipe. Do not thread plastic pipe.

13. Locate unions where required for adequate access and assembly of the piping system.

14. Provide serrated nipples for transition from plastic pipe to rubber hose.

15. Pipe shall not be dropped into the trench.

B. Installation of PVC Piping, Class Type:

1. Install piping in accordance with the Appendix of AWWA C 900 and AWWA C 909 complemented with manufacturer's published instructions.

2. Provide for contraction and expansion at each joint with a rubber ring and integral thickened bell as part of each joint.

3.02 **FIELD QUALITY CONTROL**

A. Leakage Test for PVC Piping, Class Type:

1. Polyvinyl-chloride (PVC) piping, Class type: Subject to visible leaks test and to pressure test with maximum leakage allowance, as specified in Section 02 66 00.

END OF SECTION

SECTION 15 07 50

CULINARY WATER AND IRRIGATION PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for pipe materials and installation in culinary and irrigation water distribution systems. All material and workmanship shall strictly comply with the Utah State Plumbing Code.

PART 2 MATERIALS

2.01 DUCTILE IRON WATER PIPE

A. Ductile Iron Water pipe shall be Class 50 for slip-on joint piping (Class 51 for 4-inch size) and Class 53 for mechanical joint and flanged joint piping.

B. All piping shall conform to AWWA Specification C-151 of the latest revision.

C. Pipe joints shall be the push-on rubber gasket type or mechanical joint type with plain rubber gaskets conforming to AWWA C-111 of latest revision or flanged connections conforming to AWWA C-115 of latest revision.

D. All Ductile Iron Pipe wall thicknesses shall conform to AWWA C 150-76 for class 200 DIP.

E. Fittings: Fittings shall conform to AWWA Specification C 110-77 and shall have mechanical or push-on rubber gasket joints.

F. Coatings and Linings for Ductile Iron Pipe

1. All exterior surfaces of pipe and fittings shall be coated with hot coal tar approximately 1 mil thick.

2. All interior surfaces of pipe and fittings shall be coated with the standard thickness cement mortar lining in conformity with the requirements of A.S.A. Standard A21.4.

G. Handling Ductile Iron Pipe

1. Pipe and fittings shall be handled in such a manner as to insure installations in sound, undamaged condition.

2. Particular care shall be taken not to injure the pipe coating and lining. Cement lining in pipe or fittings which is broken or loosened shall be cause for rejection of the pipe or fittings.

3. All damaged pipe coating shall be prepared, prior to laying the pipe or placing the backfill.

4. Repair shall be accomplished by removing all damaged coating, wire-brushing to exposed metal, and applying two coats of coal tar coating of a type and quality to that originally in coating the pipe.

H. Cutting, Cleaning and Inspection

1. Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method which will not damage the pipe.

2. Before installation, each pipe shall be inspected for defects and rung with a light hammer to detect cracks.

3. All defective, damaged or unsound pipe shall be rejected.

I. Markings

1. Pipe markings shall include the following, marked continuously down the length:
   a. Manufacturer's Name
   b. Nominal Size
   c. Class Pressure Rating
   d. NSF Logo
   e. Identification Code

2.02 POLYVINYL CHLORIDE PIPE (PVC)

A. This specification provides the requirements for Class 200 (SDR 21) PVC pressure rated pipe with rubber gasket couplings and fittings. Lighter pressure classes shall not be used.

B. PVC pipe installations must be approved on an individual basis.

C. Pipe Requirements

1. Rigid PVC pressure pipe as described in this specification is designed to carry potable water at pressures up to the maximum class rating.

2. Material used to produce the pipe, couplings, and fittings shall conform to ASTM D-1784, Type I, Grade I, 2000 psi design stress.

3. The standard dimensional ratio for the pipe shall be as follows (C-900 for Ø≤12", C-905 for Ø>12"):

SDR 26	(Class 160)
SDR 21	(Class 200)
SDR 18	(Class 235)

D. Conformance: All PVC pipe shall conform to the latest revisions of the following specifications.

1. AWWA Spec. C-900 (PVC pressure pipe for water)

2. ASTM Spec. D-2241 (PVC plastic pipe SDR-PR and Class T)

3. Commercial Standard CS256-63 (pressure rated pipe)

4. National Sanitation Foundation Testing Laboratories (NFS)

5. Rubber Gasketing shall conform to ASTM 1869.

E. Physical Requirements: The pipe and couplings shall be manufactured to meet the following requirements:

1. Quick Burst Test: The hydrostatic strength shall meet the following based on method of test ASTM D-1599.

PIPE CLASS	90 SECOND MIN. BURST PRESSURE	HOOP STRESS
200	740 psi	7400 psi

2. Sustained Pressure Test: A sample shall withstand without failure for 1000 hours the following pressures in accordance with ASTM 1598:

PIPE CLASS	HYDROSTATICAL PRESSURE	HOOP STRESS
200	420 psi	4200 psi

3. Flattening: A two-inch long specimen shall be compressed at a uniform rate of loading between parallel plates so that 100% flatness occurs within one minute. There shall be no evidence of cracking or breaking.

4. Tensile Strength: Shall be conducted in accordance with ASTM D-638. Minimum tensile strength shall be 7400 psi.

5. Impact Test: Shall be conducted in accordance with ASTM D-2444.

F. Chemical Requirements

1. Acetone Immersion: A sample shall be completely immersed in anhydrous acetone for a 60 minute period with examination at 20 minute intervals.
2. This test shall meet the requirements of ASTM D-2152.

G. Pipe Dimensions

1. Standard lengths shall be 20 feet.

2. Wall thickness shall be in accordance with CS256-63 and ASTM d-2241.

3. Pipe ends shall be beveled to accept the gasketed coupling (4" and larger).

H. Couplings and Fittings

1. The coupling and fittings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used.

2. They shall have a minimum pressure rating of 200 psi.

3. Insertion depth of the pipe in the coupling shall be controlled by a gauge mark or mechanical stop in the coupling which will allow for a thermal expansion and contraction.

I. Lubrication: Lubrication shall be water soluble, non-toxic, be non-objectionable in taste and odor imparted to the fluid, be non-supporting of bacteria growth, and have no deteriorating effect on the PVC or rubber gaskets.

J. Concrete Blocking

1. All fittings at bends and branches in water pipe lines shall be provided with concrete thrust blocking and mega-lugs as shown on the Standard Drawings.

2. Blocking shall be of concrete specified in Section 03 30 40, poured in place and shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as to not obstruct access to the joints of the pipe or fitting.

3. The use of pre-cast thrust blocks shall not be utilized without approval by the City Engineer.

PART 3 EXECUTION

3.01 General Installation Requirements

A. The following will be required when installing pipe:

1. The bottom of the trench shall be cut flat, true and even to provide uniform bearing for the full length of the pipe barrel.

2. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with adjoining pipe to prevent sudden offsets.

3. Pipe bedding and trench backfill shall be as defined Sections 02 20 50, 02 20 60, 02 22 00, 02 22 50, 02 24 50, and 02 25 00.

4. As work progresses, interior of pipe shall be cleared of dirt and other superfluous materials.

5. Trenches shall be kept free from water until pipe jointing has been completed and pipe shall not be laid when condition of trench or weather is unsuitable for such work.

6. At all times when work is not in progress, all open ends of pipe and fittings shall be securely closed so that no water, earth, or other substance will enter pipe or fittings.

7. The joining of mechanical joint and push-on rubber gasket joint pipe shall be in accordance with recommendation of the pipe manufacturer.

8. Culinary water pipe shall have a minimum of 5 feet of cover at all times unless approved by City Engineer.

9. Pressurized irrigation pipe shall be laid to grade and have a minimum of 2 foot of cover.

10. Pressure tests will be required on both culinary and pressure irrigation lines, in accordance with Section 02 66 00.

3.02 **LOCATION OF STUB PIPES**

A. The location of each sewer stub shall be marked by placing a 2 x 4 marker at the end of the pipe and extending vertically from the end of the pipe to approximately 15 inches above the ground surface.

B. The portion of the 2 x 4 extending above ground, shall be painted as follows:

1. Green - indicating sewer stub.

2. Blue - indicating water

C. The sidewalk and curb shall be stamped in the following manner, showing locations of water, sewer, and pressure irrigation stub pipes:

1. A “w” stamp for water.

2. A “s” stamp for sewer.

3. A “i” stamp for pressure irrigation

D. Meter can for the culinary water shall be installed by the developer/contractor.

E. A meter/valve box shall be installed for pressure irrigation by the developer/contractor.

3.03 **SCHEDULE**

A. Culinary water shall use C-900 Class 200 PVC pipe minimum or ductile iron pipe.

END OF SECTION

SECTION 15 07 60

SANITARY SEWER AND STORM DRAIN SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The requirements for pipe material and installation in sewer and drainage collection systems. All materials and workmanship shall strictly comply with the Utah State Plumbing Code.

1.02 REFERENCES

A. Section 02 66 00: Pipeline Testing.

B. AASHTO-291: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

C. ASTM D 1248: Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

D. ASTM D 2239: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter.

E. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

F. ASTM D 2657: Standard Recommended Practice for Heat Joining of Thermoplastic Pipe and Fittings.

G. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.

H. ASTM D 3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

I. ASTM D 3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

J. ASTM F 405: Standard Specification for Corrugated High Density Polyethylene (PE) Tubing and Fittings.

K. ASTM F 667: Standard Specification for Large Diameter Corrugated High Density Polyethylene Tubing and Fittings.

L. ASTM F 1055: Standard Specification for Electofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

M. ASTM C 1479: Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.

1.03 **DEFINITIONS**

A. Standard Dimension Ratio (SDR): Average diameter of pipe divided by the minimum wall thickness. The diameter may be either inside or outside measurement depending upon which standard is referenced.

B. Code Designation: A rating of polyethylene pipe materials by the Plastic Pipe Institute. The designation PE 3408 designates the type of plastic pipe (PE), the grade (34), and the hydrostatic design stress measured in units of 100 psi (08).

1.04 **SUBMITTALS**

A. Manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

PART 2 MATERIALS

2.01 **CONCRETE SEWER PIPE**

A. Concrete sewer pipe may be used for all sanitary sewers and storm drains up to and including 18-inch size unless otherwise specifically designated in these Specifications or on the approved Drawings.

B. Pipe shall be extra strength pipe manufactured to comply with the requirements of ASTM Designation C-14.

C. Joints shall be of the bell and spigot rubber gasket design with joints and gaskets conforming to the requirements of ASTM Designation C-443.

D. Pipe joints shall be so designed as to provide for self-centering, and when assembled, to compress the gasket for form a water-tight seal.

E. The gasket shall be confined in a groove on the spigot, so that pipe movement of hydrostatic pressure cannot displace the gasket.

2.02 **REINFORCED CONCRETE PIPE**

A. Reinforced concrete pipe shall be used for all sanitary sewers and storm drains of size larger than 18-inches and for all sewers and drains of smaller size where installation does not provide a cover of at least 3 feet over the top of the pipe.

B. Reinforced concrete pipe shall comply with the requirements of ASTM C-76 (Class III) with bell and spigot rubber gasket type joints for sanitary sewers and the alternate option of tongue and groove mortar joints for storm drain lines.

2.03 **PLASTIC SEWER PIPE**

A. This specification covers rigid polyvinyl chloride pipe and fittings, hereinafter called PVC pipe and PVC fittings. The pipe and fittings shall meet or exceed all of the requirements of ASTM Specification D-3034.

B. Samples of pipe, physical and chemical data sheets, shall be submitted to the City Engineer for approval and his approval shall be obtained before pipe is purchased.

C. This pipe shall be homogeneous throughout and free form cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.

D. Physical Requirements

1. All PVC sewer pipe shall be made for clean, virgin, Type 1, Grade 1, PVC conforming to ASTM resin specification D-1784.

2. All pipe joints shall be bell and spigot type with rubber ring gasket to permit expansion and contraction.

3. Pipe and fittings must be assembled with a nontoxic lubricant.

4. Four-inch diameter pipe may be the solvent weld type provided an expansion joint is provided if the length of run exceeds 100 lineal feet.

5. All pipe shall be less than 20 feet in length.

6. Pipe will be SDR-35, the following are minimum required dimensions:

NOMINAL PIPE SIZE INCHES	OUTSIDE DIAMETER INCHES	MINIMUM WALL THICKNESS, INCHES
4	4.215	0.125
6	6.275	0.180
8	8.400	0.240
10	10.500	0.300
12	12.500	0.360
15	15.300	0.375
18	18.701	0.536
21	22.047	0.632
24	24.803	0.709

7. Spigot ends will have 15° tapered end with a memory mark around the diameter of the pipe to indicate proper insertion depth.

8. Wyes shall be of the same material as the pipe and in no case shall have thinner walls than that of the pipe furnished.

9. Sample wyes must be submitted for the City Engineer's approval and his approval must be obtained before purchase of the wyes.

2.04 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

A. Smooth pipe systems

1. Material: Polyethylene code designation PE 3408 as rated in ASTM D 2239 with a minimum ASTM D 3350 cell classification of 345434C, and an SDR or pressure class rating as indicated.

2. Fittings: Manufactured of same resin as the pipe.

3. Joints:
   a. Thermally welded butt fusion in accordance with ASTM D 3261.
   b. Flanged in accordance with ASTM D 2657.
   c. Ultra high molecular weight electofusion tape with a polyethylene coupler meeting ASTM F1055 requirements.

4. Nuts and Bolts: Carbon steel machined heavy hex heads, Class 2 fit in accordance with ASTM A 307; Grade B, threads in accordance with ASME B1.1 Tape wrap steel materials for protection against corrosion after piping installation.

B. Corrugated Pipe Systems

1. Material: "High density polyethylene pipe shall be smooth lined and meet the requirements of AASHTO M294 Type S."

2. Material: Polyethylene, in accordance with ASTM F 405 or ASTM F 667, Type III, Category 4 or 5, Grade P33, Class C, or Grade P34, Class C as defined by ASTM D 1248.

3. Fittings: Manufactured of same resin as the pipe.

4. Joints: Split corrugated couplings with plastic or stainless steel ties and leak resistant neoprene gasket.

C. Pipe Markings

1. Mark pipes continuously to identify:
   a. Manufacturer's name (or trade mark) and code.
   b. Nominal size.
   c. Polyethylene code designation.
   d. SDR rating. (Not applicable to corrugated polyethylene.)
   e. Date of manufacture.
   f. Pressure class. (Not applicable to corrugated polyethylene.)
   g. ASTM or AWWA designation number.

D. All storm drain pipe must be a minimum of 18-inch in diameter

2.05 CORRUGATED METAL STORM DRAIN CULVERT PIPE

A. Galvanized or aluminized steel

1. Material according to ASTM A-929.

2. Pipe according to AASHTO M-36.

3. Design according to ASTM A-796.

4. Installation according to ASTM A-798.

B. Asphalt dipped according to ASTM A-849.

C. Pipe shall be Galvanized, Aluminized, or Asphalt dipped as required by City Engineer.

D. Minimum No. 14 gage plate thickness.

E. Pipe must be a minimum of 18-inches.

2.06 **SUBSURFACE DRAIN PIPE**

A. Pipe

1. Perforated PVC (ASTM D-1784).

2. Perforated Concrete Sewer Pipe (AASHTO M-86 & M-170).

3. Perforated Corrugated polyethylene piping (ASTM F-405-77a).

B. Bedding shall be drain rock.

2.06 **SEWER LATERAL CONNECTIONS**

A. All sewer lateral connections to new sewers shall be through preformed wyes.

B. Connections to existing sewers will be done with sewer tapping machine as shown in Standard Drawings.

C. Minimum lateral size is 4-inches.

D. All other size lateral connections shall be at a sewer manhole.

PART 3 EXECUTION

3.01 **PIPE LAYING**

A. All sewer pipe installation shall proceed up grade on a stable foundation with joints closely and accurately fitted.

1. Grade shall not be less than slope required for a full pipe to maintain 2 foot per second velocities.

2. Maximum slope of any sewer piping will be 10%. Anything over 8% slope will require approval from Roosevelt City's Engineer.

3. Minimum sewer pipe sizing is 8".

4. Minimum cover over the top of sewer pipe shall be 4-feet.

SEWER PIPE SIZE (inches)	MINIMUM SLOPE (ft/ft)
8	0.0035
10	0.0025
12	0.0020
18	0.0015
21	0.0010
24	0.0008
30	0.0006
36	0.0005

This table shows the slope required for different sized sewer pipe in order to achieve the required 2 foot per second velocity.

B. Gaskets shall be fitted properly in place and care shall be taken in joining the pipe units to avoid twisting of gaskets.

C. 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.

D. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejointed as for a new pipe.

E. When laying is not in progress, the ends of the pipe shall be closed with tight fitting stopper to prevent the entrance of foreign material.

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

G. HDPE shall be installed as per manufacturer's instructions, ASTM D 2321 or ASTM D 2774 as applicable.

H. Pipe shall be air tested per state regulations.

I. Concrete collars are required at all storm drain pipe connections to manholes or inlets.

3.02 **GRAVEL FOUNDATION FOR PIPE**

A. 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 drain rock compacted into place. See Section 02 22 50.

3.03 **BEDDING**

A. Refer to section 02 20 60.

3.04 **COMPACTION**

A. Refer to Section 02 25 00.

END OF SECTION

SECTION 15 10 80

AIR-RELEASE AND VACUUM-RELIEF VALVES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of vacuum relief valves, air-release valves, combination air-release and vacuum relief valves for water service.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Pressure Testing of Piping: 02 66 00.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Provisions.

B. Submit manufacturer's catalog data. Show dimensions, materials of construction by ASTM reference and grade, and coatings.

PART 2 MATERIALS

2.01 VALVE IDENTIFICATION

A. Valves are identified on the plans by size and type.

2.02 VALVE TAGGING AND IDENTIFICATION

A. Provide identifying valve tags with Contract Documents

2.03 BOLTS AND NUTS FOR FLANGED VALVES

A. See specification for the pipe to which the valve is attached.

2.04 GASKETS FOR FLANGED END VALVES

A. Gaskets for flanged end valves shall be as described in the detail piping specifications.

2.05 VALVE DESIGN AND OPERATION

A. Air-release valves for water service shall function to slowly release pockets of air which accumulate at high points in piping systems. Valves 3/4 inch and smaller shall be of the direct-acting type or lever type. Valves larger than 3/4 inch shall have a float-actuated compound lever with linkage mechanism to release air. Float shall withstand an external pressure of 1,000 psig without collapsing.

Air-release valves of sizes 1 inch and 2 inches shall incorporate a body with flanged top cover and replaceable orifice and a synthetic rubber needle or disc actuated by the float and linkage mechanism. Top cover shall include a 1/2-inch threaded outlet with bronze plug. Body shall include a 1/2-inch threaded drain outlet near the bottom with a bronze plug.

B. Combination air-release valve 4 inches and larger for water service shall consist of an air and vacuum valve with an air-release valve attached to it. The air and vacuum valve shall serve to release and admit large quantities of air when pipelines are filled and drained. The attached air-release valve shall serve to release small quantities of air that accumulate during pipeline operation. Connect the attached air-release valve to the air and vacuum valve with standard weight steel piping (ANSI B36.10) and an isolation gate valve.

2.06 MATERIALS OF CONSTRUCTION

A. Materials of construction for air-release valves for water service shall be as follows:

Item	Material	Specification
Body and cover	Cast iron	ASTM A 48, Class 30; or ASTM A 126, Class B
Float	Stainless steel	AISI Type 316, ASTM A 240 or A 276
Linkage, orifice air-release mechanism	Stainless steel	AISI Type 316, ASTM A 240 or A 276
Needle	Buna-N	--

B. Materials of construction for air and vacuum valves for water service shall be as follows:

Item	Material	Specification
Body and cover	Cast iron	ASTM A 48, Class 30; or ASTM A 126, Class B
Float, guide rod, guide bushings	Stainless steel	AISI Type 316, ASTM A 240 or A 276
Seat	Buna-N	--

C. Bronze shall have the following chemical characteristics:

Constituent		Content
Zinc		7% maximum
Aluminum		2% maximum
Lead		8% maximum
Copper + Nickel + Silicon		83% minimum

D. Rubber seats shall be made of a rubber compound that is resistant to free chlorine and monochloramine concentrations up to 10 mg/l in the fluid conveyed.

E. Body and cover bolts, nuts, and cap-screws shall be Type 304 stainless steel.

2.07 **VALVE END CONNECTIONS**

A. Valves smaller than 3 inches shall have threaded ends. Valves 3 inches and larger shall have flanged ends.

B. Flanges for Class 150 valves shall comply with ANSI B16.1, Class 125. Flanges for Class 300 valves shall comply with ANSI B16.1, Class 250.

C. Threaded ends shall comply with ANSI B1.20.1.

2.08 **VALVES**

A. Air-Release Valves, 1 inch and 2 inches, Class 300:

Valves shall have an operating pressure of 300 psi. Orifice size shall be 3/32 inch. Valves shall be APCO 200A, Val-Matic Model 38, or equal.

B. Combination Air and Vacuum Relief Valves, 1 inch through 3 inches class 150.

1" Valves shall be APCO 143C or equal

2" Valves shall be APCO 145C or equal

3" Valves shall be APCO 147C or equal

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.

3.02 **VALVE PRESSURE TESTING**

A. Test valves at the same time that the connecting pipelines are pressure tested. See Section 02 66 00 for pressure testing requirements. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the test pressure.

END OF SECTION

SECTION 15 11 00

VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gate, globe, butterfly, check, ball, pressure sustaining, pressure relief, pressure reducing, solenoid valves, air valves, pressure reducing and sustaining valves, and their installation.

1.02 REFERENCES

A. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

B. AWWA C504: AWWA Standard for Rubber-Seated Butterfly Valves.

C. AWWA C508": AWWA Standard for Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS.

D. AWWA C509: AWWA Standard for Protective Interior Coatings for Valves and Hydrants.

E. AWWA C550: AWWA Standard for Protective Interior Coatings for Valves and Hydrants.

F. AWWA C600: AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

G. AWWA C500: Metal-Seated Gate Valves for Water Supply Service.

1.03 SUBMITTALS

A. Manufacturer's affidavit certifying product was manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed.

B. Provide detailed technical information as required by the Engineer for evaluating the quality of the valve. This shall include complete dimensions, weights, materials lists and operation charts, etc.

1.04 WARRANTY

A. Provide 2-year warranty.

PART 2 PRODUCTS

2.01 VALVES - GENERAL

A. Submerged or Above Water: Provide fasteners in accordance with Section 15 05 20.

B. Underground: Unless otherwise indicated, provide the following:

1. 2.5" and larger: Flanged ends or designed for bolting to flanged pipe.

2. Less than 2.5": Screwed ends.

3. For valves exceeding 3" diameter, provide with non-rising stems and a 2" square operating nut.

C. Below and Operating Deck: Provide shaft extension from the valve to deck level.

D. Above Ground: Non-rising stems and equipped with a handwheel unless indicated otherwise.

E. Manually Operated Valves Over 6' Above Operating Level: Provide with chain operated handles.

F. Install so that handles clear all obstruction when moved from open to closed.

G. Rated Working Pressure: 250 psi unless indicated otherwise.

H. Unless otherwise indicated coat non-plastic valves in accordance with AWWA C550.

2.02 GATE VALVES

A. Furnish gate valves 3" through 48" that conform to the requirements of AWWA C509, with cast iron body, bronze mounted, resilient wedge, non-rising stem design with double "O" ring seals and epoxy coated in conformance with AWWA C550.

B. Operating Direction: Open counterclockwise.

C. Buried Valves: Flanged or mechanical joint.

D. Operators shall be suitable for buried service and shall have an operator shaft extension to finished grade, a 2-inch square AWWA nut, valve box, and cover.

E. Maximum shutoff pressure of 250 psi.

F. Gate Valves Aboveground:

1. Valves less than 3 Inches (76 mm) in size for clean water and air service: manufacturer's standard bronze, solid wedge disc, rising stem, screwed end, class 150 pounds.
   a. Manufacturers: One of the following or equal:
      1) Crane, Figure 431.
      2) Jenkins, Figure 47.
      3) Lunkenheimer Company, Figure 2151.

2. Valves 3 inches in size and larger: Flanged 200 pound (90.7 kg) iron body; bronze mounted; outside screw and yoke (OS&Y); double disc; parallel seat; with stems of silicon bronze in accordance with ASTM B 98, Alloy No. C 66100; and handwheel.
   a. Manufacturers: One of the following or equal:
      1) M&H Valve Company, Figure 68-02.
      2) Mueller, A-2483-6.
      3) Waterous

G. Gate Valves Underground:

3. Valves 3 inches (76 mm) through 12 inches (305 mm) in size for underground service: iron body, resilient seat, non-rising stem, double O-ring stem seal, in accordance with AWWA C 509.
   a. Manufacturers: One of the following or equal:
      1) M&H Valve Company.
      2) Mueller Company.
      3) Waterous

4. Valves 14 Inch Size and Larger for Underground Service: Double disc, parallel seat, iron body, bronze mounted, non-rising stem (NRS) in accordance with AWWA C 500.
   a. Manufacturers: One of the following or equal:
      1) M&H Valve Company.
      2) Mueller Company.

2.03 BUTTERFLY VALVES

A. Material, in accordance with AWWA C504. Protective coatings shall be as specified in Section 15 of AWWA C 504.

B. Records of tests shall be furnished as specified in AWWA C 504. Valve discs for valves on liquid service shall be stainless steel disc to 12 inches and stainless steel disc or stainless steel mating edge on ni-resist cast iron or cast iron disc above 12 inches. Method of attaching edge to disc shall be subject to approval by the Engineer.

C. Valves and operators shall be designed for a flow through the valve corresponding to a pipeline velocity of 16 feet per second with the vane in the position of maximum coefficient of torque or for the maximum torque that may occur under the specified operating conditions of flow, pressure, valve angle, including seating, unseating, and bearing torque, with the safety factors as required in AWWA C 504 standards and as recommended in Table 2A, Appendix A, of AWWA C 504, whichever is greater.

D. Body Type: Short body or long body at the option of the Contractor as determined by their installation. Short body valves may only be used where the disc will not interfere with adjacent fittings.

E. Wafer Butterfly valves shall not be used as isolation valves.

F. The valve key, shaft, dowel pins, or taper pins used for attaching the valve shaft to the valve disc shall be Type 304 or Type 316 stainless steel or equivalent corrosion resistant material. All portions of the shaft bearings shall be stainless steel, bronze, nylon, or fiberglass and Teflon in accordance with AWWA C 504.

G. Valve disc shall seal in a position of 90 degrees to the pipe axis and shall rotate 90 degrees between full open and tight closed position.

H. All nuts and screws used with clamps and discs for rubber seats shall be securely held from loosening from vibration or cavitational effects.

I. Butterfly valves shall be provided with 150 lb. flanges. Maximum shutoff pressure shall be 250 psi.

J. Valves larger than 6 inches that are buried in the ground shall be provided with a totally enclosed worm gear operator mounted on the valve. The valve shaft shall extend from the valve to the operator and shall be as specified for valve shafts. The operator shall be gasketed for watertightness. Operators shall be suitable for buried service and shall have an operator shaft extension to finished grade, a 2-inch square AWWA nut, valve box, and cover.

K. Manual operators on butterfly valves larger than 6-inches shall be geared operated; except valves 10 inches and smaller on low pressure air services may be lever operated.

L. Wafer Valves: subject to approval of Engineer.

M. Valve Shafts: Install horizontal.

2.04 CHECK VALVES

A. Valves: In accordance with AWWA C508.

B. Valve shall be Cla-Val Series 582W Two Door Check or approved equal.

C. Working pressure of 250 psi.

2.05 PRESSURE RELIEF VALVE

A. Valve shall open quickly at an adjustable pre-set overpressure to dissipate damaging surge, and close slowly at adjustable speed after restoration of normal line pressure.

B. A needle valve shall be furnished to regulate valve closing speed.

C. The valve shall have only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides or spokes within the waterway. There shall be no springs to assist the valve operation. All controls and piping shall be of non-corrosive construction.

D. Valve seat will be renewable without removing valve body from pipe installation.

E. Valve interior trim shall be bronze B-62. The valve shall be supplied completely piped ready for installation.

F. Valve shall be flanged suitable for 250 psi working pressure and for discharging 250 psi to atmosphere without damage to the valve or seat.

G. Valve shall be by Cla-Val (model 50-01) or equal.

H. Provide a 120 V electrical contact switch and extension rod to allow activation of alarm in the event the valve opens.

2.06 SOLENOID VALVES

A. All solenoid valves shall be as manufactured by Automatic Switch Company, Florham Park, New Jersey; Skinner Electric Valve Division, The Skinner Chuck Company, New Britain, Connecticut; or equal. Size shall be as required by application.

B. Valves shall be capable of manual operation.

2.07 **AIR VALVES**

A. Designed to allow large quantities of air to escape out of the orifice when filling pipeline and to close water tight when water enters. The air and vacuum valve shall also permit large quantities of air to enter through the orifice when the pipeline is being drained to break the vacuum. The air release valve shall allow air to discharge when air accumulates in the pipe under pressure.

B. This discharge orifice area shall be larger or equal to the inlet of valve.

C. The valve shall consist of a body, cover, baffle, float and seat. The baffle will be designed to protect the float from direct contact of the rushing air and water to prevent the float from closing prematurely in the valve. The seat shall be fastened into the valve cover without distortion and shall be easily removed if necessary.

D. The float shall be stainless steel designed to withstand 1000 psi or more. The float shall be center guided for positive seating.

E. Valve shall be by Apco or approved equal.

F. The valves must be painted with a heavy coat of red lead TTP86 type IV for resistance to corrosion.

G. All materials of construction shall be certified in writing to conform to A.S.T.M. specifications as follows:

Body, Cover and Baffle	Cast Iron	ASTM A48 Class 30
Float	Stainless Steel	ASTM A240
Seat	Buna-N	

2.08 **PRESSURE REDUCING and SUSTAINING VALVES**

A. Manufacturers: The following or equal:

1.	Pressure Reducing & Sustaining:	Cla-Val #92-01, or 700 Series, or equal
2.	Pressure Reducing:	Cla-Val #790-01, or equal
3.	Pressure Relief:	Cla-Val #750-01, or equal

B. Valve and control system shall reduce line pressure a predetermined outlet setpoint, and maintain that setpoint at all flows from zero through maximum, regardless of fluctuations in inlet pressure.

C. Control system shall include an external “Y” type strainer, pilot shutoff cocks, adjustable pressure reducing pilot, and adjustable closing speed control.

D. Main valve shall be constructed of 304 stainless steel, and shall contain an elastomeric liner control element.

E. No internal stems or bearings will be permitted. A stainless steel inline basket strainer shall be included.

2.09 **GLOBE VALVES**

B. Globe Hose Valves:

1. Manufacturers:
   a. Globe Threaded Valve: One of the following or equal:
      1) Crane, No. 7TF.
      2) Stockham, Figure No. B22T.

2. Design:
   a. Disc: Renewable, made of teflon or Buna-N.
   b. Class 150 threaded ends, rate for 250 degrees Fahrenheit (121 degrees Celsius) at a pressure of 270 pounds per square inch (1862 kPa).

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Flush all line before valve installation.

B. In ductile iron water mains install valves in accordance with AWWA C600.

END OF SECTION

SECTION 15 12 00

FIRE HYDRANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of hydrants, valves and other accessories.

B. Barrel type Fire Hydrants.

1.02 REFERENCES

A. AWWA C110: American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.

B. AWWA C111: American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

C. AWWA C502: AWWA Standard for Dry-Barrel Fire Hydrants.

D. AWWA M17: AWWA Manual for Installation, Operation, and Maintenance of Fire Hydrants.

1.03 PRODUCT HANDLING

A. Package fire hydrants, gate valves, and valve boxes for protection against dirt and damage during shipment and storage.

B. Handle to prevent contamination of drain hole plugging.

1.04 SUBMITTALS

A. Product Data: Manufacturer's technical product data and installation instructions for valves and hydrants.

B. Shop Drawings: Show interface and spatial relationship between piping and adjacent structures.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Waterous or equal.

2.02 MATERIALS FOR HYDRANTS

A. In accordance with AWWA C502 and pattern approved by Owner.

2.03 HYDRANT END CONNECTIONS

A. Mechanical joint or flanged in accordance with AWWA C110 and AWWA C111.

2.04 **HYDRANT DIMENSIONS**

A. Cast-Iron Body Fire Hydrant: Compression type, opening against pressure and closing with pressure, base valve design, 150 psi working pressure, with 1/4" diameter minimum tapping and bronze plug in standpipe.

1. Size: Minimum 5 1/4" valve opening

2. Direction to Open Hydrant: Left

3. Size and Shape of Operating and Cap Nuts: Pentagon 1-1/2" point to flat.

4. Hose Nozzles: Two 2-1/2" National Standard Thread, cap, gasket and chain.

5. Pumper Nozzles: One 4-1/2" National Standard Thread, cap, gasket and chain.

6. Depth of Cover: 5'-0" unless otherwise authorized.

7. Connection to Main: O-ring seals and a 6" ASA 125 pound flanged inlet.

8. Minimum acceptable pressure design will be: working pressure of 175 psi and a hydrostatic pressure of 350 psi.

9. Bottom connection: 6" flanged. Designed to allow the flanges at the sidewalk level to separate when hydrant is sheared off.

10. Automatic drain: Opens as the hydrant is closed.

11. Hydrant spacing will not exceed 500 feet.

B. Waterous WB67-250 or approved equivalent.

2.05 **PIPE**

A. Ductile iron, In accordance with Sections 15 07 50 & 15 06 10.

B. PVC, In accordance with Section 15 07 50 & 15 06 30.

2.06 **VALVES**

A. Use a hydrant equipped with a barrel valve that remains closed when separation occurs at the sidewalk level flange.

B. Unless indicated otherwise, furnish an auxiliary 6" diameter valve with flange by mechanical joint and connections. Refer to Section 15 11 00 for additional requirements.

2.07 **NUTS, BOLTS, ACCESSORIES**

A. In accordance with Manufacturer's Specifications.

B. Anchorages: Provide anchorages for tees, wyes, crossed, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.

C. Thrust Blocks: Concrete Class 3000 minimum, in accordance with Section 03 30 40.

D. Valve Box, Valve Chamber: In accordance with Section 15 00 00.

E. All fasteners will be Romac blue bolts and nuts or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with Engineer to furnish hydrants of the same manufacturer and model presently used by water utility company.

B. Install hydrants, valves, and valve boxes as indicated and in accordance with AWWA M17.

C. Drain rock and concrete thrust block shall be required at base of hydrant as shown on City Standard Drawing for fire hydrants.

D. Hydrants shall be red.

E. Hydrant Spacing

1. Hydrants shall be spaced as per Uniform Fire Code, Appendix III-B, Table No. A-111-B-1, Number and Distribution of fire hydrants.

2. No lot shall be more than 250 feet from a fire hydrant as measured along the street right-of-way line.

F. Hydrant will have a 6 foot hydrant flag attached to it as shown in the Standard Drawings Water - 2

END OF SECTION

SECTION 15 15 00

WATER METERS AND SERVICE CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water meters, service connections, and materials.

1.02 REFERENCES

A. AWWA C704: AWWA Standard for Cold-Water Meters - Propeller Type for Main Line Applications.

B. AWWA C800: AWWA Standard for Underground Service Line Valves and Fittings.

C. Roosevelt City Standard Drawings: WATER - 1

1.03 SUBMITTALS

A. Manufacturer's test records on the range and accuracy of the meter being furnished.

B. Equipment material diagram and parts schematic.

PART 2 PRODUCTS

2.01 SERVICE METERS

A. Provided and installed by the City unless indicated otherwise.

2.02 SERVICE CONNECTION METER SETTINGS

A. Service materials minimum, in accordance with AWWA C800.

B. Service Pipe:

1. Provide blue HDPE 3408 SDR 9 HDPE pipe with compression fittings.

2. Connection of water services to main lines shall be through a corporation type stop and 36" gooseneck formed with the tubing.

3. In subdivision developments, the contractor shall be responsible to furnish and install the corporation type stop and laterals to a point on private property 24 inches past the street right-of-way line.

C. Meter Boxes: Plastic or asphalt-dipped corrugated metal. Fiber meter boxes are not acceptable. Provide a meter box with ring and cover of sufficient strength to withstand loadings in vehicular traffic areas without breaking.

1. Meter boxes will not be placed in the driveway of any homes or businesses.

D. Corporation Stop and Saddle:

1. Refer to Standard Drawing Water - 1

PART 3 EXECUTION

3.01 INSTALLATION

A. Notify Roosevelt City Hall, at least one working day prior to the time the meter is to be installed.

B. Any required re-setting of the water meter following initial installation shall be done by the City at the expense of the Developer or Contractor.

3.02 METER, CAN AND SETTER

A. Place meter can in park strip or 1 foot off of back of sidewalk.

B. The following can be used for meter cans:

1. Carson 00202002 20X36 black meter box

C. Install setter within 36" of ground surface.

D. Lids shall be manufactured by D&L or Tyler.

E. Lids shall be flush with top of sidewalk elevation.

F. 4”X25” foam meter insulation for frost protection will be supplied and set in the top of each can.

END OF SECTION

SECTION 16 53 00

RESIDENTIAL STREET LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaries and accessories.

B. Poles.

1.02 RELATED SECTIONS

A. Section 03 30 40 - Portland Cement Concrete

1.03 REFERENCES

A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

B. ANSI C82.1 - Ballasts for Fluorescent Lamps-Specifications.

C. ANSI C82.4 - Ballasts for High-Intensity-Discharge and Low Pressure Sodium Maps (Multiple-Supply Type).

D. ANSI 05.1 - Specifications and Dimensions for Wood Poles.

E. IES RP-8 - Recommended Practice for Roadway Lighting.

F. IES RP-20 - Lighting for Parking Facilities.

G. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Shop Drawings: Indicated dimensions and components for each luminaire which is not a standard Product of the manufacturer.

B. Product Data: Provide dimensions, ratings, and performance data.

1.05 SUBMITTALS FOR INFORMATION

A. Test Reports: Indicate measured illumination levels.

B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.06 **SUBMITTALS FOR CLOSEOUT**

A. Operation and Maintenance Data: Submittals for project closeout.

B. Maintenance Data: For each luminaire.

1.07 **REGULATORY REQUIREMENTS**

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.08 **COORDINATION**

A. Coordinate with electric Contractor.

B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 APPROVED PRODUCTS

2.01 **MANUFACTURES**

A. Holophane – Washington GranVille 2 Series.

2.02 **FIXTURE REQUIREMENTS**

A. Bulb: LED, 70 Watt Max

B. Fixture Head Type: Cutoff with full top aluminum reflector

C. Fixture Style: Washington Acorn

D. Voltage: 120 Volt

E. Head: Glass or Acrylic, Asymmetric

F. Temperature: 5000K

G. Photocell: Twistlock

H. Mounting Condition: Concrete base with J bolts.

I. Pole: As required in this schedule.

2.03 **POLES**

A. Height: 14 feet

B. Material: Aluminum or Concrete, non-direct burial type

C. Color: Dark / Black

D. Shape: Fluted or smooth

E. Base: Decorative style, 18 inch minimum height

F. Loading Capacity Ratings:

1. 100 Pounds.

2. Steady Wind: 90 MPH minimum.

2.04 **CONDUIT**

A. One inch PVC scheduled 90 electrical (gray) conduit.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Provide concrete bases for lighting poles at intersections and cul-de-sac's or as shown on the plans. All concrete shall be a minimum of 4 foot below finished grade.

B. Install poles plumb. Provide shims and double nuts to adjust plumb.

C. Install conduit at a minimum burial depth of 24" from the secondary J-box or transformer secondary compartment, as appropriate, to the street light mounting base for each street light location.

3.02 **FIELD QUALITY CONTROL**

A. Operate each light after installation and connection. Inspect for improper connections and operation.

B. Test photo-electric for cell operation.

3.03 **ADJUSTING**

A. Adjust light to provide illumination levels and distribution as directed.

B. Adjust photo-electric cell to operate correctly.

3.04 **CLEANING**

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.05 **PROTECTION OF FINISHED WORK**

A. Relamp lights which have failed Final Completion

3.06 **LIGHTING LOCATION**

A. 60 and 66 foot Right-of-Way

1. Location: In planter strip or if combination sidewalk, 1 one foot behind sidewalk.

2. Spacing: At each intersection, cul-de-sac, and other critical point as determined by the City Engineer. 300’ minimum to 325’ maximum.

B. 72 foot Right- of -Way

1. Location: In planter strip or one foot behind sidewalk as indicated by drawings, and other critical point as determined by the City Engineer.

2. Spacing: At each intersection, cul-de-sac, and other critical point as determined by the City Engineer.

END OF SECTION

Standard Drawings

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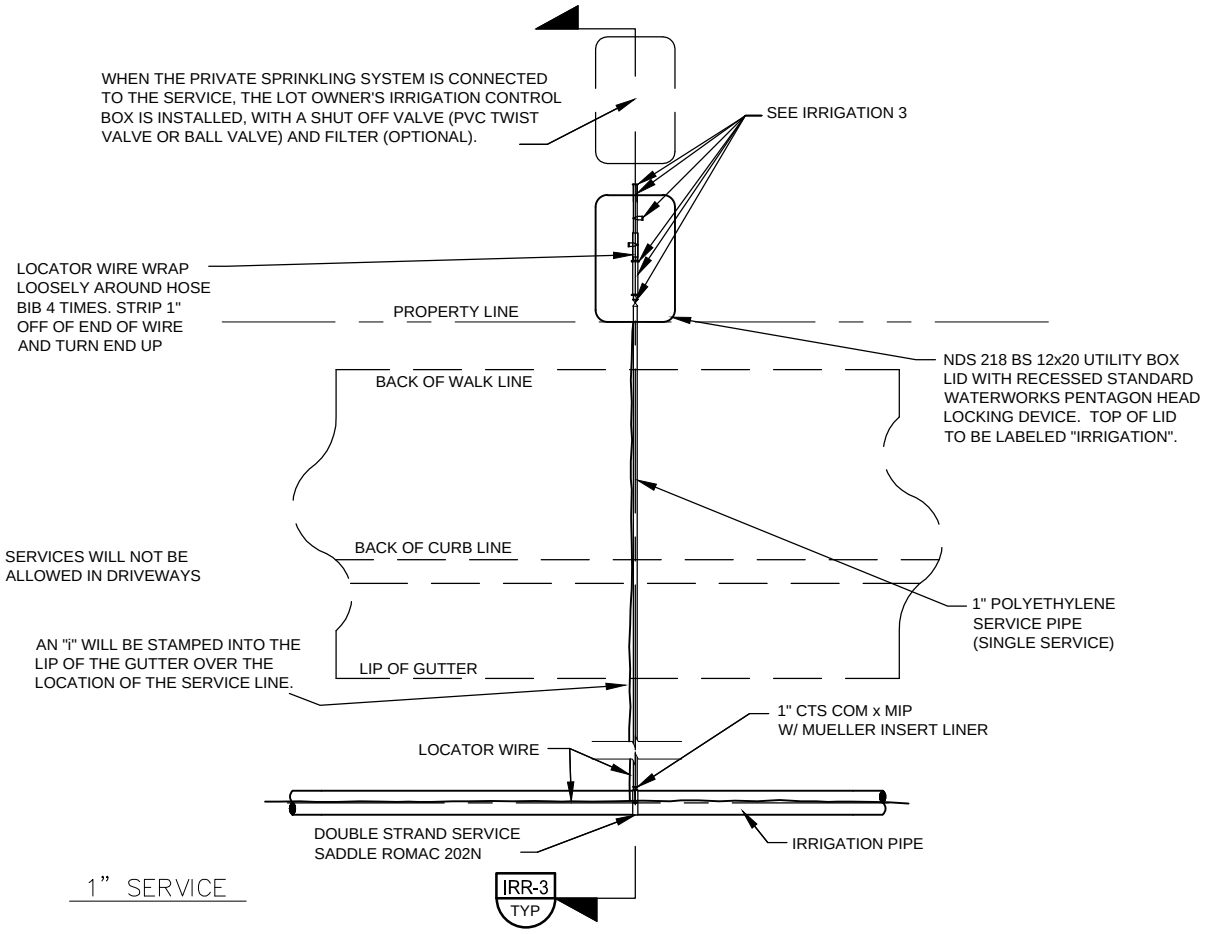
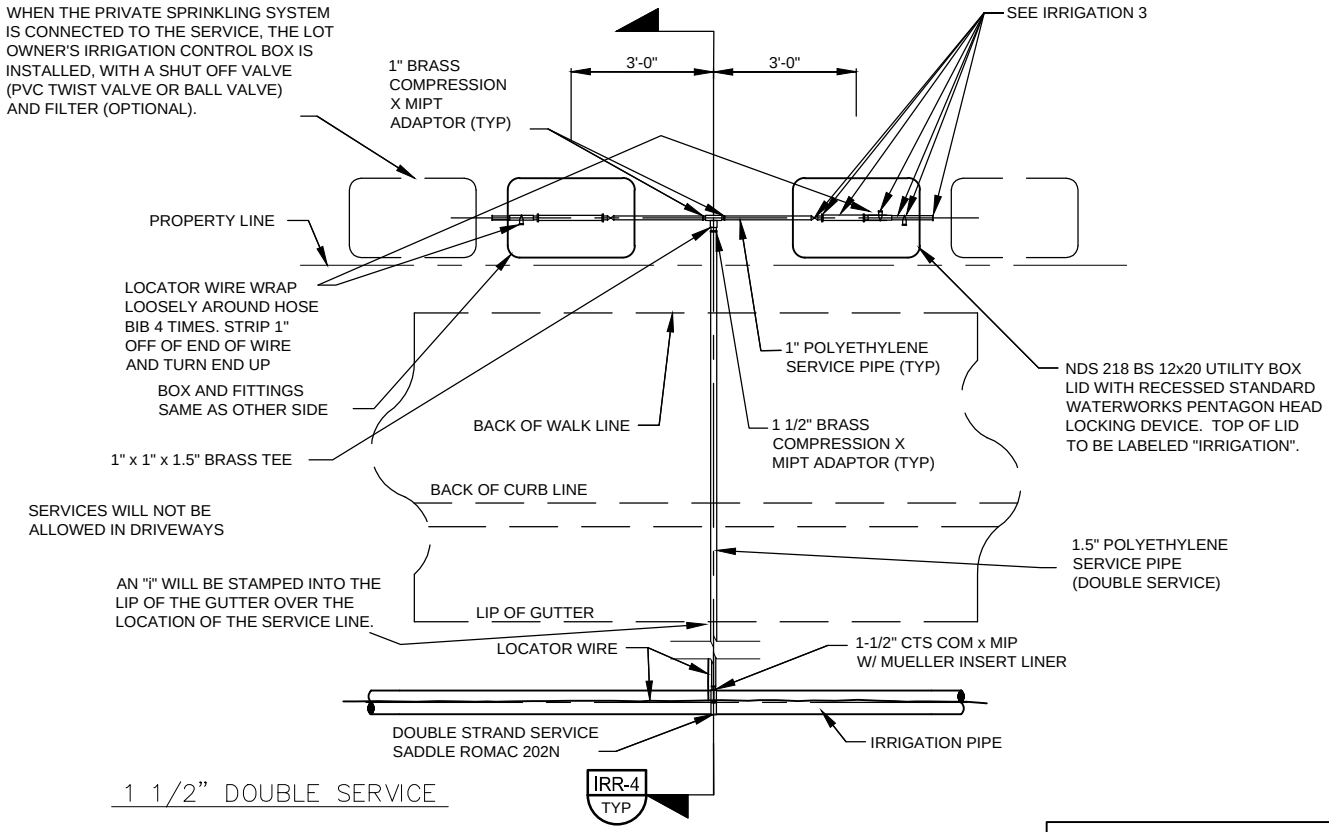




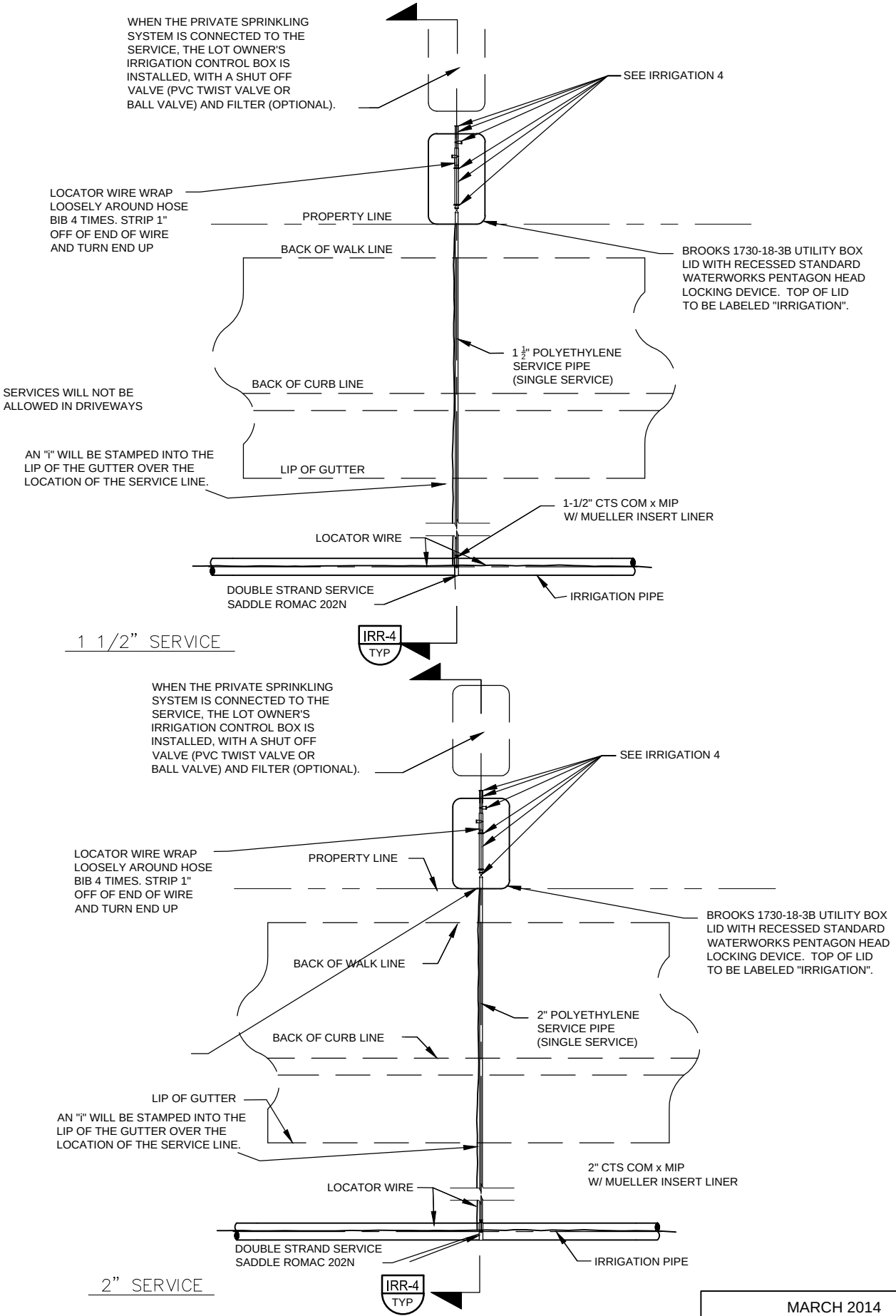
1" SERVICE CONNECTION & 1 1/2" DOUBLE SERVICE CONNECTION

N.T.S.

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

IRRIGATION - 1



1" & 1 1/2" SERVICE CONNECTION

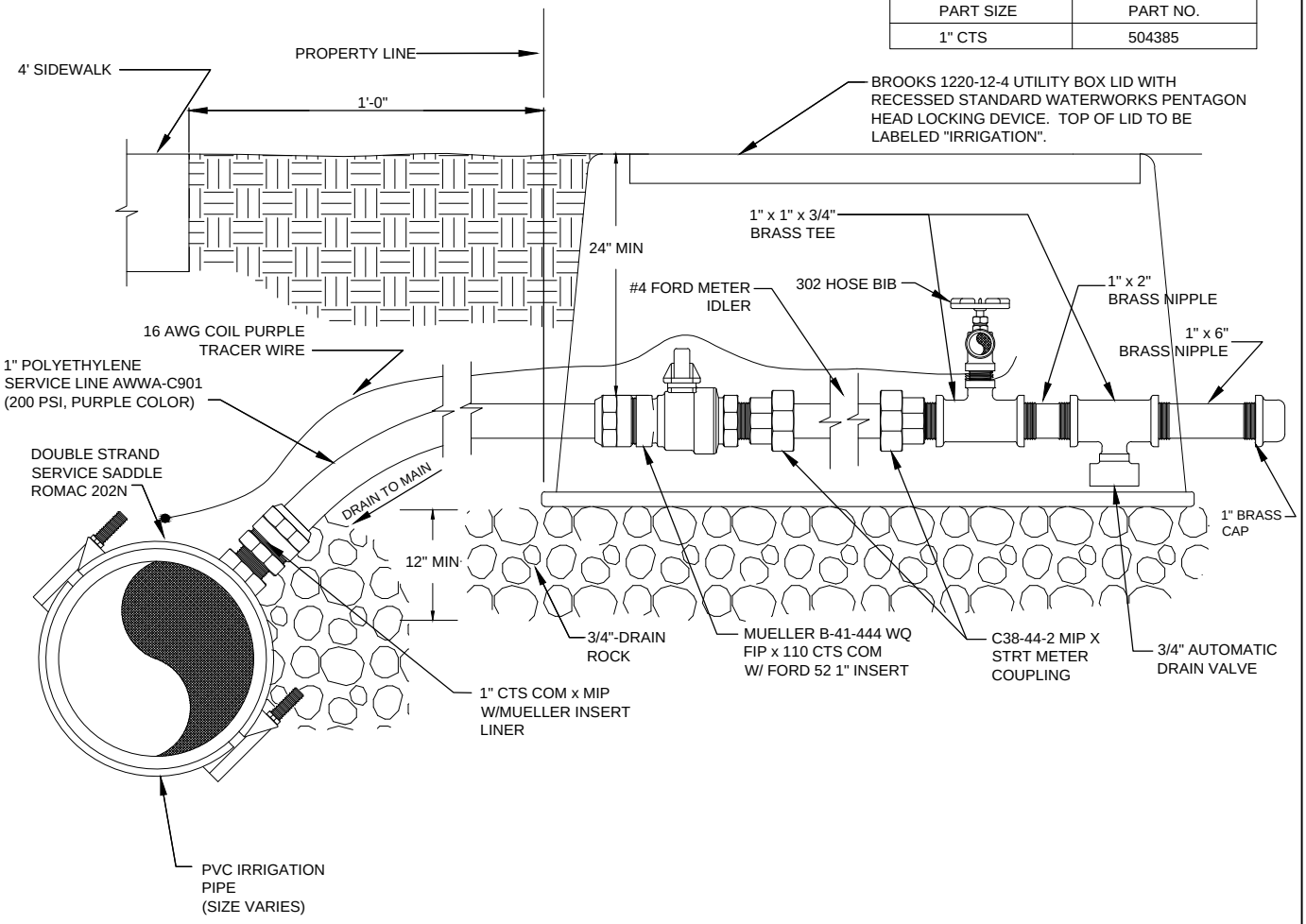
N.T.S.

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

IRRIGATION - 2

MUELLER 110 COMPRESSION INSERT LINER	
PART SIZE	PART NO.
1" CTS	504385



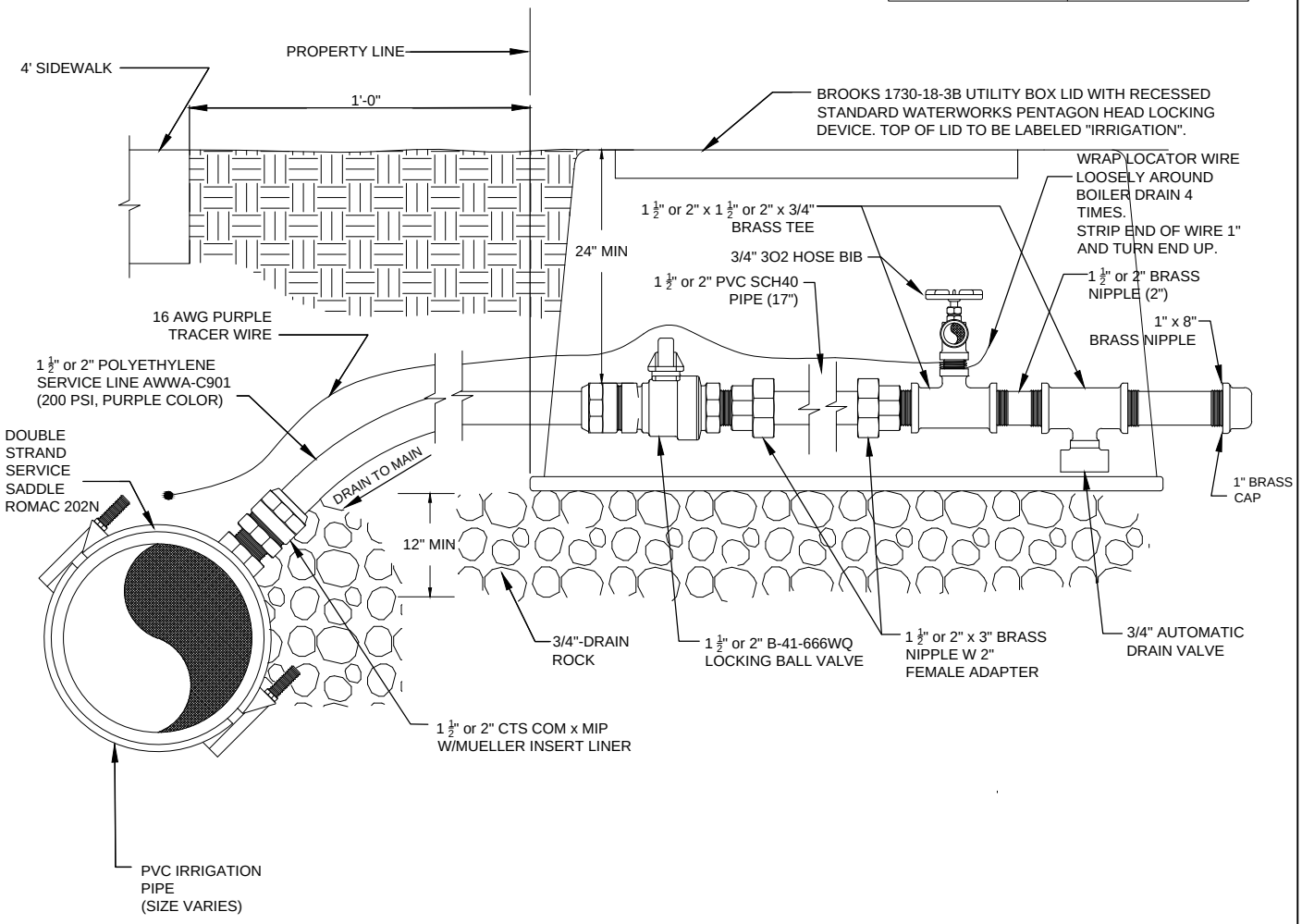
1" IRRIGATION SERVICE CONNECTION DETAIL

NTS

NOTES:

1. THE IRRIGATION BOX SHALL BE PLACED AT THE PROPERTY LINE.
2. ALL FITTINGS TO BE AS SPECIFIED OR APPROVED EQUAL.
3. PIPE DOPE TO BE USED ON ALL THREADED FITTINGS. (RECTOR SEAL T PLUS 2 TEFLON ENRICHED THREAD SEALANT.)
4. ROOSEVELT CITY'S PREFERRED METHOD OF INSTALLATION OF ALL SERVICES IS DIRECTIONAL BORING - WHERE SOIL CONDITIONS PERMIT. TRENCH EXCAVATION IN EXISTING ROADS ONLY WITH CITY APPROVAL.
6. CONTRACTOR IS RESPONSIBLE TO PRESERVE AND PROTECT ALL LANDSCAPE INCLUDING, BUT NOT LIMITED TO, TREES, SHRUBS, GRASS, ROCK, ETC. THE CONTRACTOR SHALL REPLACE ANY AND ALL DAMAGED LANDSCAPE CAUSED BY THE INSTALLATION OF PRESSURE IRRIGATION SERVICES AND ALL OTHER ASSOCIATED APPURTENANCES TO THE SATISFACTION OF THE PROPERTY OWNER AND ROOSEVELT CITY.
7. CONTRACTOR WILL STAMP AN "i" INTO THE FACE OF THE CONCRETE CURB DIRECTLY ABOVE THE IRRIGATION LINE.
8. ALL HPDE FITTINGS TO BE FUSED AS PER MANUFACTURER'S RECOMMENDATIONS.
9. SERVICES WILL NOT BE ALLOWED IN DRIVEWAYS.

MUELLER 110 COMPRESSION INSERT LINER	
PART SIZE	PART NO.
1 1/2" CTS	506139
2" CTS	506141



1 1/2" AND 2" IRRIGATION SERVICE CONNECTION DETAIL

NTS

NOTES:

1. THE IRRIGATION BOX SHALL BE PLACED AT THE PROPERTY LINE.
2. ALL FITTINGS TO BE AS SPECIFIED OR APPROVED EQUAL.
3. PIPE DOPE TO BE USED ON ALL THREADED FITTINGS. (RECTOR SEAL T PLUS 2 TEFLON ENRICHED THREAD SEALANT.)
4. ROOSEVELT CITY'S PREFERRED METHOD OF INSTALLATION OF ALL SERVICES IS DIRECTIONAL BORING - WHERE SOIL CONDITIONS PERMIT. TRENCH EXCAVATION IN EXISTING ROADS ONLY WITH CITY APPROVAL.
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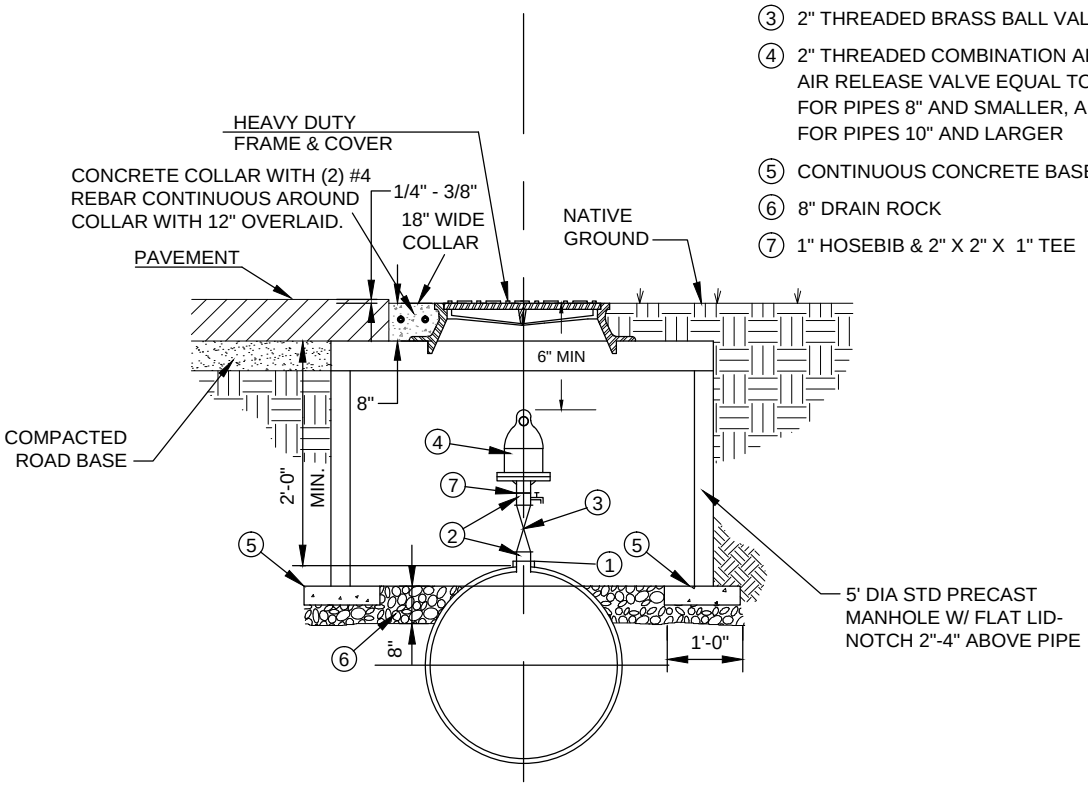
8. ALL HPDE FITTINGS TO BE FUSED AS PER MANUFACTURER'S RECOMMENDATIONS.
9. SERVICES WILL NOT BE ALLOWED IN DRIVEWAYS.

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

IRRIGATION - 4

1. 2" BRASS TAPPING SADDLE W/ S.S. STRAPS
2. SCH. 80 BRASS NIPPLE THR. (MALE) ALLOW FOR VALVE HANDLE TO OPERATE.
3. 2" THREADED BRASS BALL VALVE
4. 2" THREADED COMBINATION AIR & VACUUM AND AIR RELEASE VALVE EQUAL TO FRESNO SERIES 3000 FOR PIPES 8" AND SMALLER, AND FRESNO SERIES 3500 FOR PIPES 10" AND LARGER
5. CONTINUOUS CONCRETE BASE - 1'-0" x 4"
6. 8" DRAIN ROCK
7. 1" HOSEBIB & 2" X 2" X 1" TEE



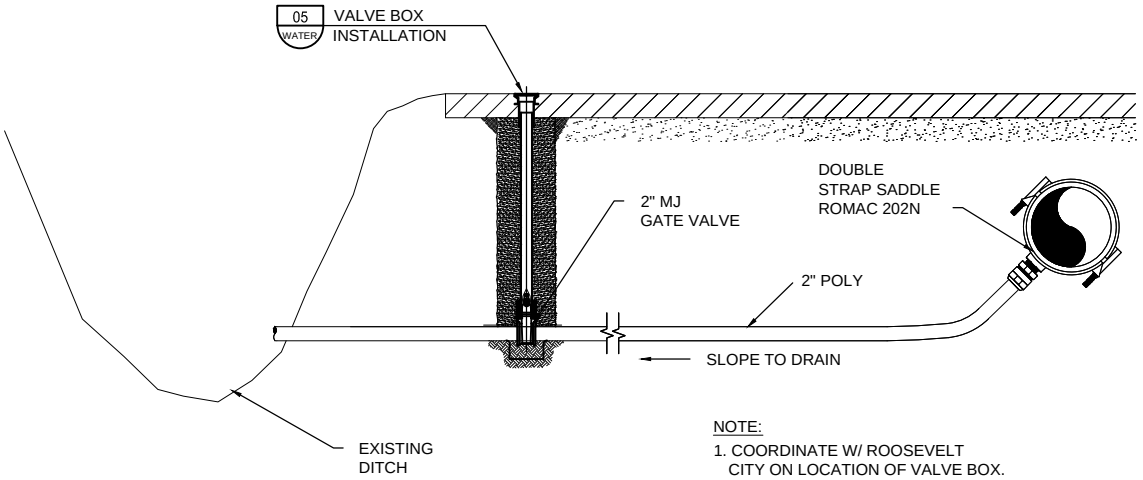
SECONDARY WATER AIR RELEASE STATION

N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

IRRIGATION - 5

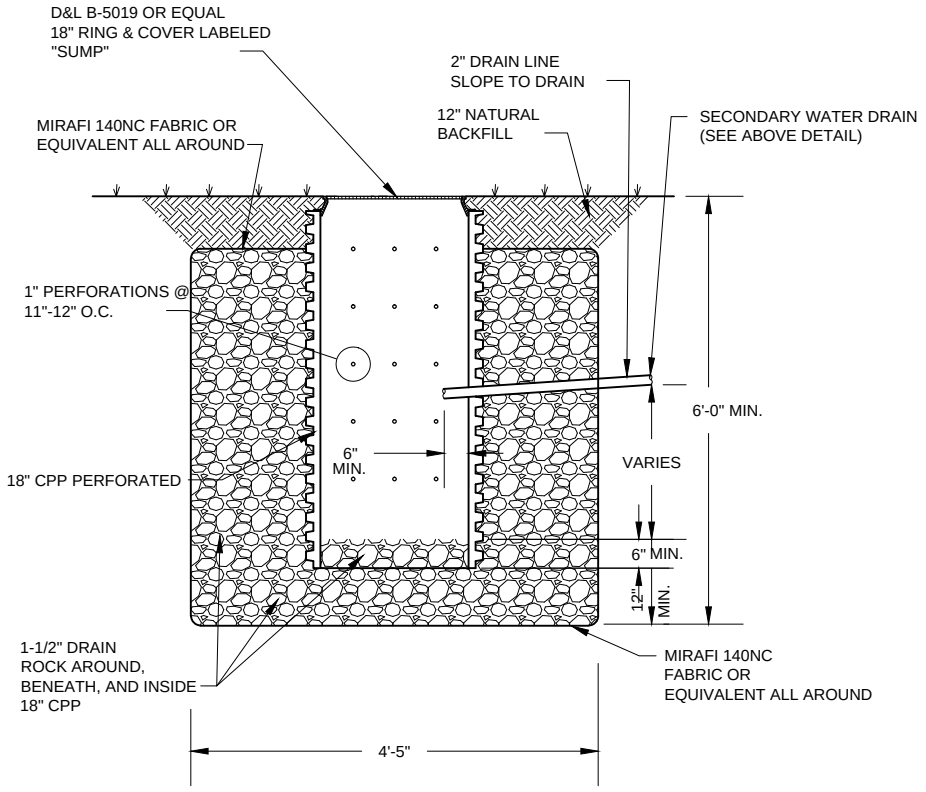


NOTE:

1. COORDINATE W/ ROOSEVELT CITY ON LOCATION OF VALVE BOX.
2. ALL COMPRESSION FITTING SHALL INCLUDE A MUELLER 2" CTS PE LINER PART NO. 506141.
3. DRAIN CAN BE ALTERNATIVELY EMPTIED INTO A SUMP. IT MAY ALSO BE EMPTIED INTO A STORM DRAIN BOX WITH PERMISSION OF CITY ENGINEER. ANY PENETRATIONS IN THE STORM DRAIN BOX WILL BE GROUTED.
4. ROAD IS NOT REPRESENTATIVE OF CITY STANDARD. SEE ROAD DETAILS.

SECONDARY WATER DRAIN

N.T.S.



NOTE:

1. SUMP MAY BE REQUIRED TO BE LARGER THAN SHOWN DEPENDING ON LENGTH AND SIZE OF PIPE THAT EMPTIES INTO IT. CALCULATIONS MUST BE PROVIDED TO PROVE THAT SUMP IS OF SUFFICIENT SIZE.

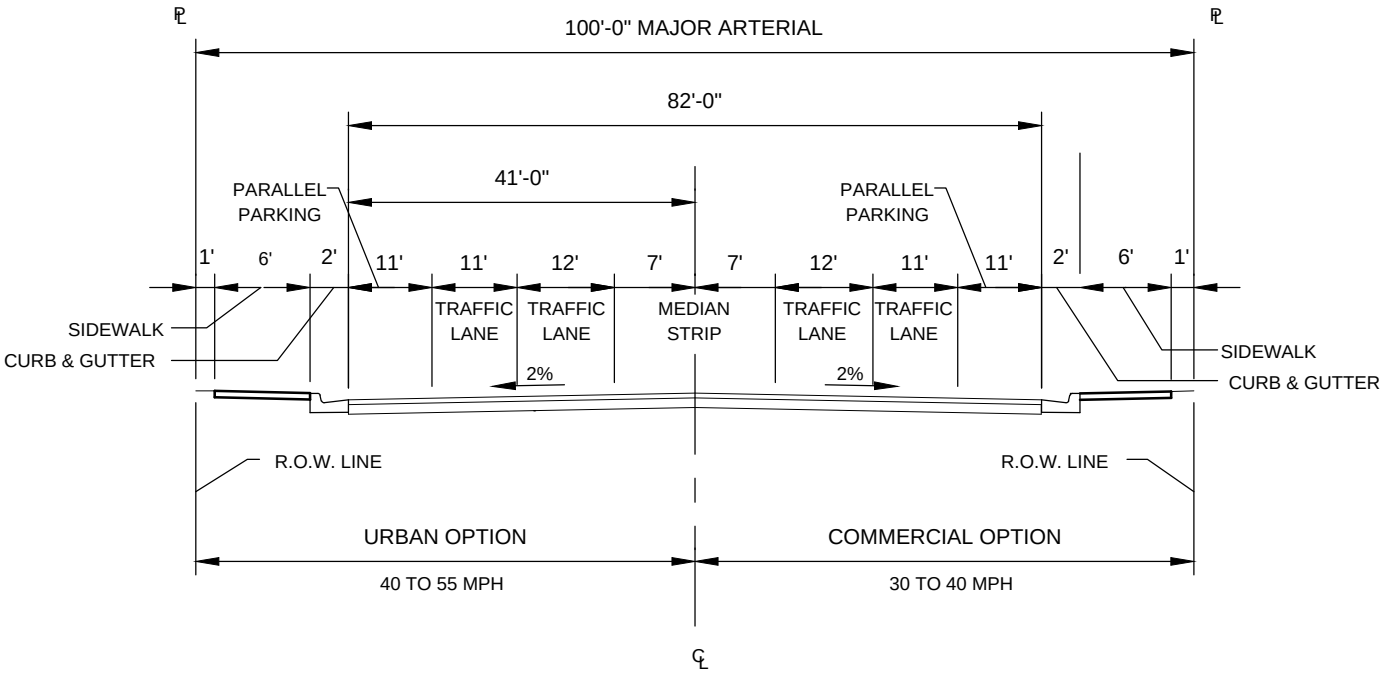
SECONDARY WATER SUMP

N.T.S.

ADDED SEPTEMBER 2015

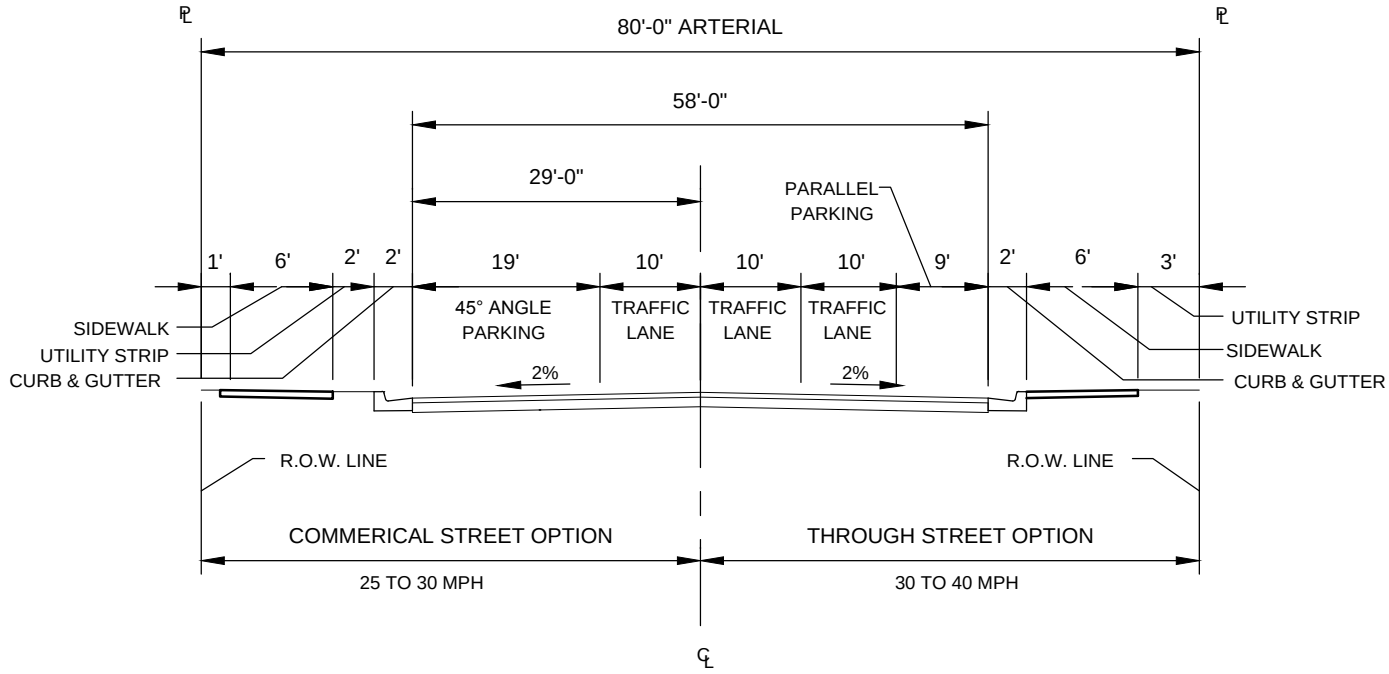
ROOSEVELT CITY
STANDARD DRAWINGS

IRRIGATION - 6



MAJOR ARTERIAL STREETS

N.T.S.



ARTERIAL STREETS

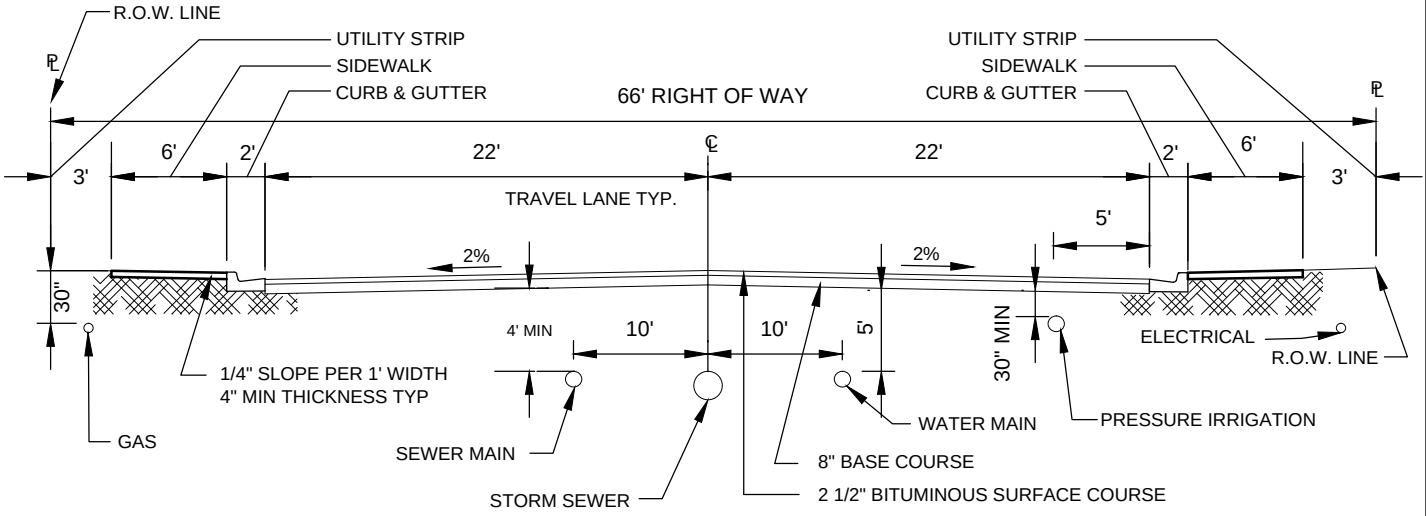
N.T.S.

NOTES:

1. UTILITIES SHALL BE INSTALLED AS IN STANDARD COLLECTOR STREET W/66' R.O.W.
2. SELECT GRAVEL SUBBASE MAY BE REQUIRED AND/OR PAVEMENT INCREASED AS DETERMINED BY THE CITY ENGINEER, BUT SHALL NOT BE LESS THAN COLLECTOR STREET REQUIREMENTS.
3. THE CURB AND GUTTER FOR ARTERIAL STREETS WILL BE 24 "WIDE HIGH BACK.
4. COMMERCIAL STREETS WILL HAVE 6-FOOT SIDEWALKS, RESIDENTIAL WILL BE ALLOWED 4-FOOT SIDEWALKS

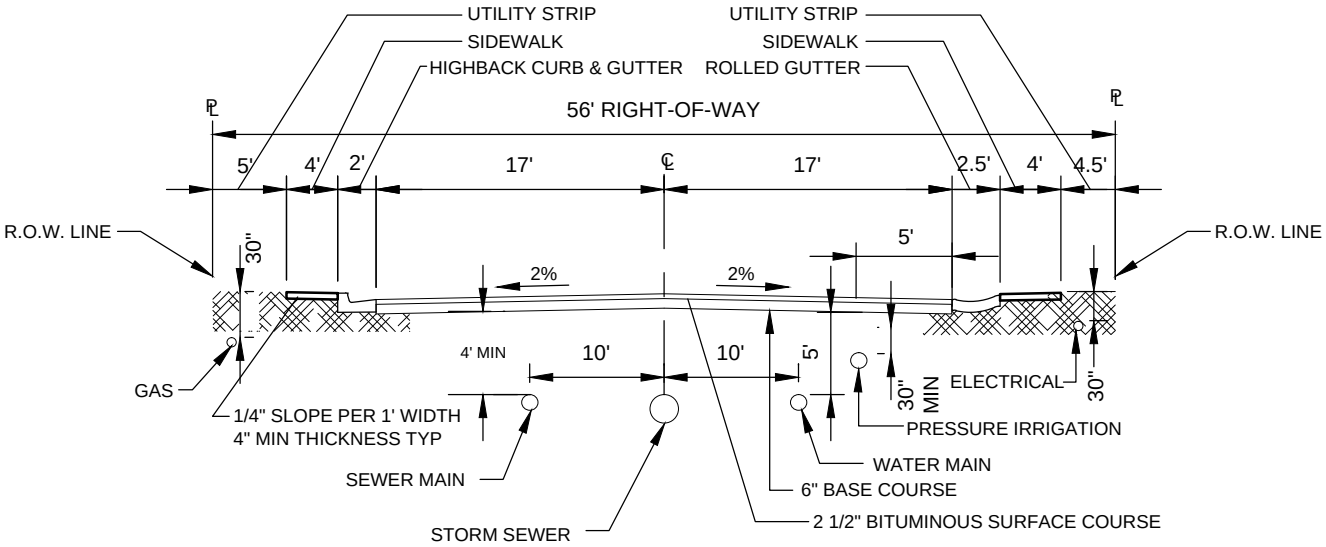
REVISED OCTOBER 2014

ROOSEVELT CITY STANDARD DRAWINGS



COLLECTOR STREETS

N.T.S.



RESIDENTIAL STREETS

N.T.S.

NOTES:

1. WHEREVER POSSIBLE, SANITARY SEWER SHALL BE INSTALLED ON THE DOWNHILL SIDE OF THE STREET.
2. WATER VALVES AND 5-INCH VALVE OPENING FIRE HYDRANTS SHALL BE LOCATED AS REQUIRED BY CITY ENGINEER.
3. NO WATER LINE SMALLER THAN 8-INCH DIA. SHALL BE INSTALLED.
4. AASHTO CLASS A-1 GRAVEL SUBBASE MAY BE REQUIRED WHEN EXISTING SUBBASE IS DETERMINED BY THE CITY ENGINEER TO BE UNSUITABLE.
5. CURB & GUTTER CAN BE 24" HIGH BACK, OR 30" ROLLED IF APPROVED BY CITY ENGINEER.
6. COMMERCIAL STREETS WILL HAVE 6-FOOT SIDEWALKS, RESIDENTIAL STREETS WILL BE ALLOWED 4-FOOT SIDEWALKS.

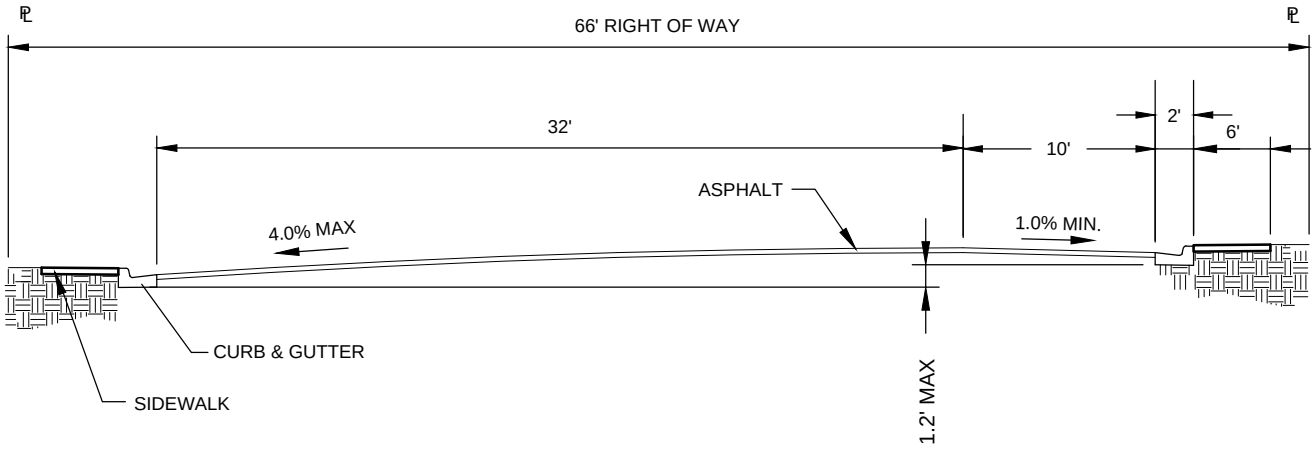
STREET CROSS-SECTIONS & UTILITY LOCATIONS

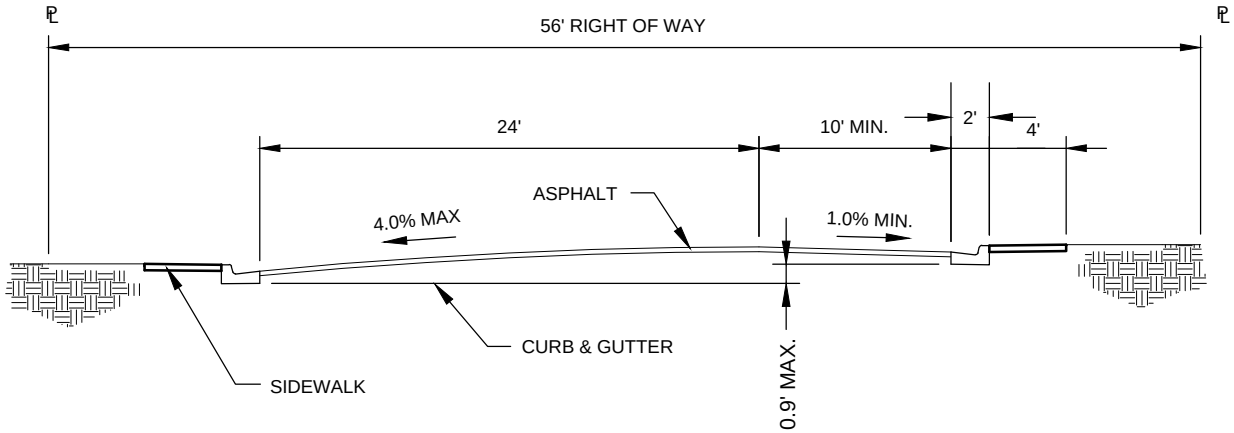
N.T.S.

REVISED OCTOBER 2014

ROOSEVELT CITY STANDARD DRAWINGS

STREETS - 2





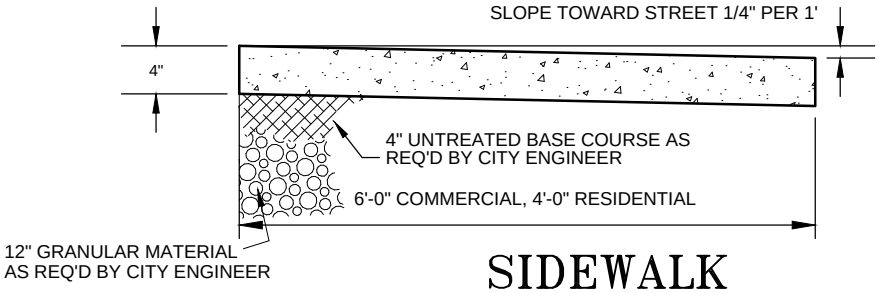
STREET CROSS-SECTIONS
(CURBS AT UNEQUAL ELEVATIONS)

N.T.S.

NOTES:

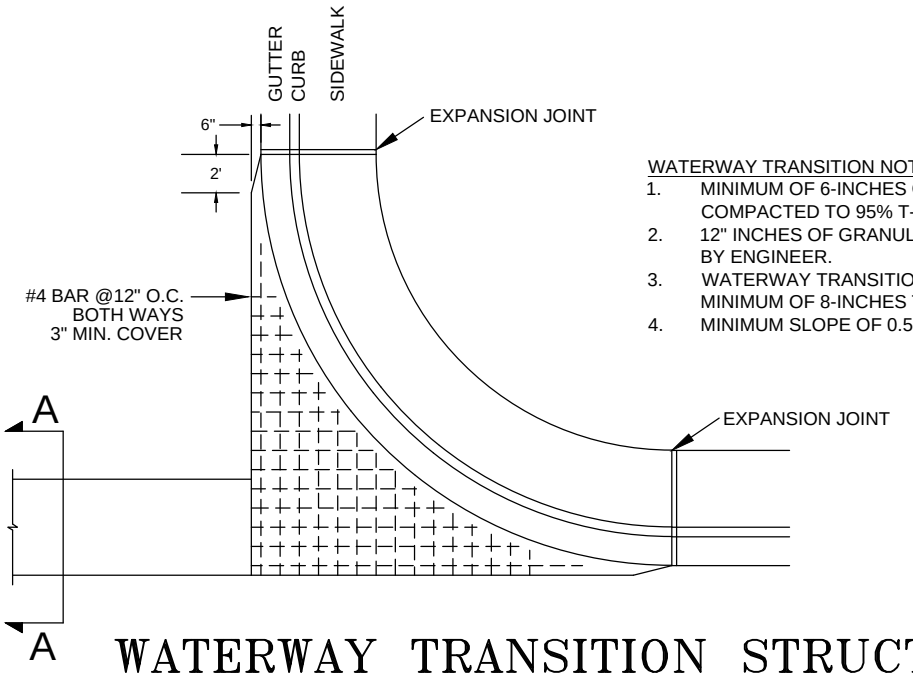
1. UTILITIES SHALL BE INSTALLED AS IN STANDARD COLLECTOR STREET W/66' R.O.W.
2. SELECT GRAVEL SUBBASE MAY BE REQUIRED AND/OR PAVEMENT INCREASED AS DETERMINED BY THE CITY ENGINEER, BUT SHALL NOT BE LESS THAN COLLECTOR STREET REQUIREMENTS.
3. THE CURB AND GUTTER FOR ARTERIAL STREETS MAY BE 24" HIGH BACK, OR 30" ROLLED GUTTER IF APPROVED BY CITY ENGINEER.
4. COMMERCIAL STREETS WILL HAVE 6-FOOT SIDEWALKS, RESIDENTIAL WILL BE ALLOWED 4-FOOT SIDEWALKS

SIDEWALK, WATERWAY TRANSITION, & WATERWAY



SIDEWALK

NTS

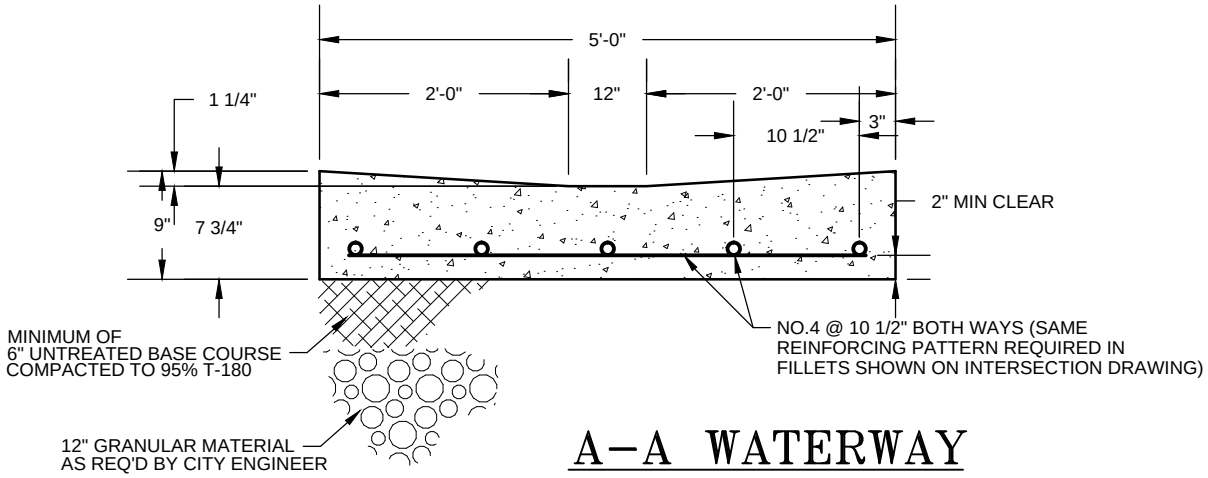


WATERWAY TRANSITION NOTES:

1. MINIMUM OF 6-INCHES OF UNTREATED BASE COURSE COMPACTED TO 95% T-180.
2. 12" INCHES OF GRANULAR MATERIAL AS REQUIRED BY ENGINEER.
3. WATERWAY TRANSITION STRUCTURE WILL BE A MINIMUM OF 8-INCHES THICK.
4. MINIMUM SLOPE OF 0.50%.

WATERWAY TRANSITION STRUCTURE

NTS



A–A WATERWAY

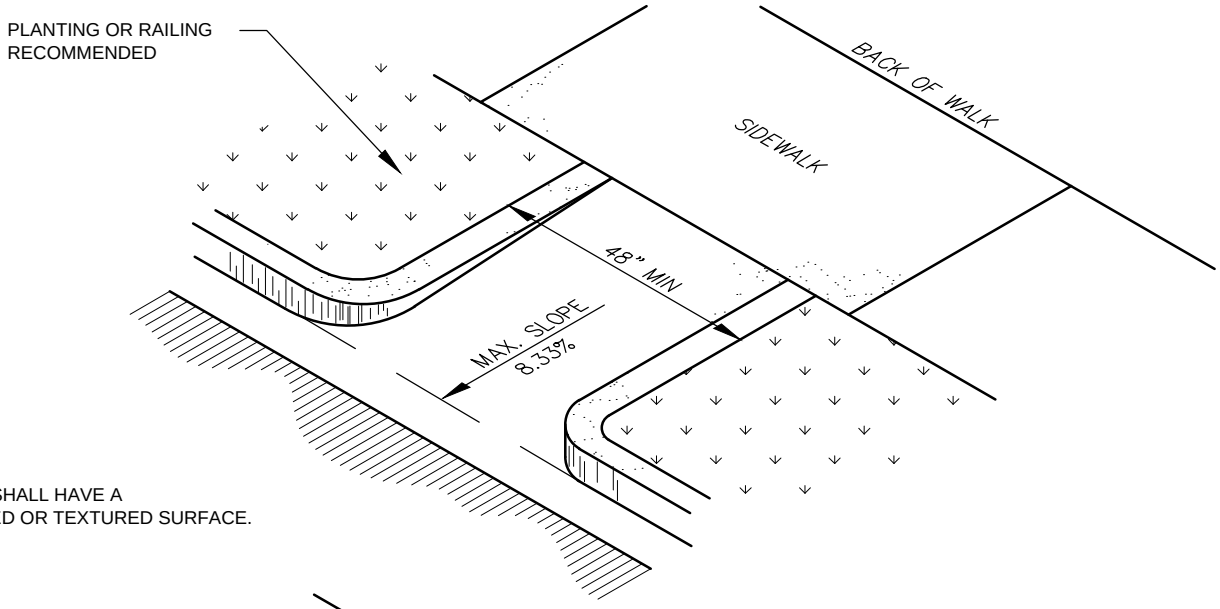
NTS

NOTE:
COMMERCIAL STREETS WILL HAVE 6-FOOT SIDEWALKS, RESIDENTIAL WILL BE ALLOWED 4-FOOT SIDEWALKS

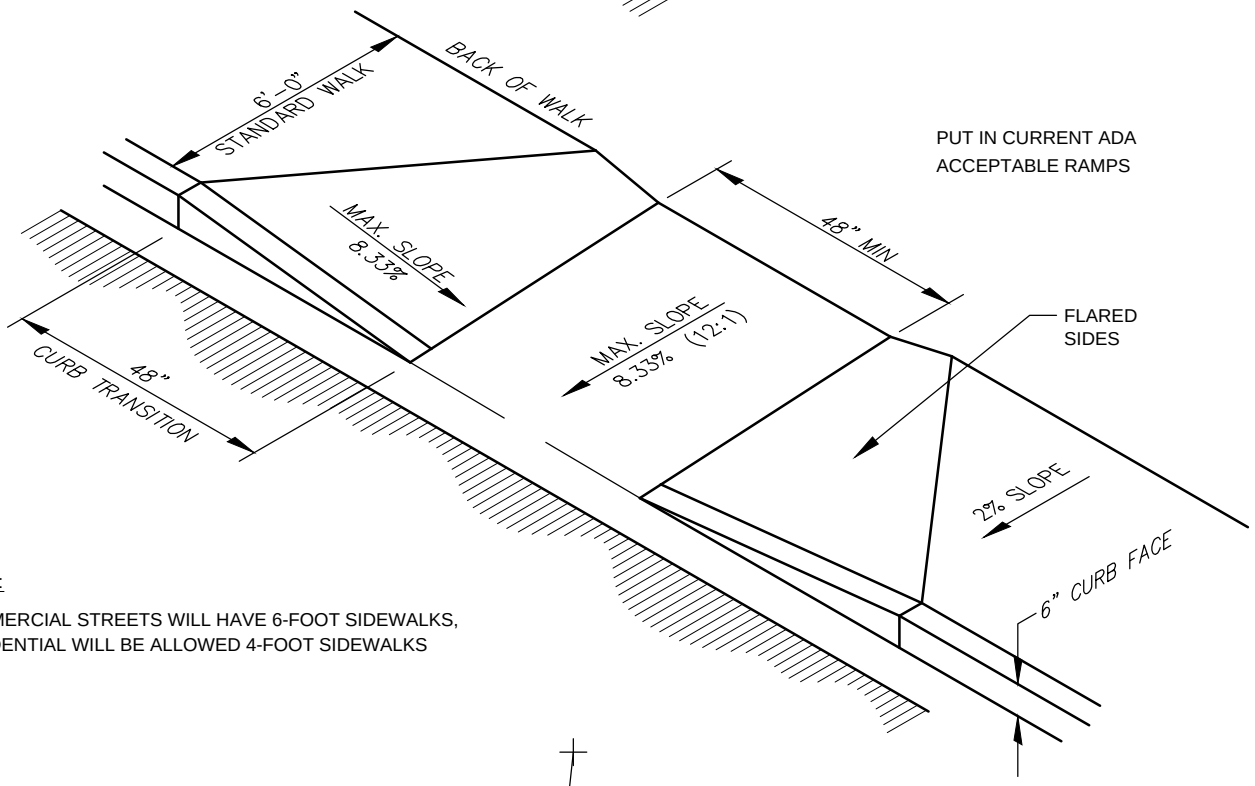
REVISED OCTOBER 2014

ROOSEVELT CITY STANDARD DRAWINGS

STREETS - 4



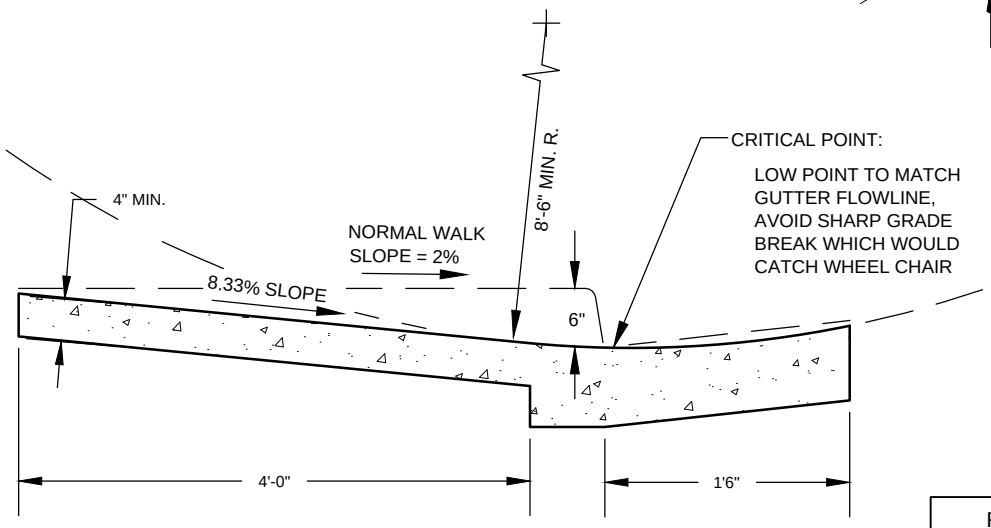
NOTE:
RAMPS SHALL HAVE A
BROOMED OR TEXTURED SURFACE.



PUT IN CURRENT ADA
ACCEPTABLE RAMPS

NOTE:

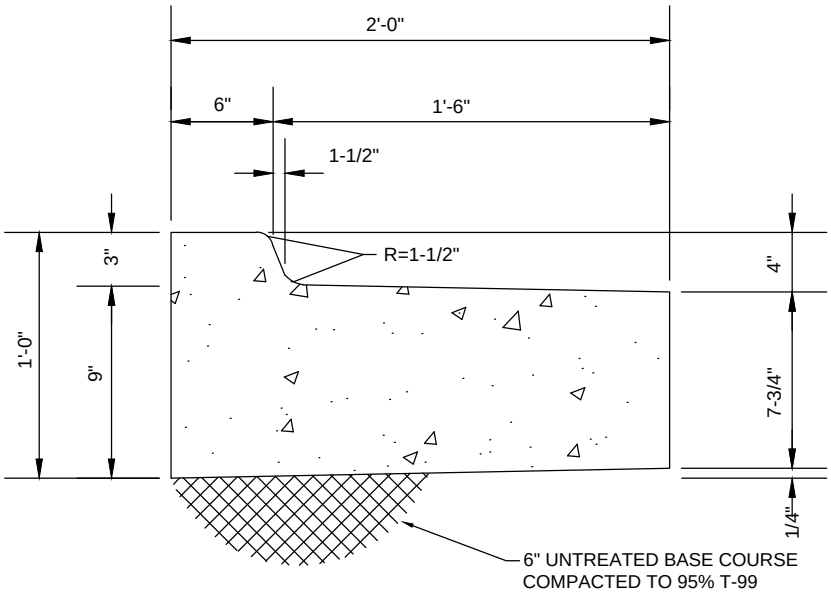
COMMERCIAL STREETS WILL HAVE 6-FOOT SIDEWALKS,
RESIDENTIAL WILL BE ALLOWED 4-FOOT SIDEWALKS



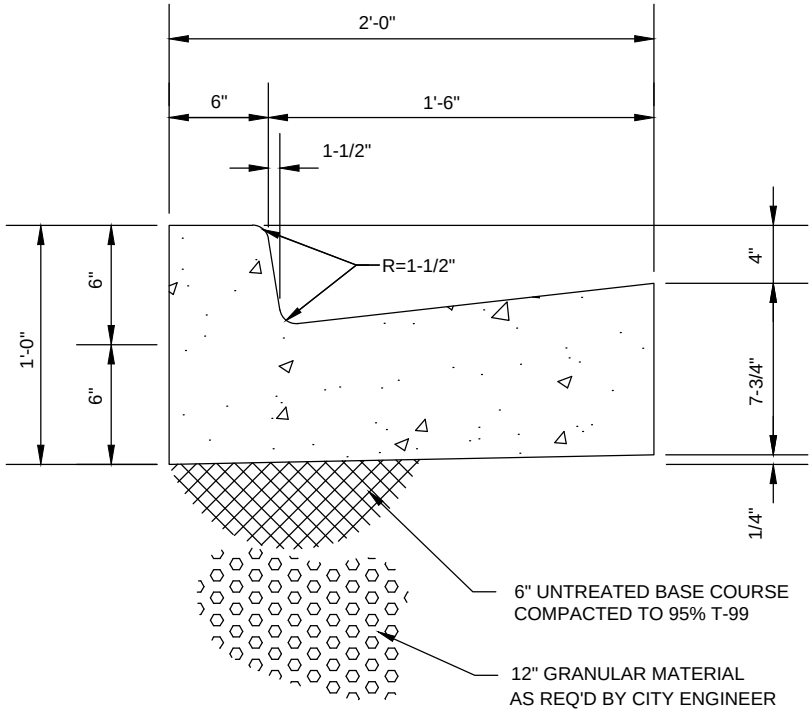
WHEEL CHAIR RAMP

N.T.S.

REVISED OCTOBER 2014
ROOSEVELT CITY
STANDARD DRAWINGS
STREETS - 5



24" REVERSE GRADE CURB & GUTTER



NOTE: HIGHBACK REQUIRED THROUGHOUT ROOSEVELT CITY UNLESS AUTHORIZED BY CITY ENGINEER

A LETTER WILL BE STAMPED INTO THE FACE OF THE CURB OVER THE UTILITY AS FOLLOWS:

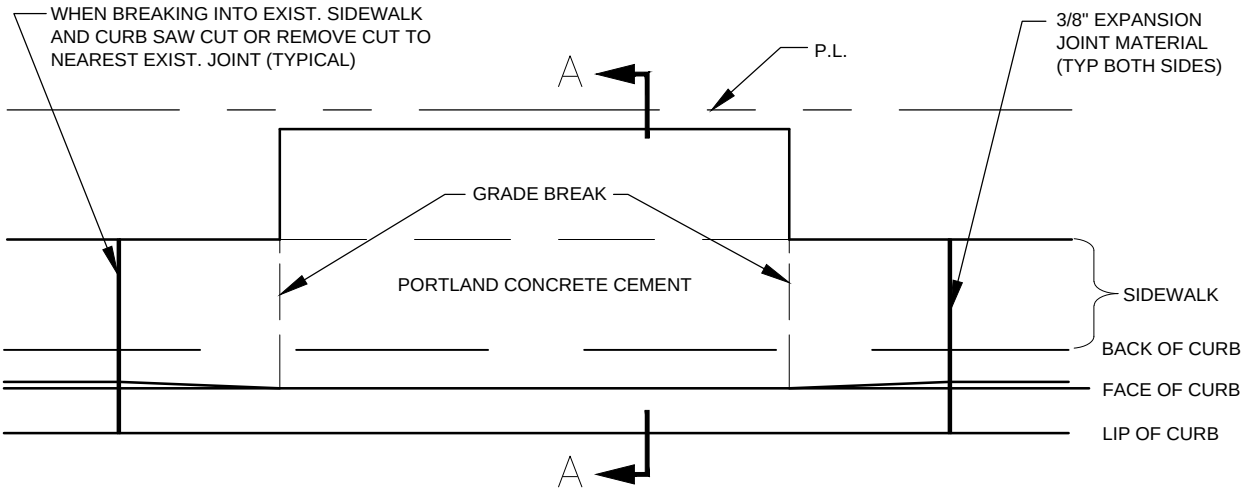
WATER:	"w"
SEWER:	"s"
GAS:	"g"
IRRIGATION:	"i"

24" HIGH BACK CURB & GUTTER

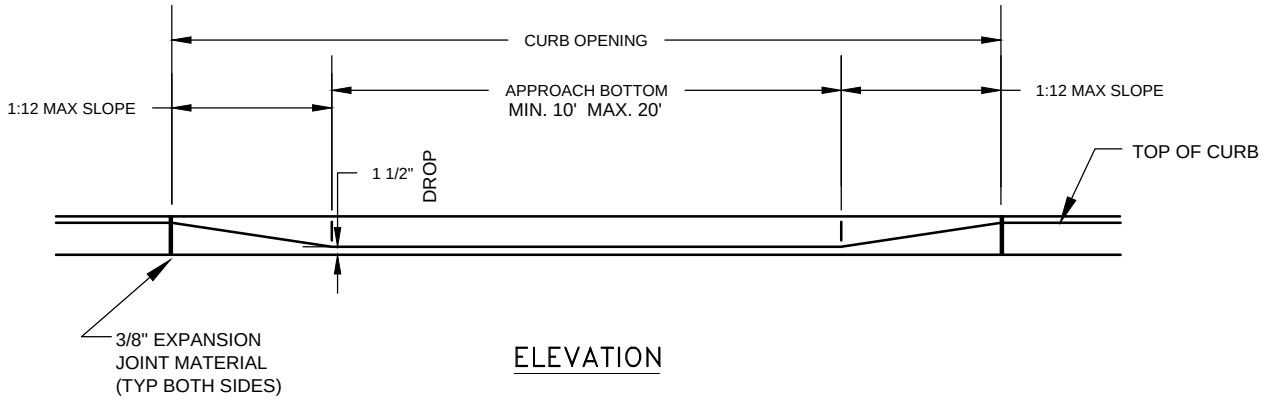
REVISED SEPTEMBER 2015

ROOSEVELT CITY STANDARD DRAWINGS

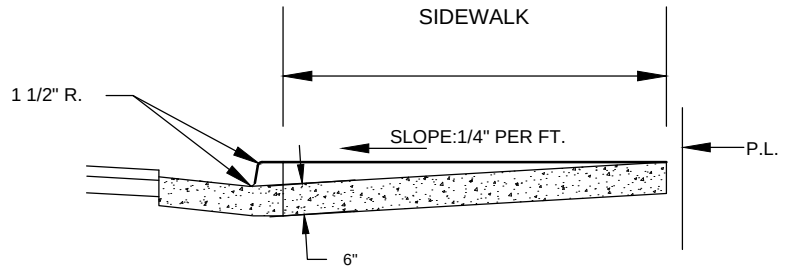
STREETS - 6



PLAN



ELEVATION



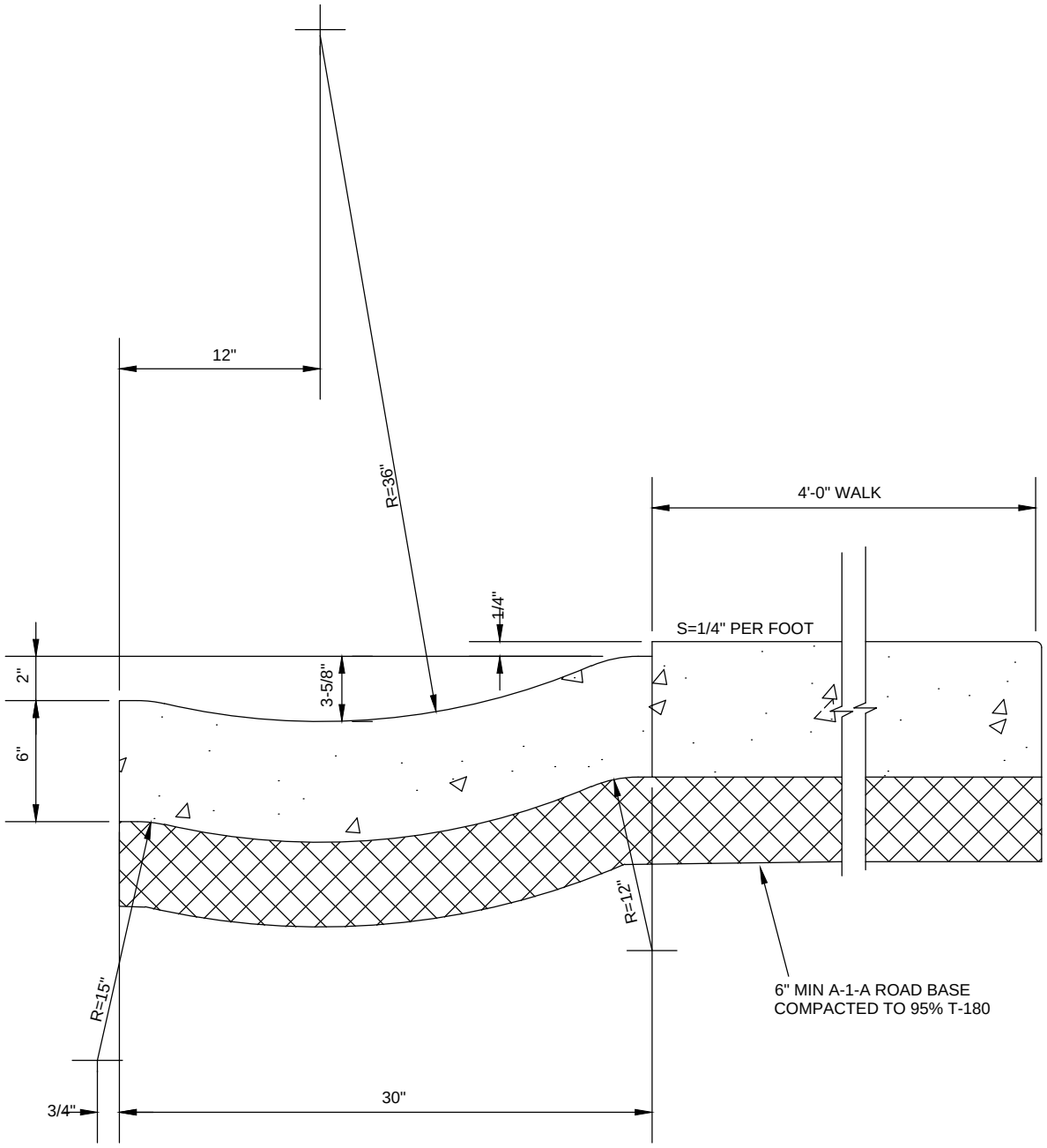
SECTION A–A

NOTE:
CURB OPENING SHALL HAVE A COURSE BROOM FINISH.
C.F. = CURB FACE

RESIDENTIAL DRIVEWAY APPROACH

N.T.S.

REVISED OCTOBER 2014
ROOSEVELT CITY
STANDARD DRAWINGS
STREETS - 7



A LETTER WILL BE STAMPED INTO THE FACE OF THE CURB OVER THE UTILITY AS FOLLOWS:

WATER:	"w"
SEWER:	"s"
GAS:	"g"
IRRIGATION:	"i"

ROLLED RESIDENTIAL GUTTER*

NTS

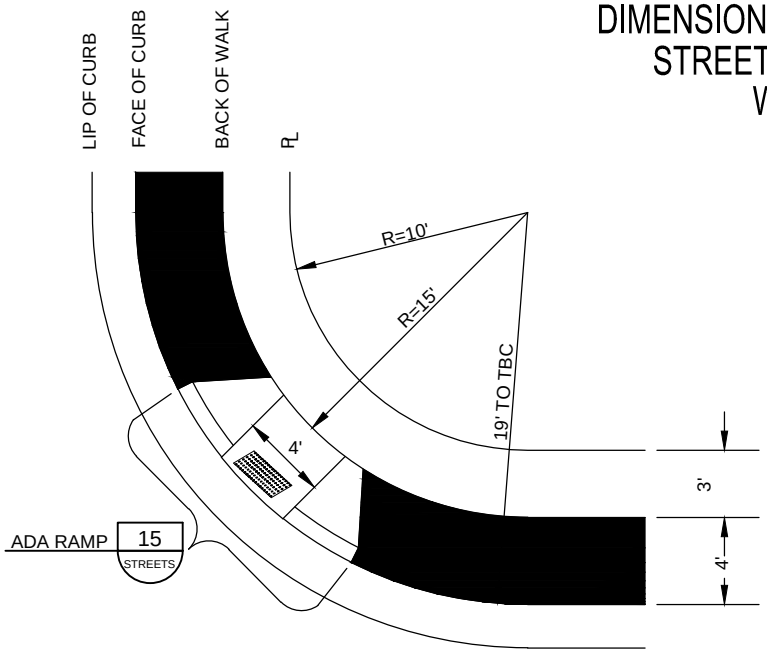
*NOTE: HIGH BACK CURB AND GUTTER WILL BE USED UNLESS APPROVED BY THE CITY ENGINEER.

REVISED OCTOBER 2014

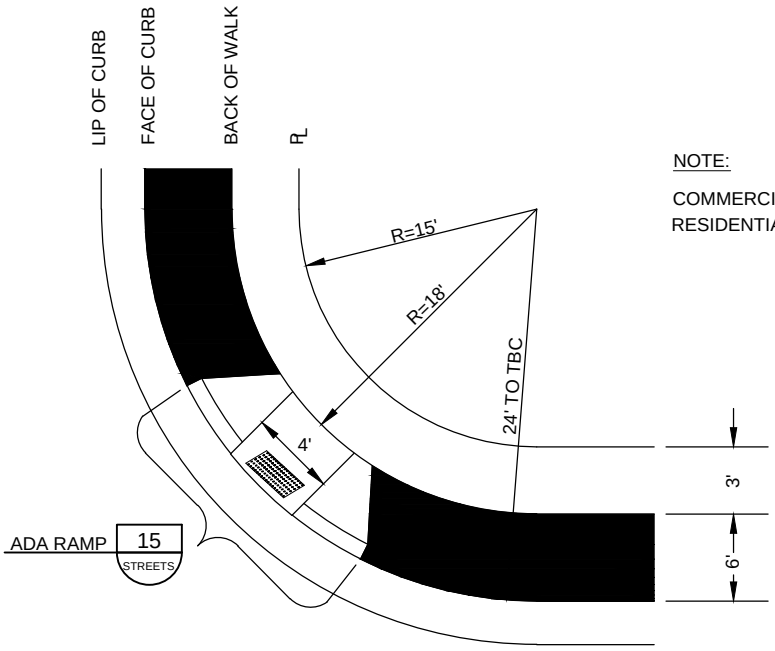
ROOSEVELT CITY
STANDARD DRAWINGS

STREETS - 8

DIMENSIONS AT CORNERS OF STANDARD STREET INTERSECTIONS SHOWING WHEEL CHAIR RAMP



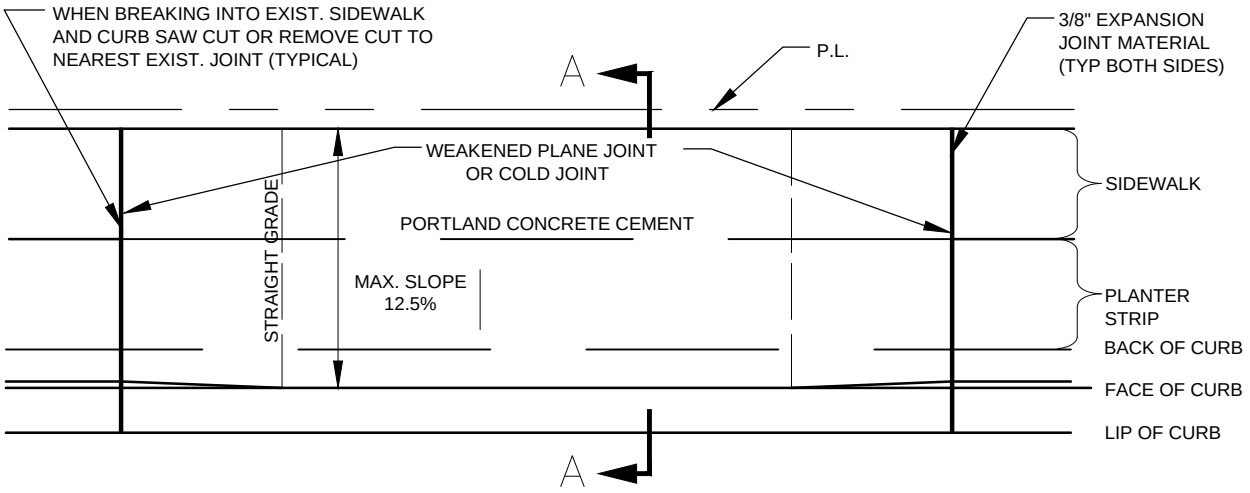
STANDARD 56'
RESIDENTIAL STREET



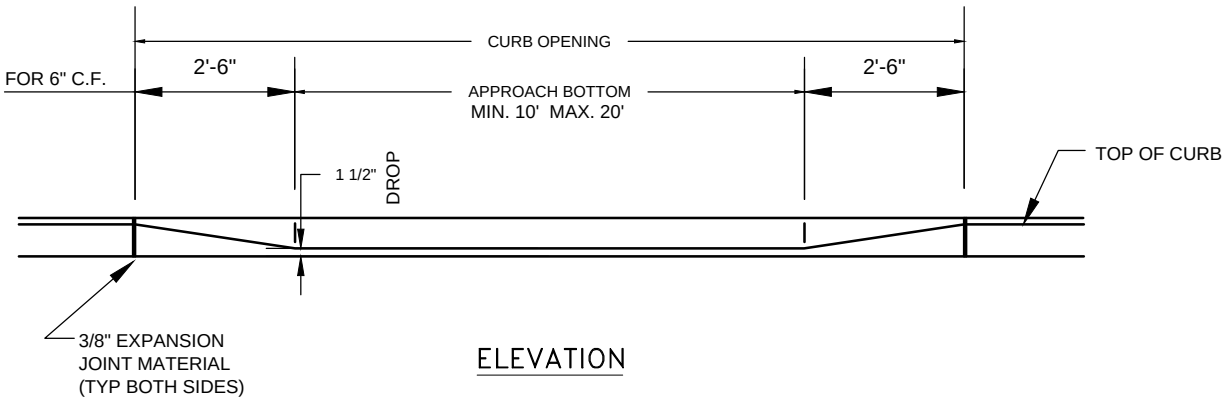
NOTE:

COMMERCIAL STREETS WILL HAVE 6-FOOT SIDEWALKS, RESIDENTIAL WILL BE ALLOWED 4-FOOT SIDEWALKS

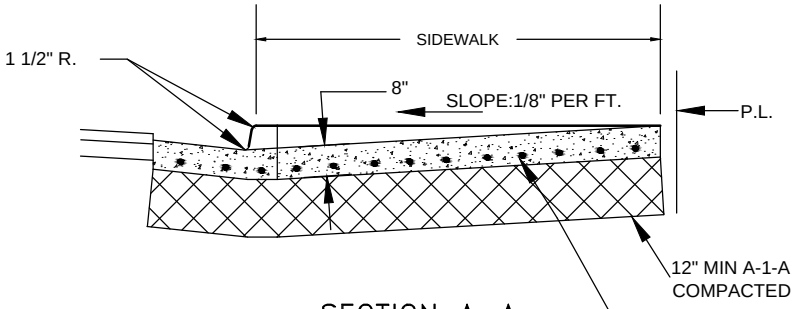
STANDARD ARTERIAL & COLLECTOR STREET ATTACHED SIDEWALK



PLAN



ELEVATION



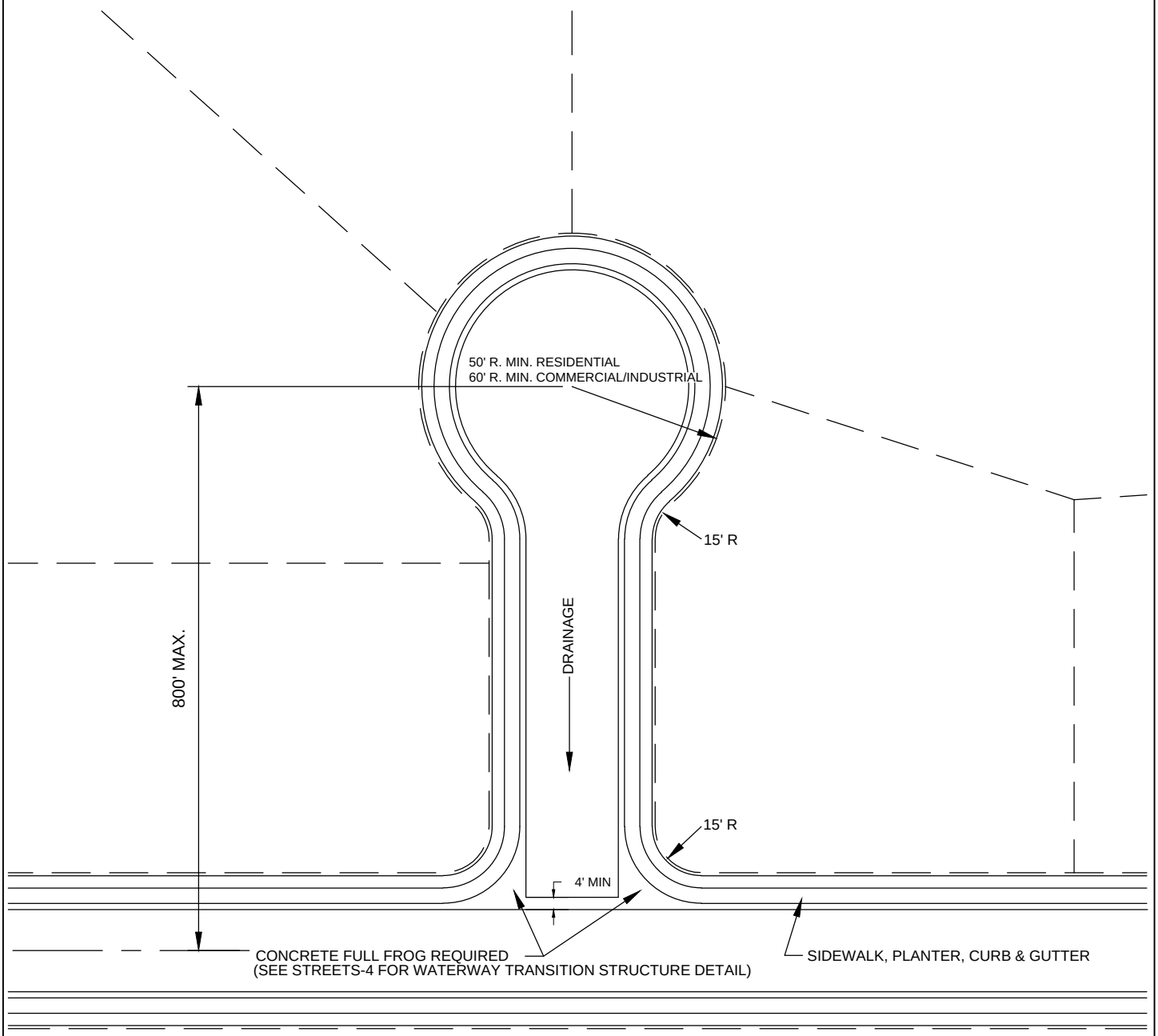
SECTION A–A

NOTE:
CURB OPENING SHALL HAVE A COURSE BROOM FINISH.
C.F. = CURB FACE

COMMERCIAL DRIVEWAY APPROACH

N.T.S.

MARCH 2014
ROOSEVELT CITY
STANDARD DRAWINGS
STREETS - 10



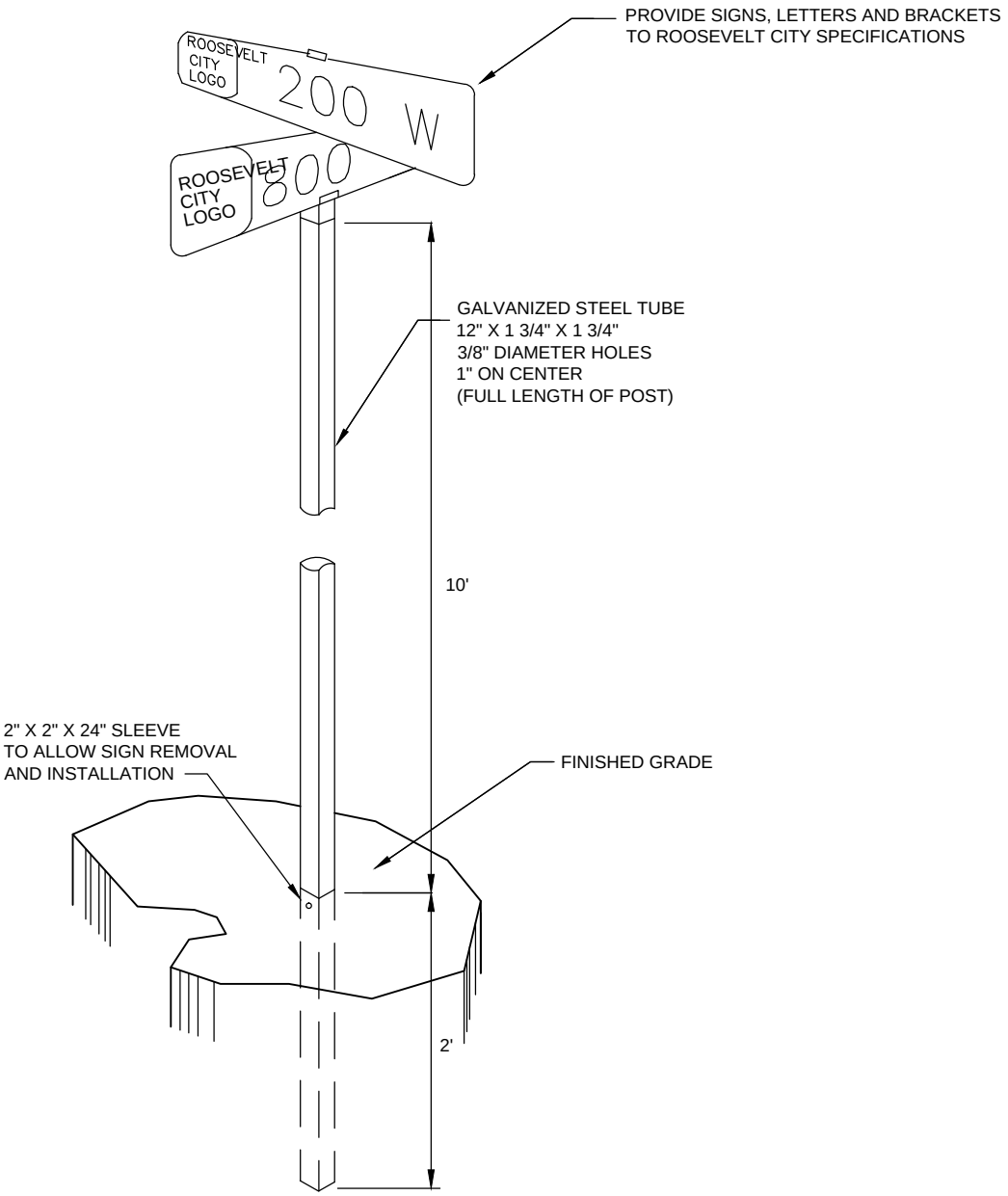
CUL–DE–SAC PLANS

N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

STREETS - 11



NOTES:

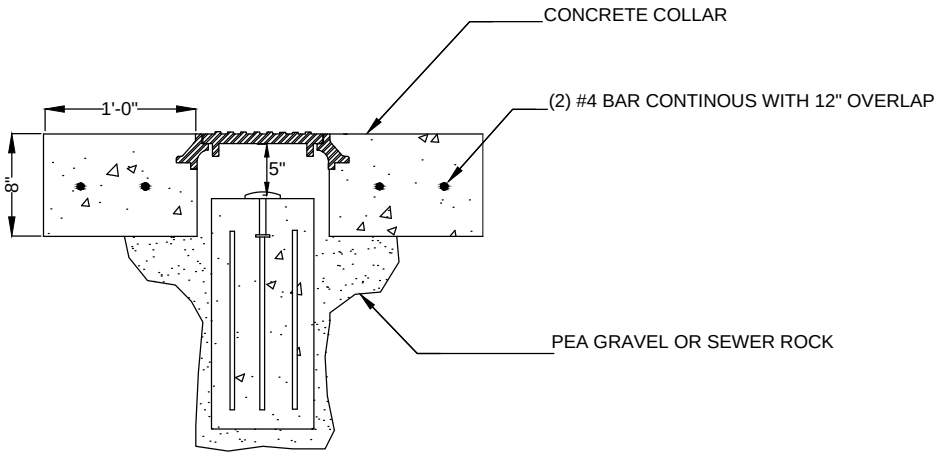
1. FORMAT: SECURE ENGINEER'S APPROVAL OF SIGN FORMAT AND INSTALLATION
2. INSTALLATION:
   - A. INSTALL SIGNS ON THE NORTH-WEST OR SOUTH-EAST CORNERS OF THE INTERSECTION.
   - B. INSTALL THE EDGE OF THE SIGN 2 FEET FROM THE VERTICAL EXTENSION OF THE BACK OF CURB AS NEAR AS POSSIBLE TO THE APPROACH CURB P.C. (POINT OF CURVATURE).
3. NAMED STREETS SHOULD ALSO INCLUDE NUMERIC LOCATION ON SIGN

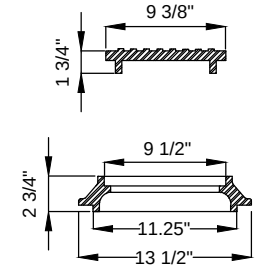
REGULATORY SIGNS:

1. ALL STOP (R1-1-30), YIELD (R1-2-36) & SPEED LIMIT (R2-1-24) SIGNS ARE 0.080 ALUMINUM WITH PRISMATIC REFLECTIVE SHEETING
2. ALL OTHER SIGNS .080 ALUMINUM ENGINEER GRADE SHEETING

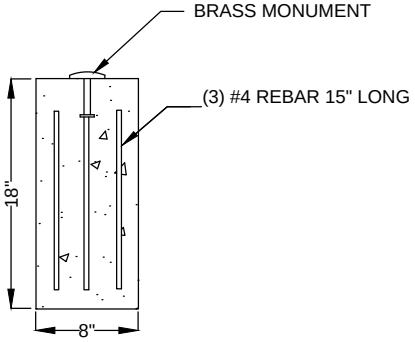
STREET SIGN DETAIL

N.T.S.





D and L Supply # K-6313 or approved equal



NOTES:

1. BRASS MONUMENT SHOULD INCLUDE MONUMENT OWNER, DATE OF SURVEY, AND LICENSE #.
2. CONCRETE BASE FOR THE SURVEY MONUMENT SHOULD BE INDEPENDENT OF CONCRETE COLLAR OF LID TO MINIMIZE VIBRATIONS TO MONUMENT.
3. CONCRETE BASE SHOULD BE INSTALLED USING PEA GRAVEL OR SEWER ROCK.
4. CONCRETE COLLAR TO HAVE TWO #4 BAR CONTINOUS AROUND COLLAR WITH 12" OVERLAP.
5. CONCRETE COLLAR SHOULD BE 1/4" LOWER THAN SURROUNDING PAVEMENT.
6. LOCATE AT CENTERLINE OF INTERSECTIONS AND CUL-DE-SACS

SURVEY MONUMENT DETAIL

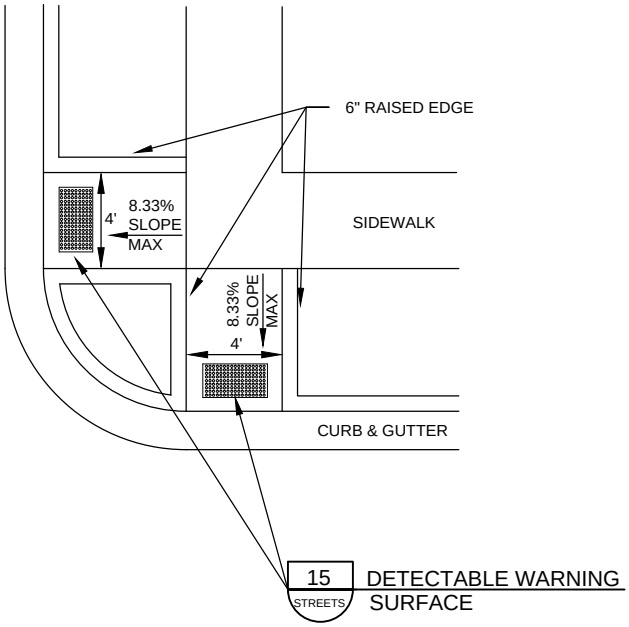
N.T.S.

MARCH 2014

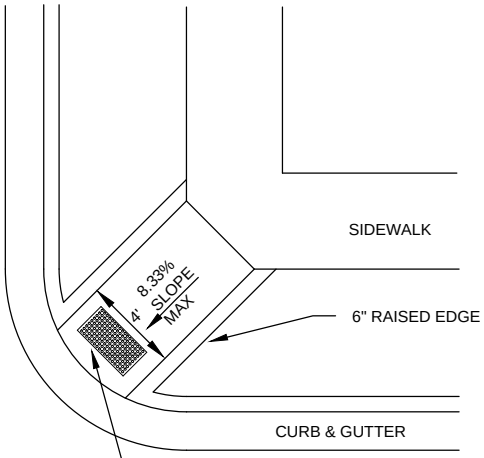
ROOSEVELT CITY
STANDARD DRAWINGS

STREETS - 13

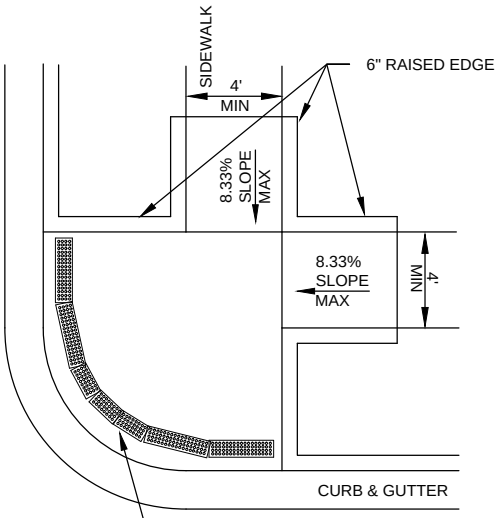
NOTES:
1. CORNER RAMPS MAY BE ALTERED AS NEEDED TO FIT EXISTING INFRASTRUCTURE.
2. ALL ADA RAMPS WILL MEET CURRENT ADA REGULATIONS.



15 STREETS DETECTABLE WARNING SURFACE



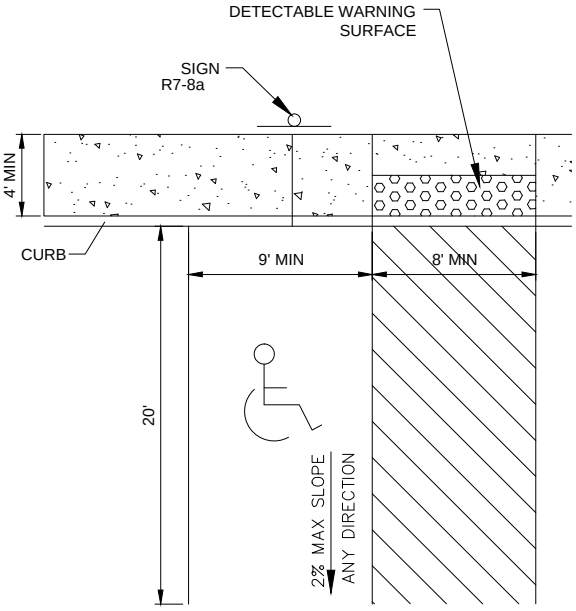
15 STREETS DETECTABLE WARNING SURFACE



15 STREETS DETECTABLE WARNING SURFACE

ALTERNATIVE ADA CORNER RAMP EXHIBITS

ADDED SEPTEMBER 2015
ROOSEVELT CITY STANDARD DRAWINGS
STREETS - 14



SIGN R7-8a

NOTE: ALL RAMPS SHALL SATISFY ADA REQUIREMENTS

ADA PARKING STALL DETAIL

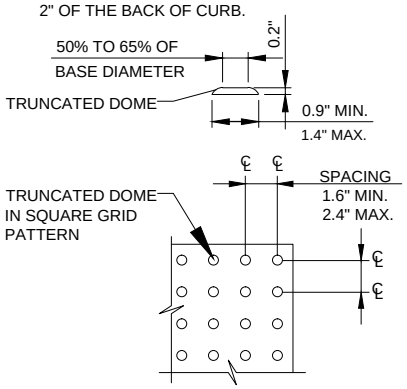
N.T.S.

SLOPE TABLE			
	ITEM	MAX. RUNNING SLOPE *	MAX. CROSS SLOPE *
Ⓛ	LANDING	2% (1V:48H)(b)	2% (1V:48H)(b)
Ⓡ	RAMP	8.33% (1V:12H)(a)	2% (1V:48H)(d)
Ⓒ	CLEAR SPA.	5% (1V:20H)(a)	2% (1V:48H)(d)
	SIDEWALK	-	2% (1V:48H)
	FLARE	10% (1V:10H)	-

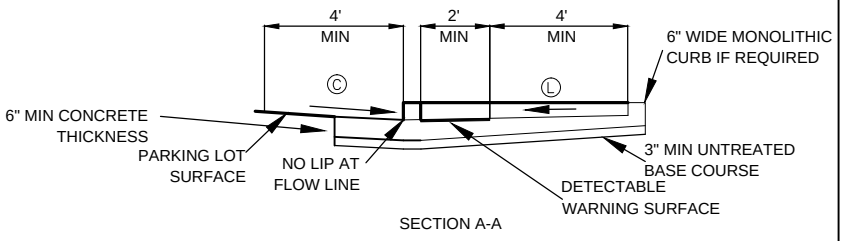
* RUNNING SLOPE IS IN THE DIRECTION OF PEDESTRIAN TRAVEL, WHILE CROSS SLOPE IS PERPENDICULAR TO PEDESTRIAN TRAVEL.

1. PROVIDE DETECTABLE WARNING SURFACE (YELLOW) FOR FULL WIDTH OF CURB CUT.

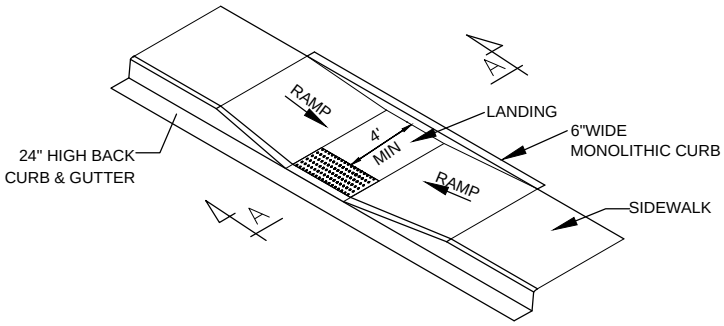
2. LOCATE DETECTABLE WARNING SURFACE SO THE EDGE NEAREST THE STREET IS AT OR WITHIN 2" OF THE BACK OF CURB.



DETECTABLE WARNING SURFACE



SECTION A-A



ADA RAMP DETAIL

N.T.S.

ADDED SEPTEMBER 2015

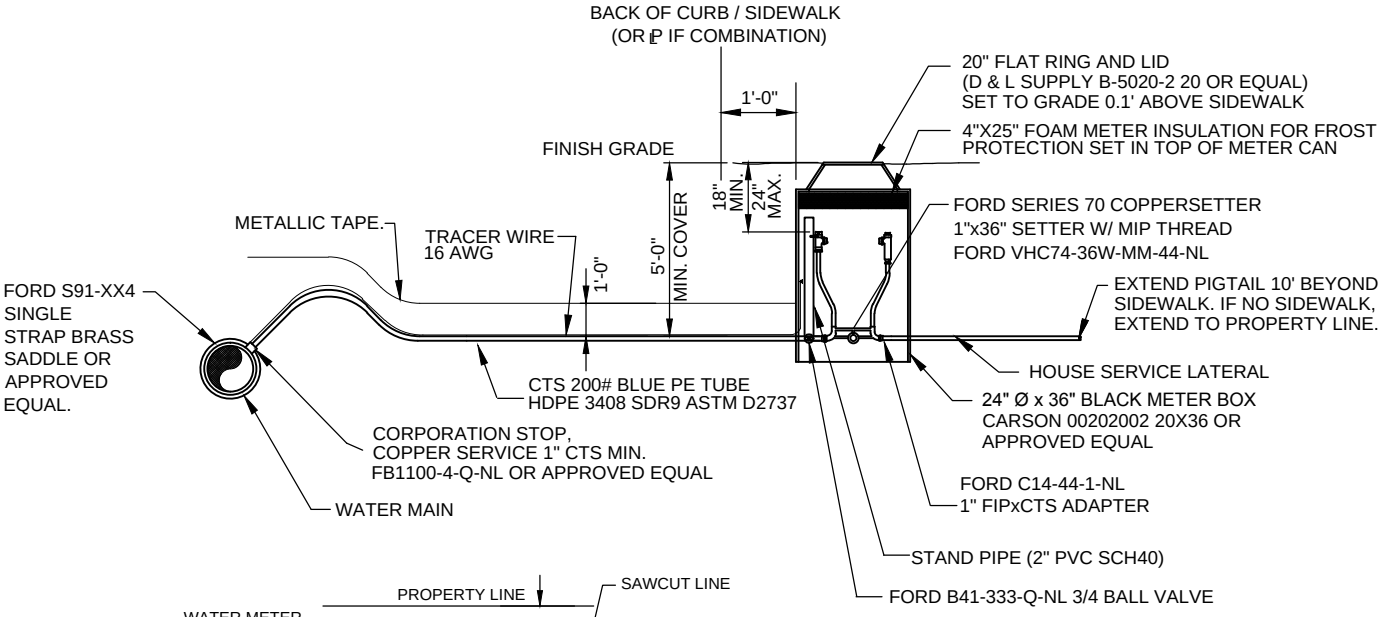
ROOSEVELT CITY STANDARD DRAWINGS

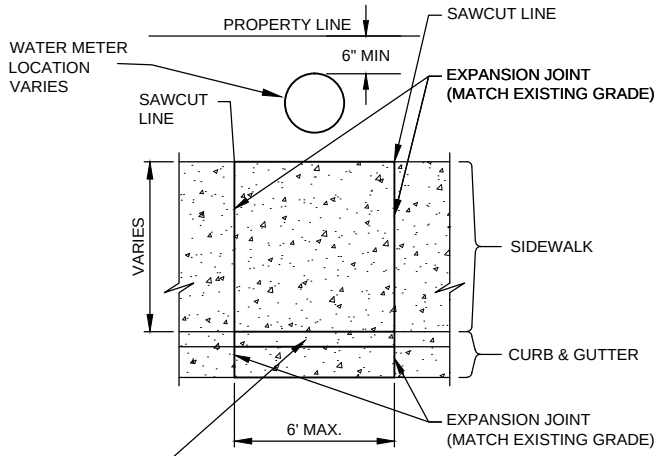
STREETS - 15

TABLE 1

METER SIZE	MODEL	SETTER
1"	VHC 74-36W-MM-44-NL	1" X 36"

NOTE: METER BOX, COVER, COPPERSETTER, CORPORATION STOP, & SERVICE LINES TO BE FURNISHED AND INSTALLED BY DEVELOPER.





PLAN VIEW
SEE NOTE 4

A LETTER WILL BE SCRIBED INTO THE FACE OF THE CURB OVER THE UTILITY AS FOLLOWS:

WATER:	"w"
SEWER:	"s"
GAS:	"g"
IRRIGATION:	"i"

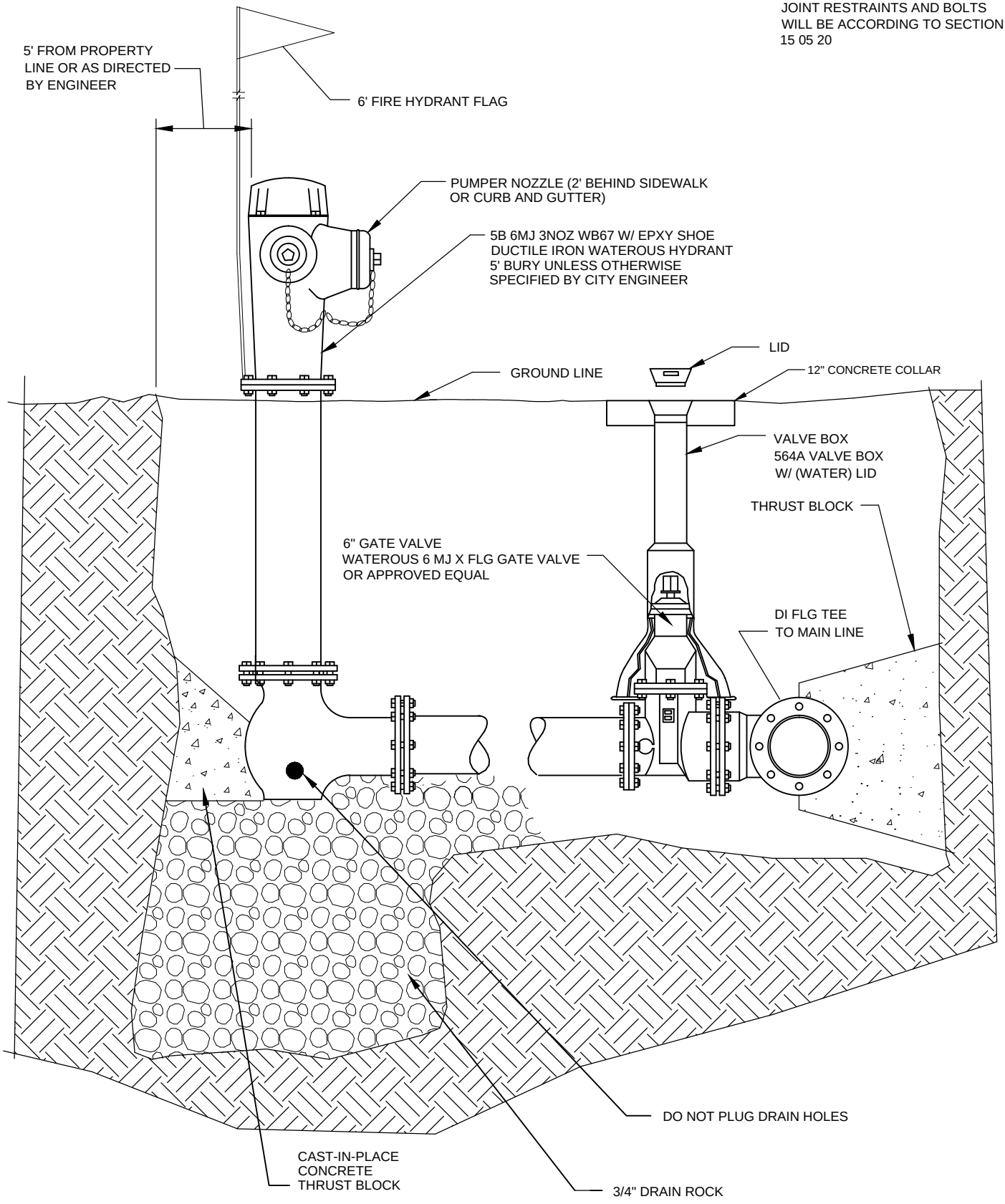
NOTES:

1. COORDINATE SERVICE CONNECTIONS WITH ROOSEVELT CITY PUBLIC WORKS.
2. CONTRACTOR TO SAWCUT EXISTING ASPHALT AND PATCH BEHIND SIDEWALK OR CURB AND GUTTER W/ 3" AC OVER 8" UTBC, WHERE THERE IS EXISTING ASPHALT.
3. CONTRACTOR SHALL RESTORE EXISTING LANDSCAPING TO PRE-CONSTRUCTION CONDITION.
4. SIDEWALK AND CURB TO BE PROTECTED. IF DAMAGED REPLACE AND SAWCUT ACCORDING TO PLAN VIEW ABOVE.
5. CONSTRUCTION NOT ALLOWED IN DRIVEWAYS.
6. WATER BOOSTER ONLY ALLOWED UPON APPROVAL OF CITY INSPECTOR.
7. 16" AND LARGER TRANSMISSION LINES WILL NOT BE TAPPED UNLESS APPROVED BY CITY WATER DEPARTMENT.
8. TRACER WIRE AND MAGNETIC TAPE WILL BE INSTALLED ACCORDING TO ROOSEVELT CITY SPECIFICATIONS AND STANDARD DRAWINGS. SEE WATER - 4, 15 00 00, AND 15 05 20.
9. PIPES AND CONNECTIONS WILL NOT CONTAIN ANY LEAD.

WATER SERVICE CONNECTION

N.T.S.

MARCH 2014
ROOSEVELT CITY
STANDARD DRAWINGS
WATER - 1



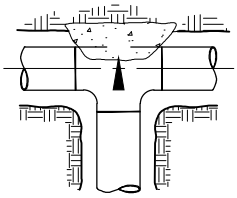
STANDARD FIRE HYDRANT DETAIL

N.T.S.

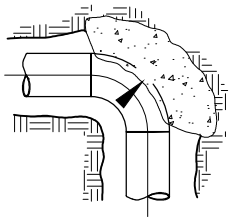
MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

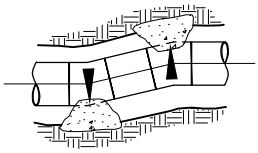
WATER - 2



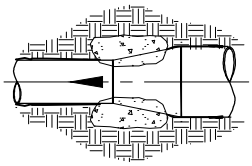
TEE



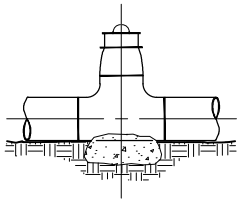
90° BEND



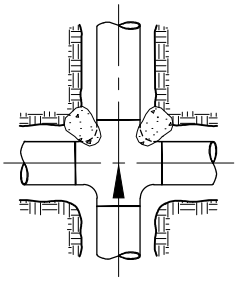
BEND



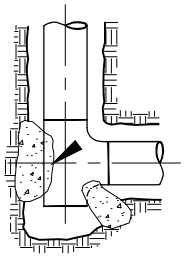
REDUCTION



ANCHOR REQ'D. FOR VALVES 12" OR LARGER



REDUCTION



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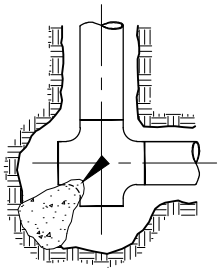

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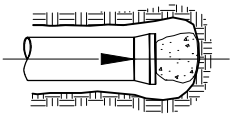
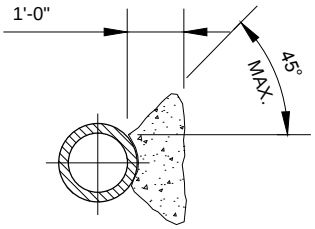


DEAD END



TYPICAL SECTION THRU THRUST BLOCK

NOTES:

1. ALL THRUST BLOCK BEARING FACES SHALL BE POURED AGAINST UNDISTURBED SOIL OR APPROVED COMPACTED BACKFILL.
2. CONCRETE SHALL BE CLASS 6.0-B-3000.
3. ALL THRUST BLOCK SIDES SHALL BE FORMED.
4. CALCULATED ON 225 LB. TEST PRESSURE, AND ALLOWABLE BEARING PRESSURE OF 2000 LB PER SQ FT, AND SAFETY FACTOR OF 1.5.
5. IN POORER SOILS SPECIAL DESIGN IS REQUIRED.
6. DIFFERING TEST PRESSURES SHALL REQUIRE MORE OR LESS BEARING AREA.
7. THRUST CALCULATIONS BASED ON LISTED INTERIOR DIAMETER OF PIPE.
8. SPECIALLY DESIGNED THRUST RESTRAINT SYSTEM MAY REPLACE. THRUST BLOCKS APPROVED BY ENGINEER.

TEST PRESSURE 225 PSI							
SOIL BEARING 2000 PSF							
SAFETY FACTOR 1.5							
THRUST BLOCK BEARING AREA IN S.F.							
DIA.	AREA(IN^2)	TEE	DEAD END	90	45	22.5	11.25
4	12.56	2.1	2.1	3.0	1.6	0.8	0.4
6	28.26	4.8	4.8	6.7	3.6	1.8	0.9
8	50.24	8.5	8.5	12.0	6.5	3.2	1.6
10	78.50	13.2	13.2	18.7	10.1	5.1	2.5
12	113.04	19.1	19.1	26.9	14.6	7.3	3.6
14	153.86	26.0	26.0	36.6	19.9	9.9	5.0
16	200.96	33.9	33.9	47.8	25.9	13.0	6.5
18	254.34	42.9	42.9	60.5	32.8	16.4	8.2
20	314.00	53.0	53.0	74.7	40.5	20.2	10.1
24	452.16	76.3	76.3	107.6	58.4	29.1	14.6
30	706.50	119.2	119.2	168.1	91.2	45.5	22.8
36	1017.36	171.7	171.7	242.1	131.3	65.6	32.8
42	1384.74	233.7	233.7	329.5	178.8	89.3	44.6

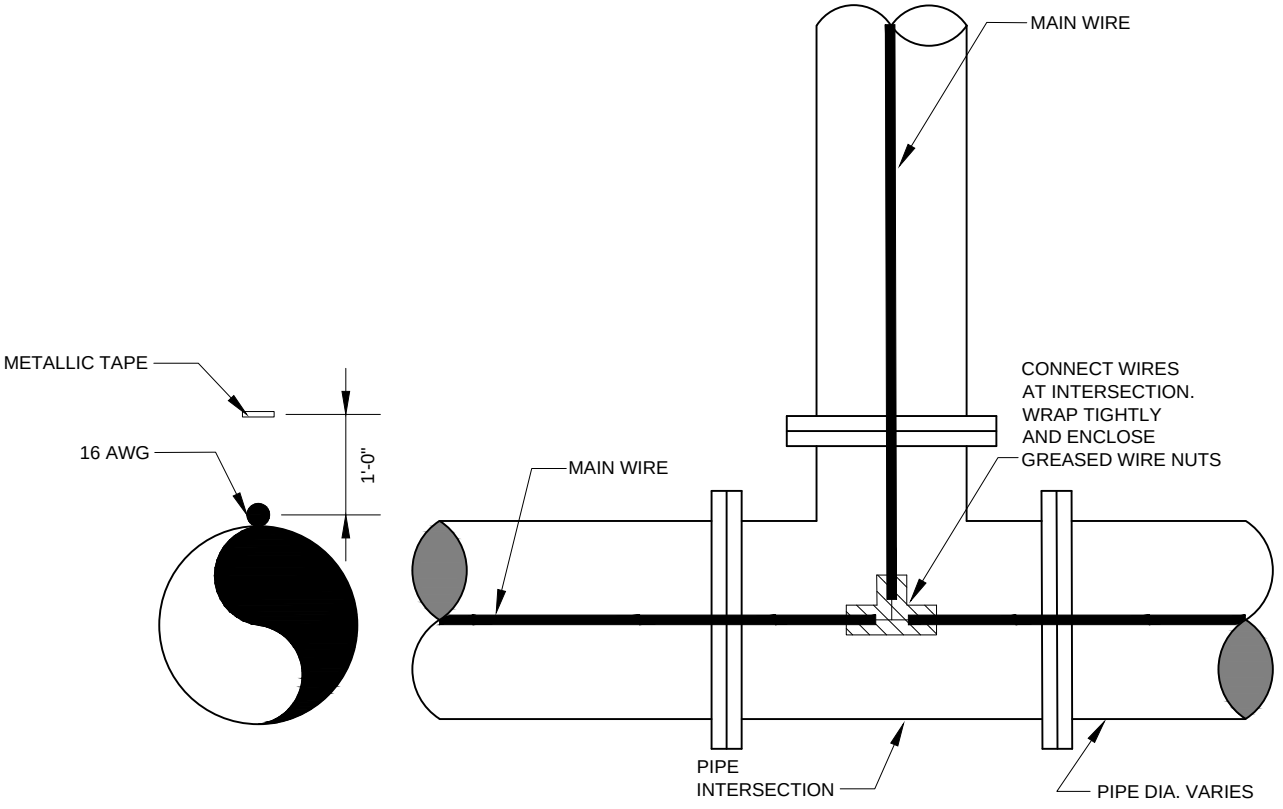
THRUST BLOCK DETAILS GENERAL CONDITIONS

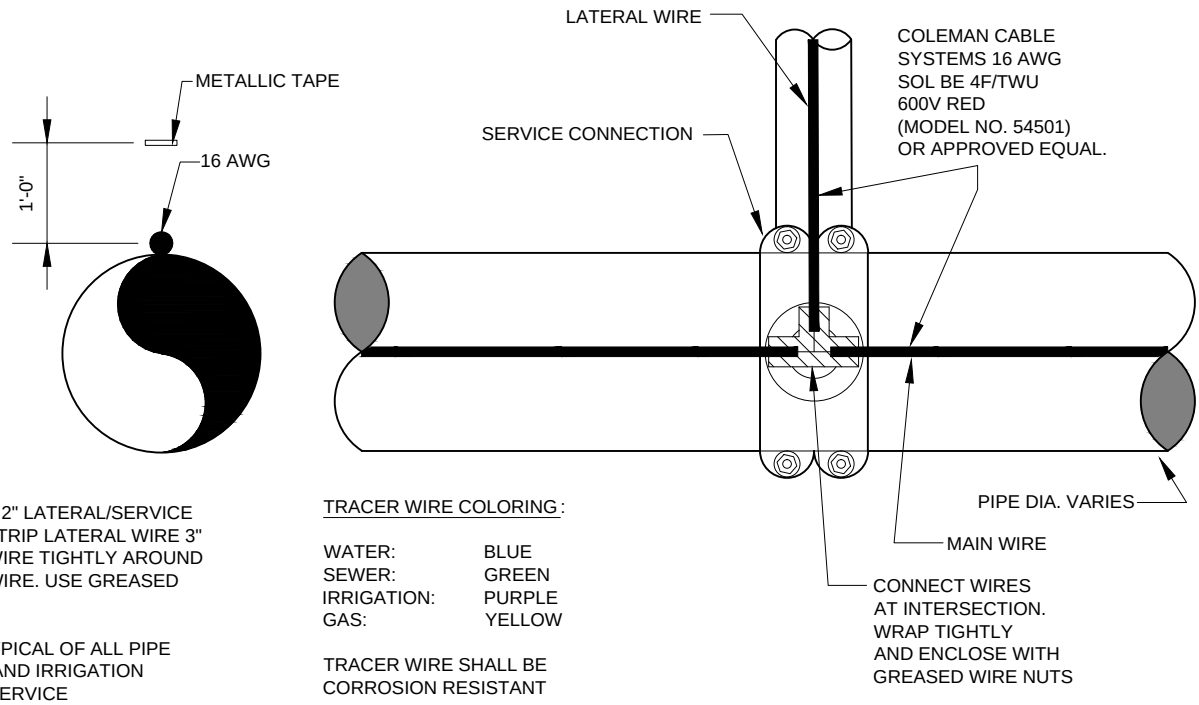
N.T.S.

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

WATER - 3





NOTES:

STRIP MAIN WIRE 2" LATERAL/SERVICE INTERSECTION. STRIP LATERAL WIRE 3" WRAP LATERAL WIRE TIGHTLY AROUND STRIPPED MAIN WIRE. USE GREASED WIRE NUTS.

THIS DETAIL IS TYPICAL OF ALL PIPE INTERSECTIONS AND IRRIGATION AND/OR WATER SERVICE CONNECTIONS.

LOCATOR WIRE SHALL BE PLACED PARALLEL W/ ALL PVC PIPING ABOVE PIPE.

FOR DUCTILE IRON PIPE AT PVC & DIP INTERSECTIONS AND AT IRRIGATION / WATER SERVICE CONNECTIONS, WRAP LOCATOR WIRE AROUND DIP AT LEAST TWICE.

TRACER WIRE COLORING:

WATER:	BLUE
SEWER:	GREEN
IRRIGATION:	PURPLE
GAS:	YELLOW

TRACER WIRE SHALL BE CORROSION RESISTANT

MAGNETIC TAPE COLORING*:

WATER:	BLUE
SEWER:	GREEN
IRRIGATION:	PURPLE
GAS:	YELLOW

*TAPE SHOULD HAVE UTILITY APPROPRIATE TEXT.

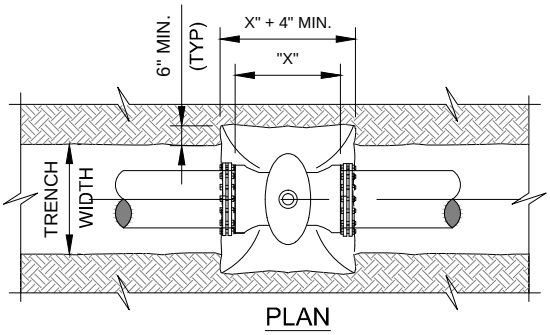
16 AWG LOCATOR WIRE

N.T.S.

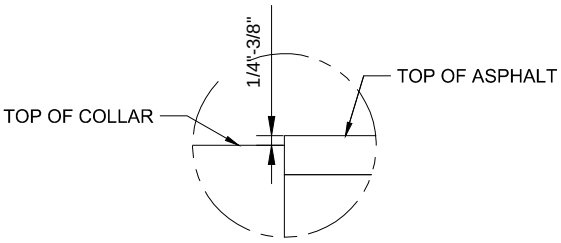
MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

WATER - 4



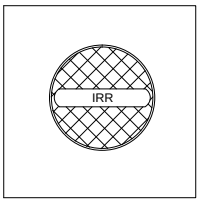
PLAN



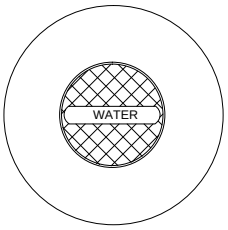
DETAIL B

LID TYPE

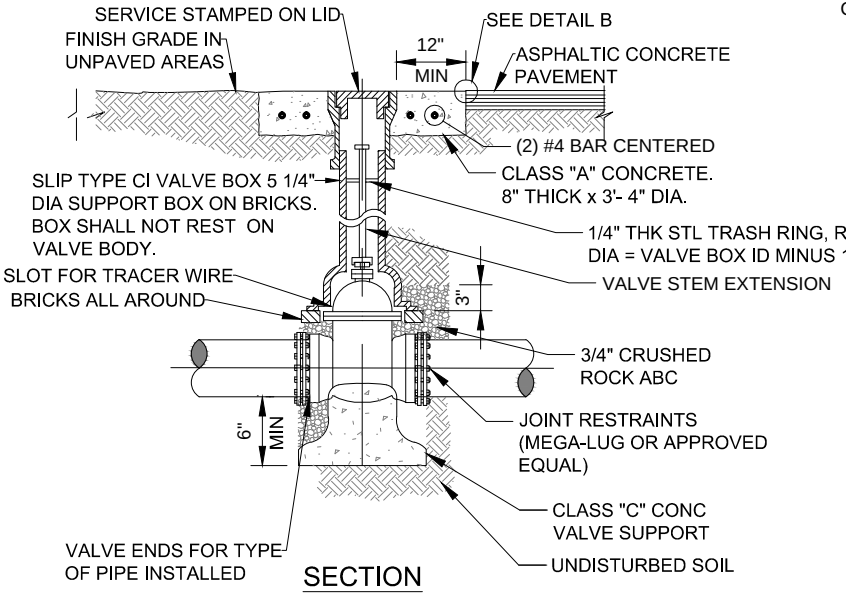
CIRCULAR SHAPED LID



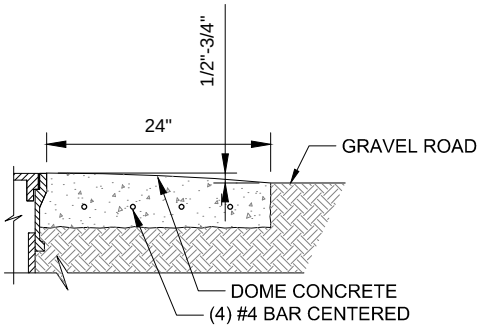
IRRIGATION VALVES WILL HAVE A SQUARE CONCRETE COLLAR



WATER VALVES WILL HAVE A ROUND CONCRETE COLLAR



SECTION



COLLAR IN GRAVEL ROADS

NOTES:

1. ALL BURIED VALVES SHALL BE PROVIDED W/ EXTENSION STEM. OPERATOR W/ 2" SQ AWWA NUT WITHIN 36" OF VALVE BOX COVER. NUT IS TO INDICATE DIRECTION OF ROTATION TO OPEN VALVE.
2. COAT BURIED PIPE & VALVE BOX PER SPECIFICATIONS.
3. CLEAN VALVE BOX OF ALL DEBRIS & SOIL.
4. VALVE TYPE AS INDICATED ON THE PLANS.
5. GRIND SMALL SLOT FOR TRACER WIRE TO PASS THROUGH AT FLARE IN VALVE BOX.

VALVE INSTALLATION

N.T.S.

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

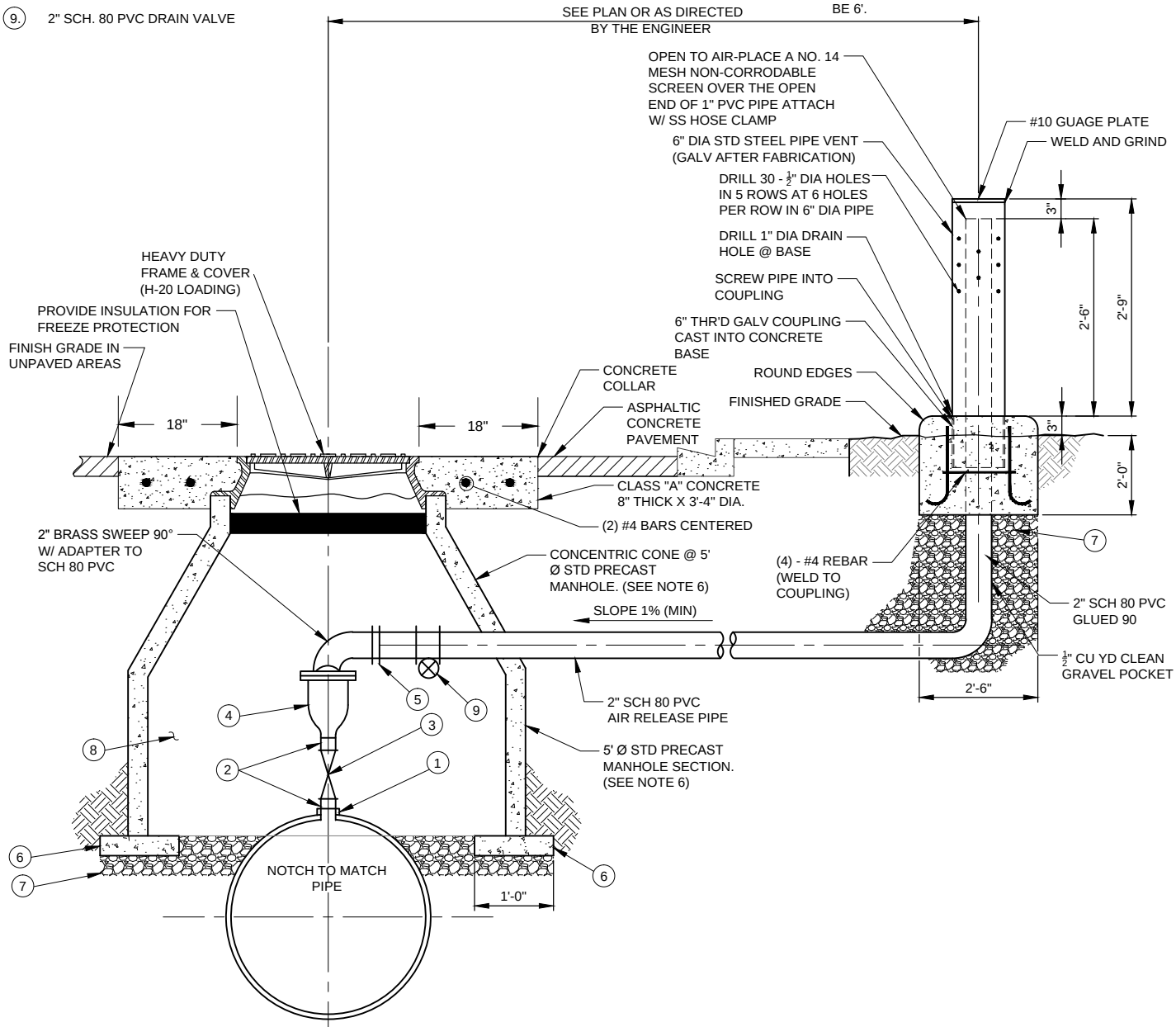
WATER - 5

PIPE SCHEDULE

1. 2" BRASS TAPPING SADDLE W/ S.S. STRAPS (ROMAC #202B-905 DOUBLE BRASS SADDLE OR APPROVED EQUAL).
2. SCH 80 BRASS NIPPLE THREADED (MALE) ALLOW FOR VALVE HANDLE TO OPERATE.
3. 2" THREADED BRASS BALL VALVE .
4. 2" THREADED AIR & VAC VALVE EQUAL TO APCO MODEL 145C, OR EQUAL.
5. PVC UNION.
6. CONTINUOUS CONCRETE BASE - 1'-0" X 4".
7. 6" UBC - COMPACT TO 95%.
8. FILL MANHOLE W/ LOOSE FILL CUSHIONING TO TOP.
9. 2" SCH. 80 PVC DRAIN VALVE

NOTES:

1. INSTALL VENT PIPE IN APPROVED LOCATION WITHIN APPROVED RIGHT-OF-WAY, NEAR R/W FENCE.
2. DO NOT CREATE OBSTRUCTION W/ VENT PIPE.
3. DO NOT INSTALL VENT IN ROAD.
4. DO NOT INSTALL VENT WITHIN 20' OF EDGE OF ASPHALT.
5. LOCATION OF AIR RELEASE STATION SHALL BE AT THE HIGHEST POINT. DETERMINE EXACT LOCATION W/ ENGINEER.
6. FOR MAINS LARGER THAN 12", THE MINIMUM STANDARD PRECAST MANHOLE REQUIRED WILL BE 6'.



ELEVATION

AIR RELEASE STATION

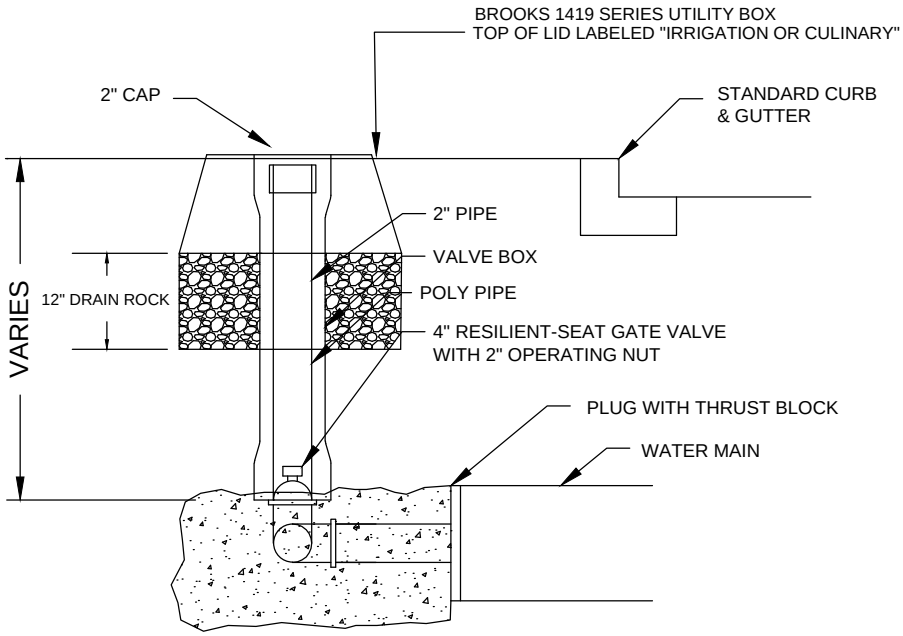
N.T.S.

MARCH 2014

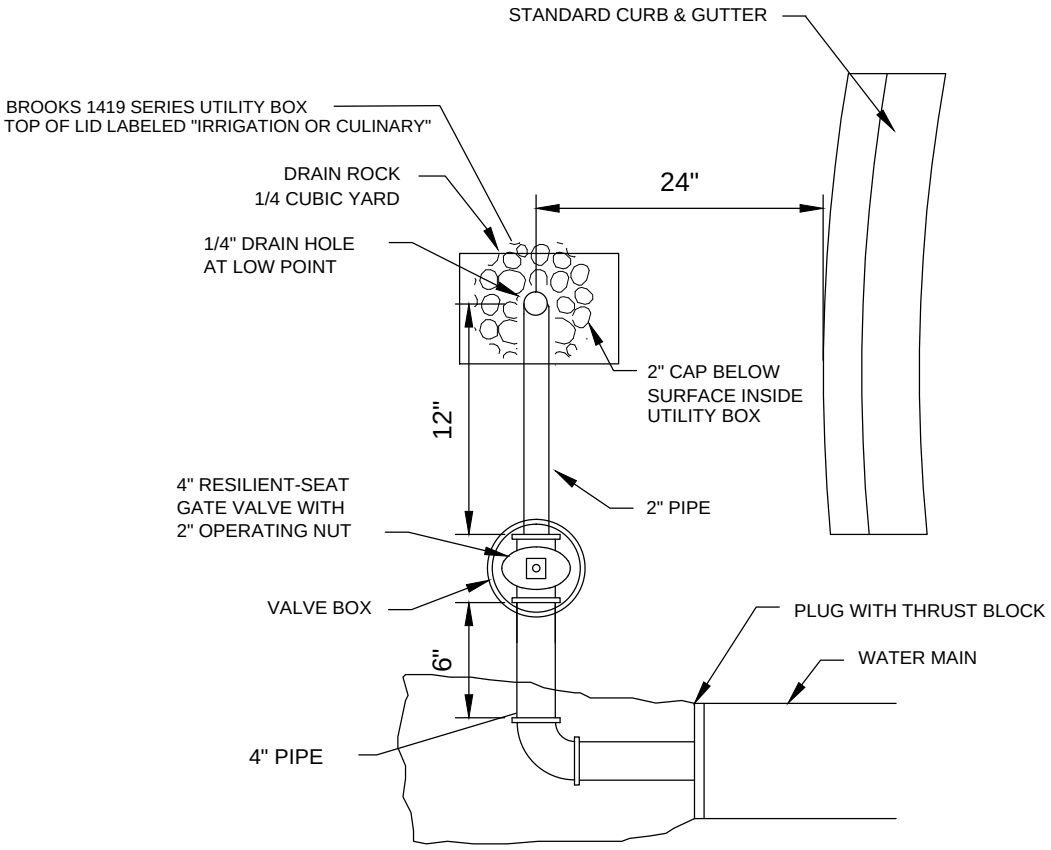
ROOSEVELT CITY STANDARD DRAWINGS

WATER - 6

NOTE: ALL PIPE TO BE GALVANIZED AFTER FABRICATION.



PROFILE



PLAN VIEW

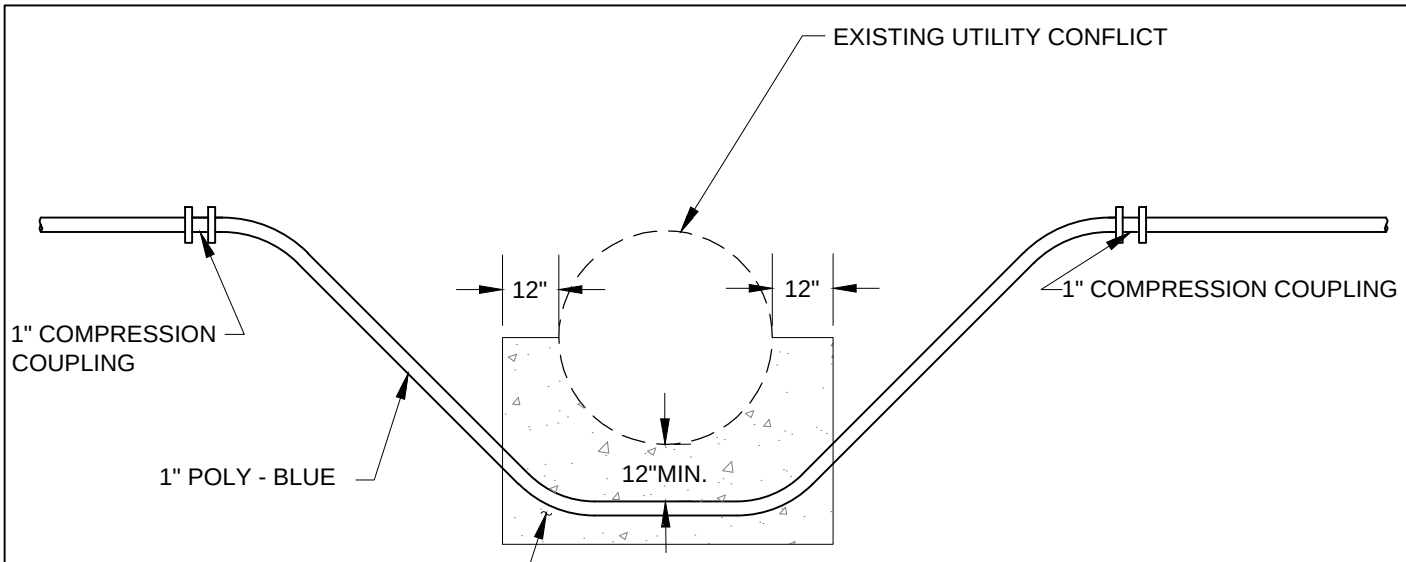
FLUSH VALVE

N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

WATER - 7

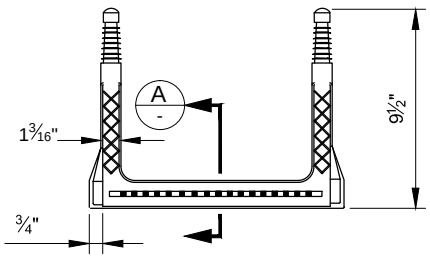


NOTES:

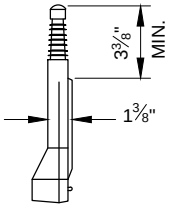
1. CONTRACTOR SHALL NOTIFY ALL AFFECTED RESIDENTS 24 HOURS BEFORE DISCONNECTING WATER LINES. COORDINATE WITH PUBLIC WORKS.

WATER SERVICE LOOP

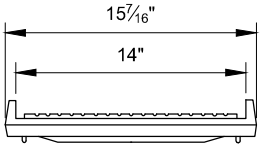
N.T.S.



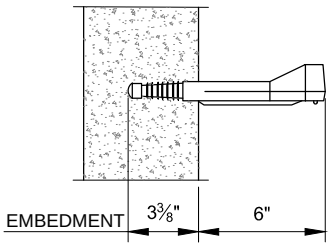
PLAN



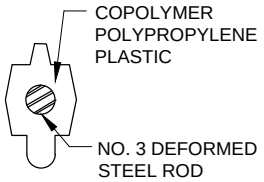
RIGHT SIDE VIEW



END VIEW



EMBEDMENT DETAIL



A - SECTION

NTS

NOTES:

1. MANHOLE STEPS: CAPABLE OF WITHSTANDING A SINGLE CONCENTRATED LOAD OF 300 POUNDS APPLIED AT A DISTANCE OF 5 INCHES FROM THE FACE OF THE STRUCTURE WALL.
2. STEPS ARE TO BE VERTICALLY ALIGNED AND UNIFORMLY SPACED WITH A MINIMUM SPACING OF 12 INCHES AND A MAXIMUM SPACING OF 16 INCHES UNLESS SHOWN OTHERWISE ON STRUCTURE PLANS.
3. USE EITHER MANHOLE STEPS CAST-IN-PLACE, OR GROUTED INTO STRUCTURE WALL IN SUCH A MANNER AS TO PREVENT PULLOUT UNDER A LOAD OF 300 POUNDS APPLIED 5 INCHES FROM THE FACE OF THE STRUCTURE WALL.
4. STEEL REINFORCING OF MANHOLE STEPS: CONFORM TO AASHTO DESIGNATION M 31, GRADE 60, DEFORMED STEEL BAR. PLASTIC COATING OF MANHOLE STEPS: CONFORM TO ASTM DESIGNATION D 2146, TYPE II, GRADE 16906.
5. MANHOLE STEPS: CONFORM TO AASHTO DESIGNATION M 199 UNLESS NOTED OTHERWISE.
6. DIMENSIONS MAY VARY WITH MANUFACTURES DESIGN. USE ALTERNATIVE DESIGN WITH THE APPROVAL OF THE ENGINEER.

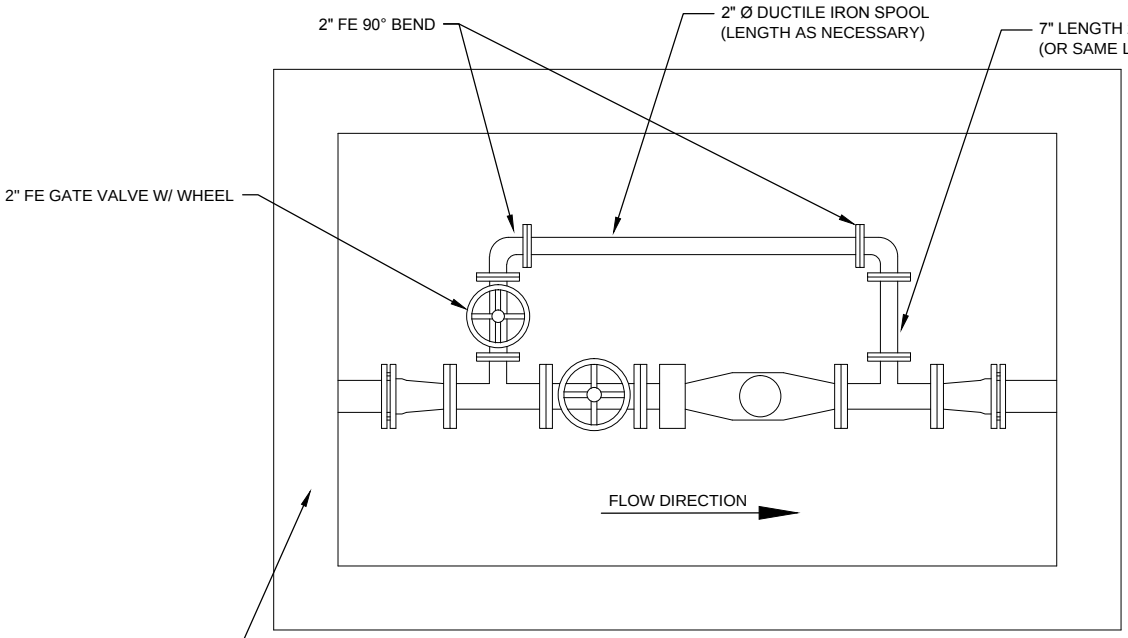
MANHOLE STEPS DETAIL

N.T.S.

MARCH 2014

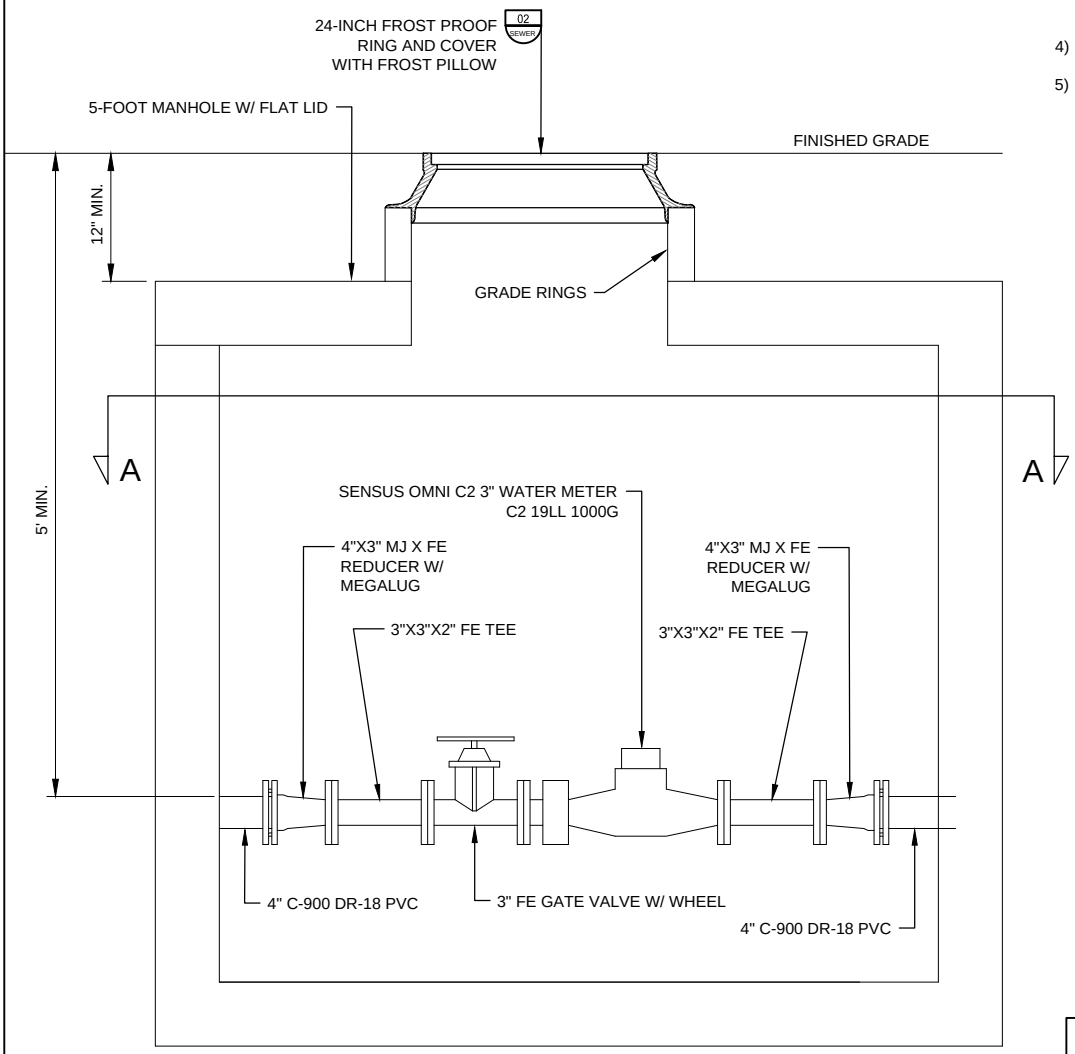
ROOSEVELT CITY STANDARD DRAWINGS

WATER - 8



SECTION A-A

NOTES:
1) 3" PIPING WILL NOT BE USED.
2) A 3" METER IS SHOWN. DESIGN WILL CHANGE BASED ON METER SIZE.
3) A DESIGN WILL BE SUPPLIED TO ROOSEVELT CITY PRIOR TO INSTALLING ANYTHING LARGER THAN A 1.5" METER.
4) A BYPASS WILL BE USED FOR ANY METER LARGER THAN 1.5".
5) ADDITIONAL VALVES WILL BE REQUIRED ON THE OTHER SIDE OF THE VALVE AS NECESSARY.

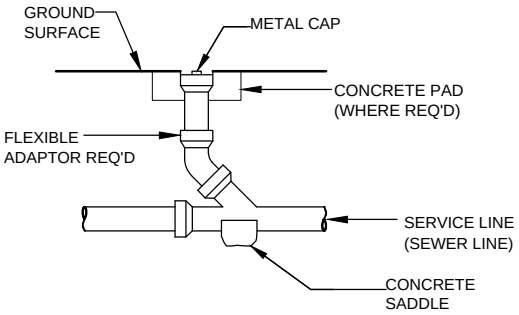


2"+ WATER METER

SEPTEMBER 2015

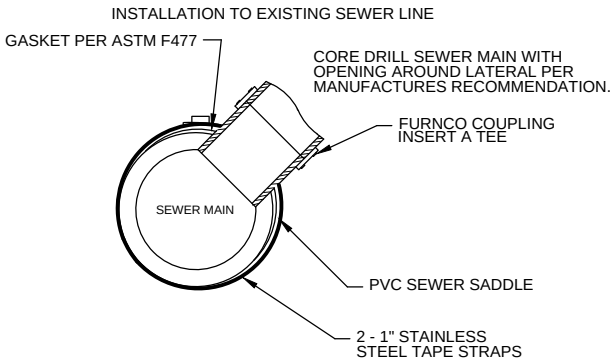
ROOSEVELT CITY
STANDARD DRAWINGS

WATER - 9



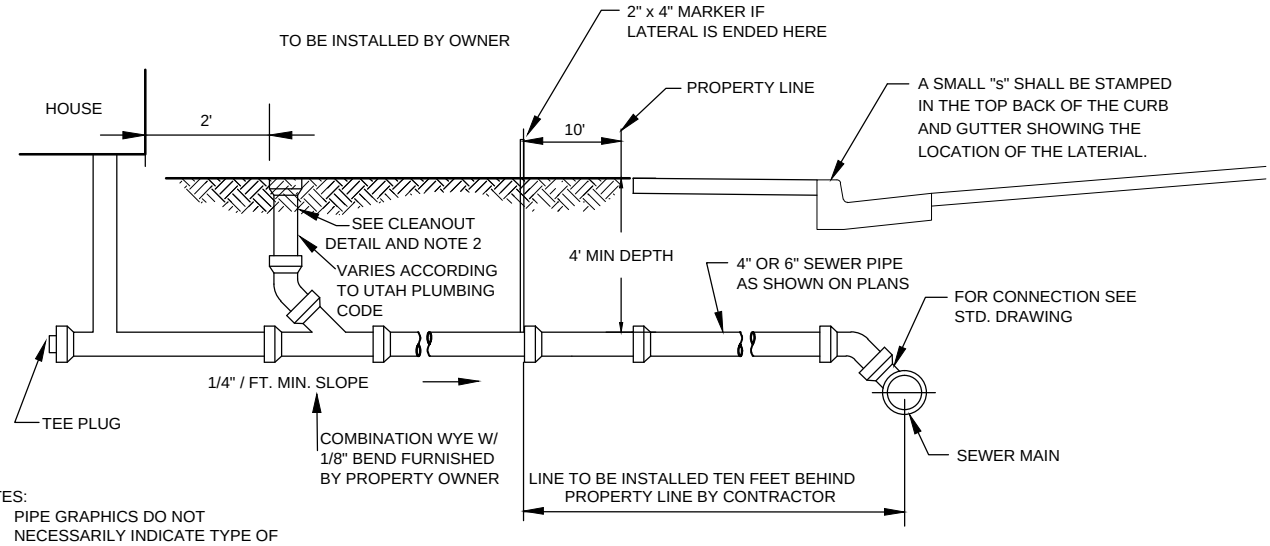
CLEANOUT DETAIL

N.T.S.



SEWER SERVICE LATERAL

N.T.S.



NOTES:

1. PIPE GRAPHICS DO NOT NECESSARILY INDICATE TYPE OF PIPE TO BE USED.
2. IF SPACING BETWEEN CLEANOUTS IS MORE THAN 100' CLEANOUT WILL BE REQUIRED.
3. INSTALLATION NOT ALLOWED IN DRIVEWAYS.
4. SEWER LATERAL WILL BE A MINIMUM OF 4 FOOT DEPTH AT PROPERTY LINE.
5. SEWER LIFT ONLY ALLOWED UPON APPROVAL.

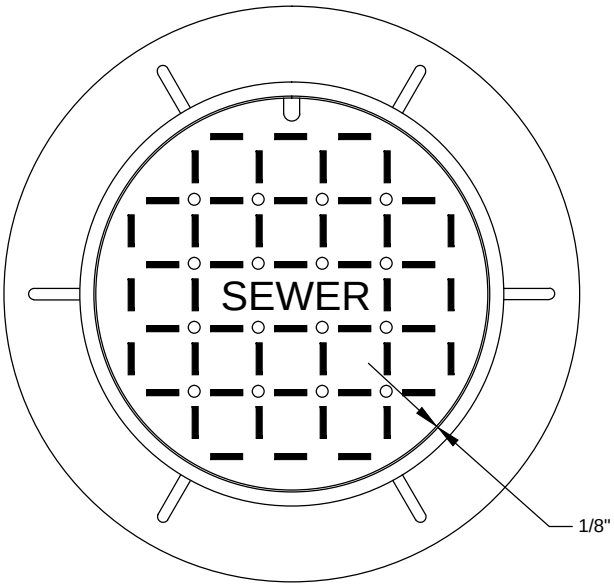
TYPICAL SEWER SERVICE CONN.

N.T.S.

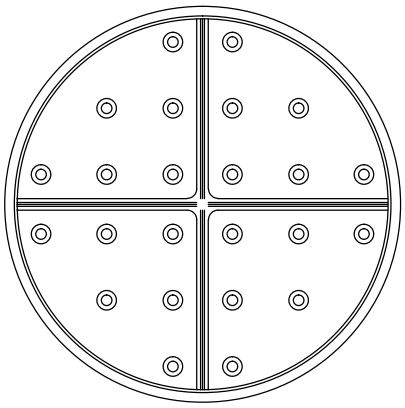
REVISED OCTOBER 2014

ROOSEVELT CITY STANDARD DRAWINGS

SEWER - 1



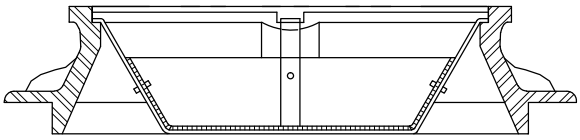
PLAN OF COVER AND RING



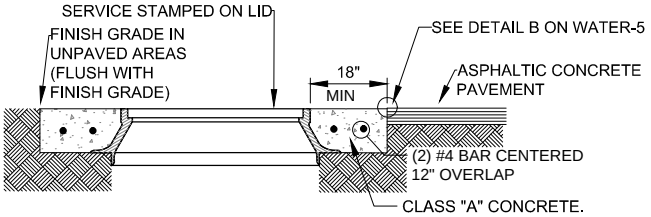
BOTTOM VIEW OF COVER

NOTES:

1 LID WORDING WILL CHANGE DEPENDING ON UTILITY

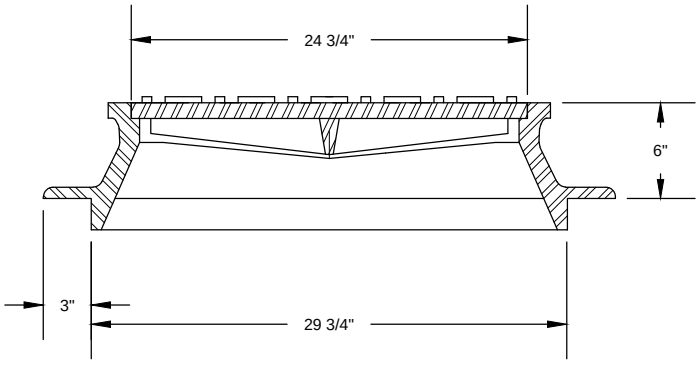


DUST PAN (FIBERGLASS) REQUIRED



CONCRETE COLLAR DETAIL

SECTIONS



D & L SUPPLY #A-1180
HEAVY DUTY, 400 LB MINIMUM

HEAVY DUTY, 400 LB. MINIMUM, MANHOLE RING AND COVER

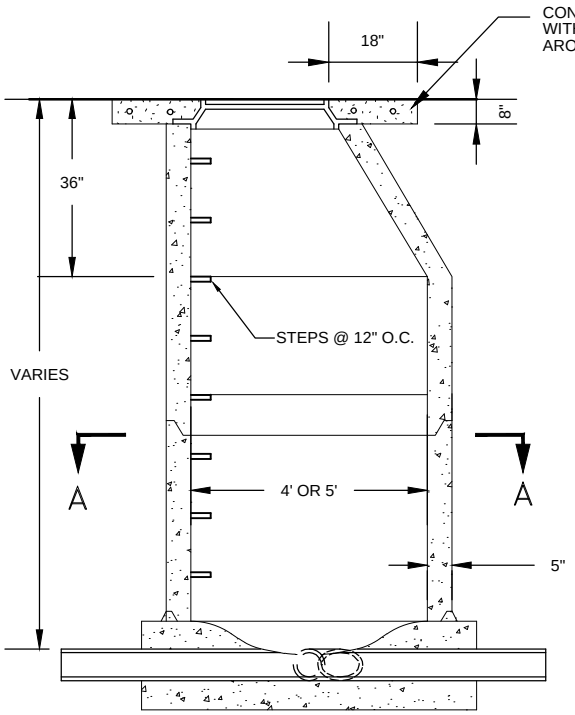
N.T.S.

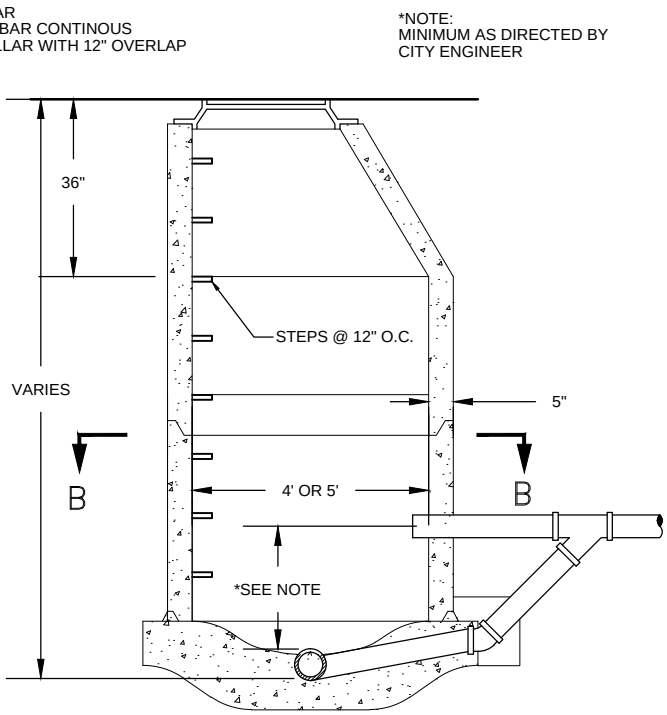
REVISED SEPTEMBER 2015

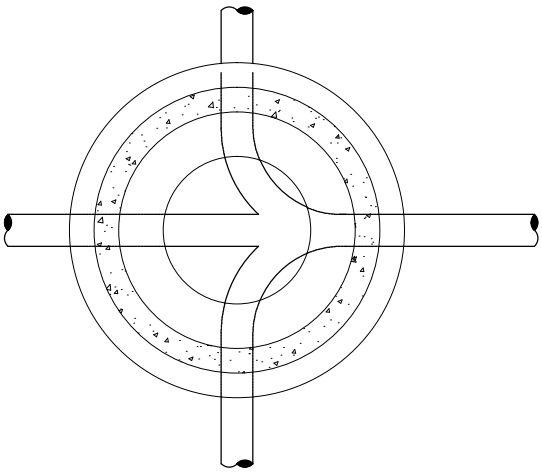
ROOSEVELT CITY STANDARD DRAWINGS

SEWER - 2

USE 5' DIA. MIN. FOR ALL PIPE 14" & LARGER USE 4' MIN. DIA. FOR ALL PIPE UP TO AND INCLUDING 12" DIA.

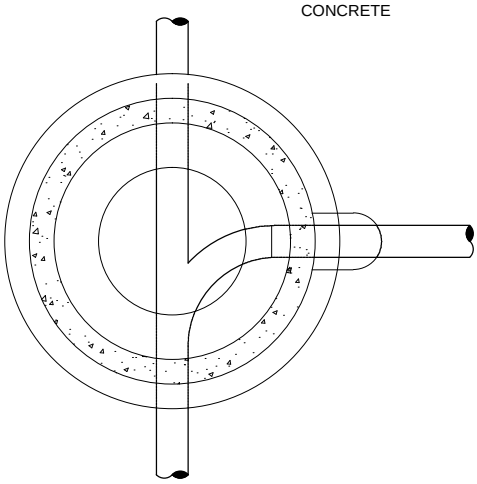






SECTION A–A

DROP PIPE
INSTALLED IN
CONCRETE



SECTION B–B

TYPICAL JUNCTION MANHOLE

N.T.S.

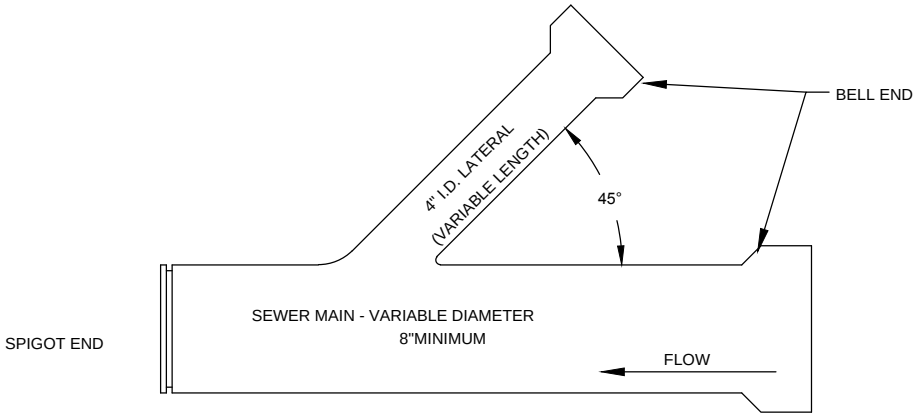
TYPICAL DROP MANHOLE

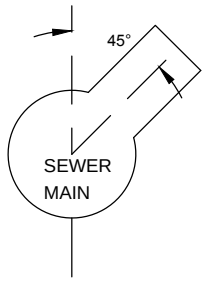
N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

SEWER - 3





INSTALLATION END VIEW

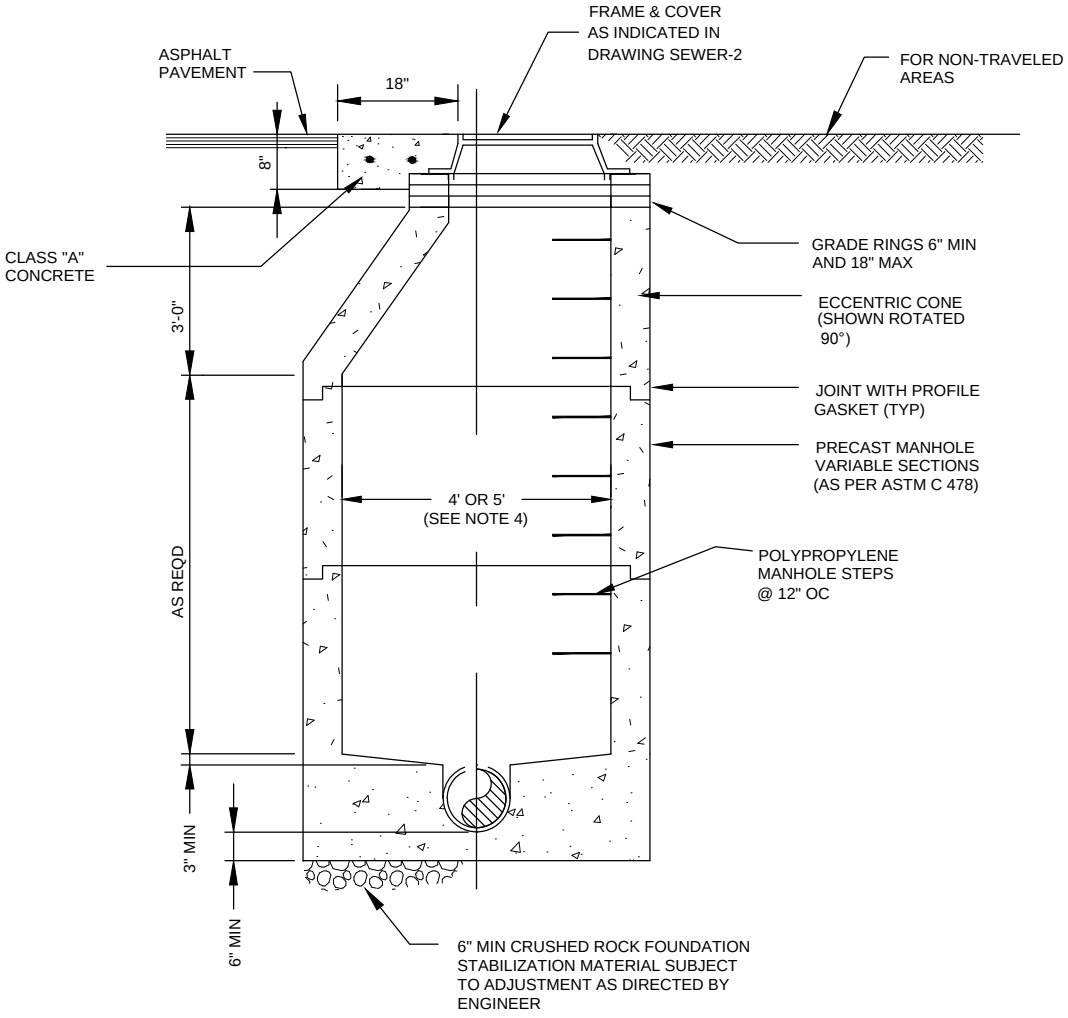
PREFABRICATED SEWER SERVICE LATERAL

N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

SEWER - 4



NOTES:

1. LOCATE MANHOLE COVER ON DOWNSTREAM SIDE OF MANHOLE. SET MANHOLE FRAME IN GROUT.
2. ALL JOINTS TO BE WATER TIGHT.
3. MANHOLE BASE AND 1ST SECTION OF MANOLE TO BE FABRICATED AS AN INTEGRAL UNIT.
4. USE 5' DIAMETER MANHOLE FOR PIPE GREATER THAN 18" DIAMETER PIPE. USE 4' DIAMETER MANHOLE FOR ALL PIPE UP TO AND INCLUDING 18" DIAMETER PIPE.
5. THE INVERT CHANNELS SHALL BE SMOOTH AND SEMI-CIRCULAR IN CROSS-SECTION AND HAVE A MINIMUM SLOPE OF 0.05 FEET PER DIAMETER FOOT.

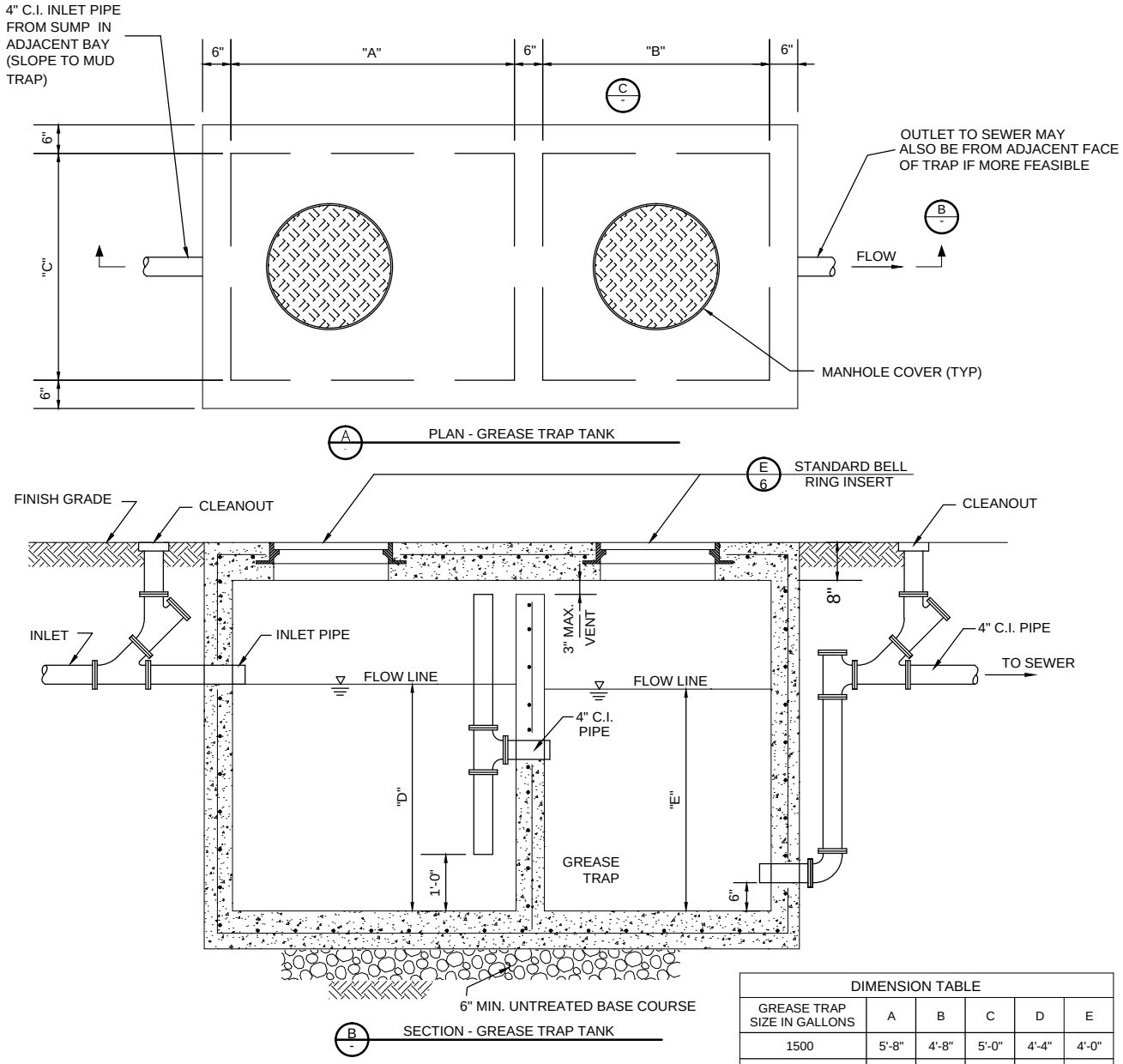
PRECAST CONCRETE SEWER MANHOLE

N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

SEWER - 5



DIMENSION TABLE					
GREASE TRAP SIZE IN GALLONS	A	B	C	D	E
1500	5'-8"	4'-8"	5'-0"	4'-4"	4'-0"
1000	5'-0"	4'-0"	4'-0"	4'-0"	3'-11"
800	3'-3"	3'-3"	4'-0"	4'-2"	3'-10"

NOTES:

1. CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 4000 PSI.
2. REINFORCING STEEL SHALL BE ASTW A615 GRADE 60.
3. THE CONCRETE COVER OVER THE REINFORCING STEEL SHALL BE A MINIMUM OF 1 1/2 INCHES.
4. THE STRUCTURE SHALL BE DESIGNED AND STAMPED BY A REGISTERED PROFESSIONAL ENGINEER LICENSED IN THE STATE OF UTAH.
5. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING LOADING CRITERIA:
   a) WALLS DESIGNED FOR A SATURATED EQUIVALENT FLUID AT-REST SOIL PRESSURE OF 120 PCF PLUS TRUCK SURCHARGE.
   b) TRUCK LOADING USING AN AASHTO H-20 TRUCK LOAD.
6. THE MANWAY FRAME AND COVER SHALL BE A TRAFFIC TYPE CASTING FOR H-20 TRUCK LOAD.
7. WHERE THE SEWER LINE ALREADY EXISTS, THE SEWER INVERT INTO AND OUT OF THE TANK SHALL BE 4'-0" ABOVE THE TANK FLOOR.
8. PLUMBING OUTSIDE OF THE GREASE INTERCEPTOR WILL BE IN ACCORDANCE TO LOCAL REGULATIONS.
9. THE BAFFLE INSIDE THE INTERCEPTOR SHALL BE WITHIN 3 INCHES OF THE CEILING.
10. COVERS SHALL BE CIRCULAR AND SHALL BE SOLID WITH PICK HOLES FOR REMOVAL.
11. THE INLET PIPE SHALL BE AT AN ELEVATION OF 1 INCH HIGHER THAN THE OUTLET PIPE.
12. SANITARY WASTES FROM TOILETS SHALL NOT BE PLUMBED TO GREASE INTERCEPTORS.
13. PIPING AS PER CITY OR SANITARY DISTRICT REQUIREMENTS.

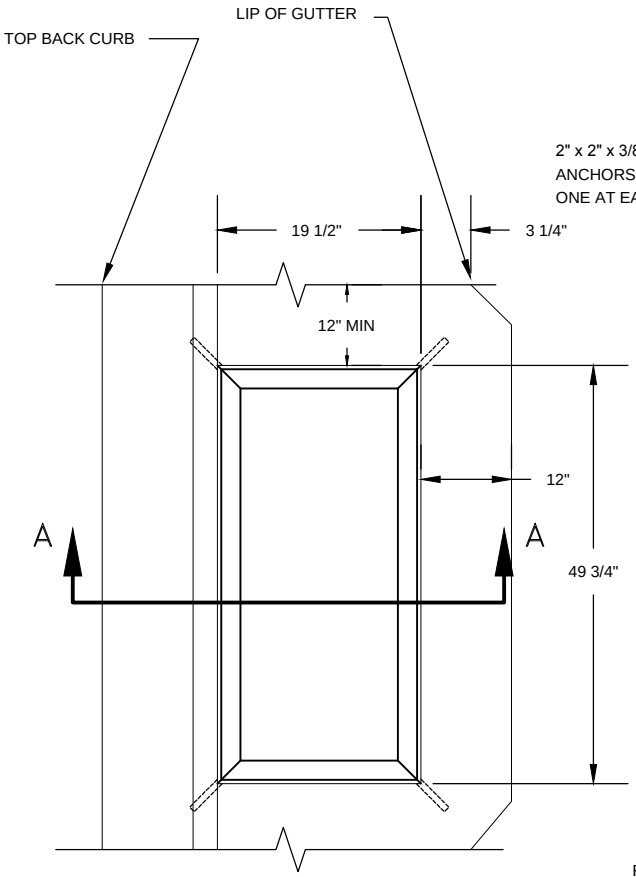
GREASE INTERCEPTOR

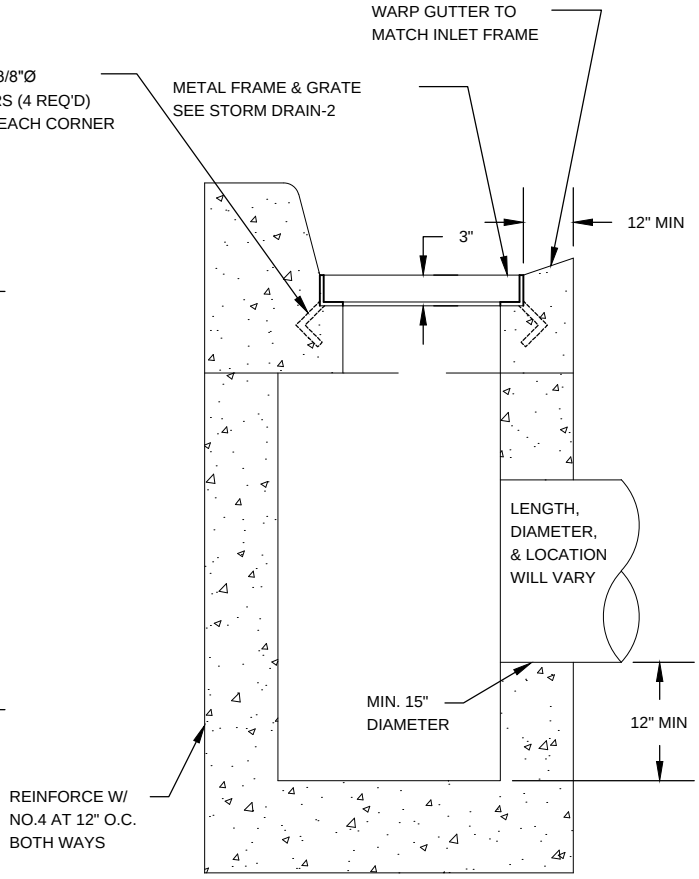
N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

SEWER - 6





SECTION A–A

NOTES:

1 ALL FRAMES & GRATES TO BE GALVANIZED

2 CONSTRUCT BOX (WALL THICKNESS) TO MATCH EXISTING OR NEW TYPE OF CURB AS SHOWN

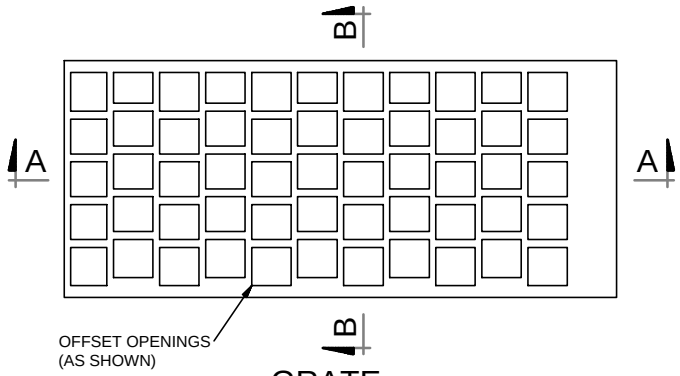
CURB DROP INLET BOX

N.T.S.

MARCH 2014

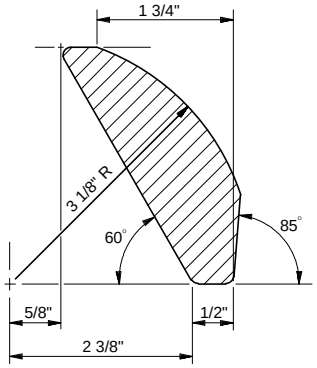
ROOSEVELT CITY
STANDARD DRAWINGS

STORM DRAIN - 1

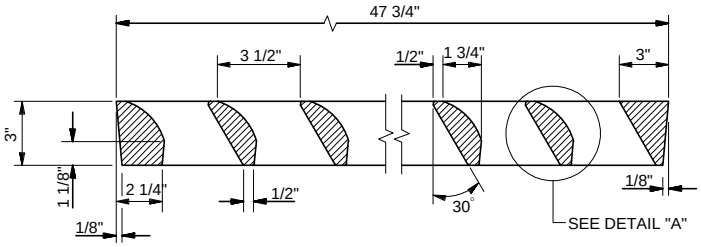


GRATE

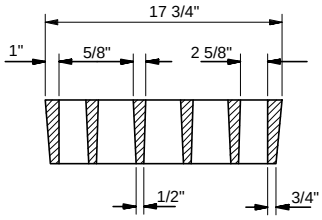
WEIGHT: 266 LBS



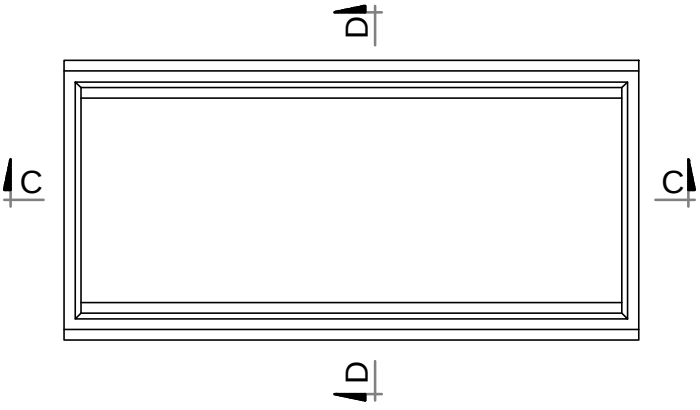
DETAIL "A"



SECTION A-A

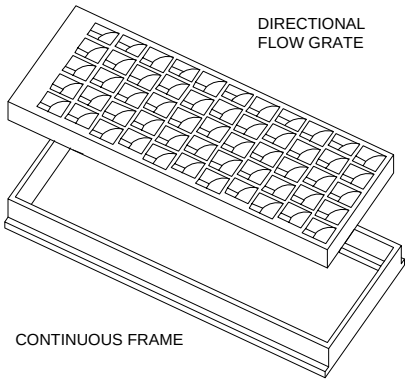


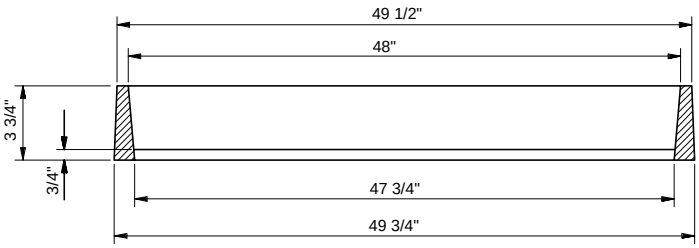
SECTION B-B



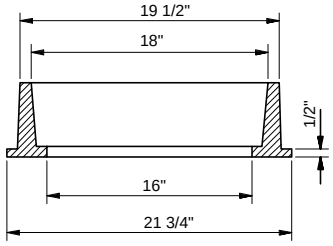
FRAME

WEIGHT: 180 LBS





SECTION C-C



SECTION D-D

GENERAL NOTES

1. ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE NOTED.
2. GRATE AND FRAME MAY BE FURNISHED IN EITHER DUCTILE IRON (ASTM A-536 GRADE 60) OR CAST GRAY IRON: AASHTO M-105, CLASS 30 B (ASTM A-48).
3. INSTALLATION REQUIRES SUPPORT UNDER LONGITUDINAL AXIS OF FRAME. ORIENT GRATE WITH DIRECTION OF FLOW.

DESIGN DATA

1. MS 18 (H-20) OR INTERSTATE ALTERNATE LOADING IN ACCORDANCE WITH CURRENT AASHTO AND INTERIM SPECIFICATIONS.
2. DUCTILE IRON AND STRUCTURAL STEEL: f_s = 20 KSI.

GRATE & FRAME

N.T.S.

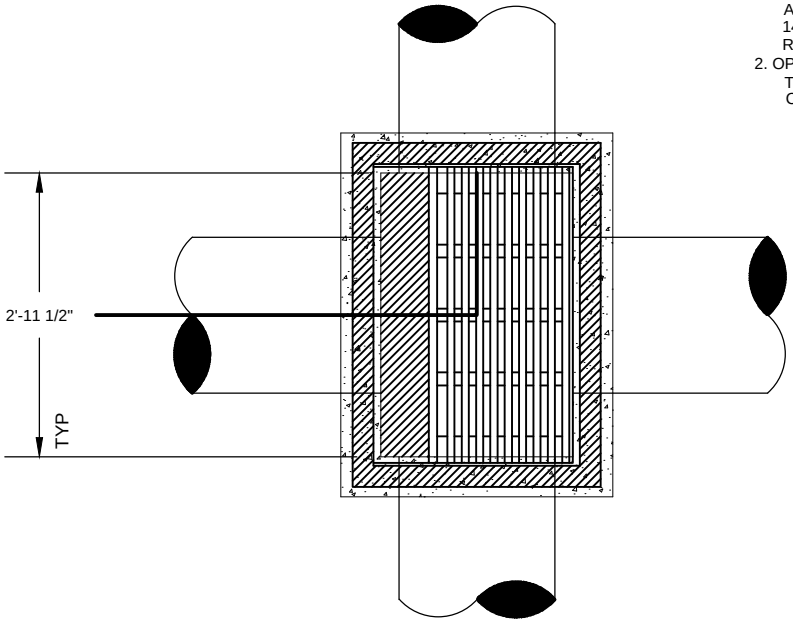
MARCH 2014

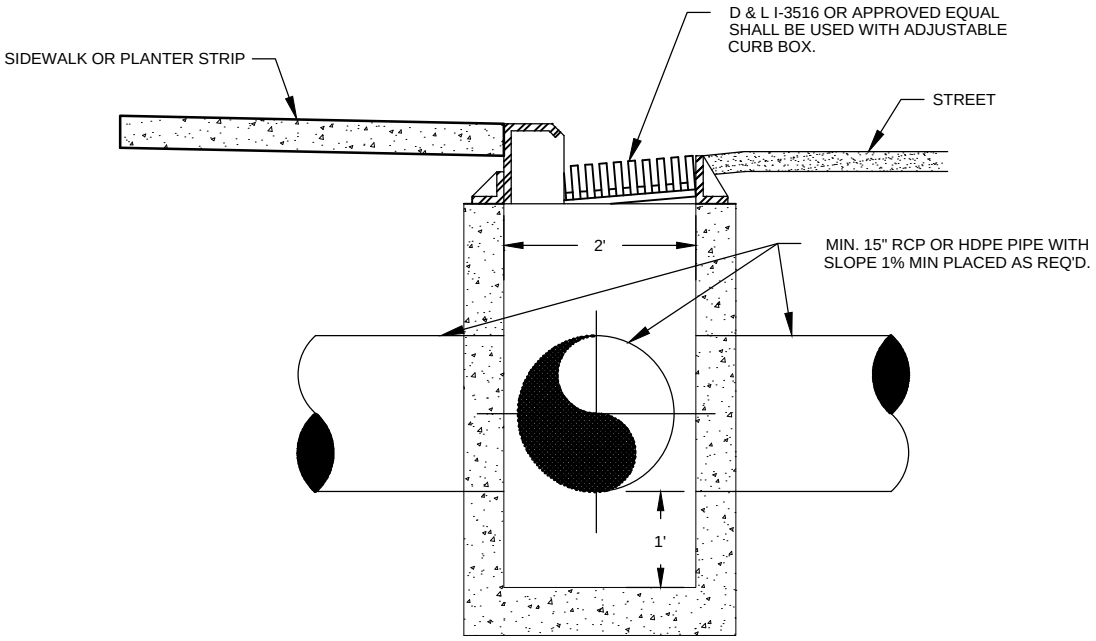
ROOSEVELT CITY
STANDARD DRAWINGS

STORM DRAIN - 2

NOTES:

1. #4 REBAR SPACED AT A MINIMUM OF 12" O.C. HORIZ. AND 8" O.C. VERTICAL. 14" OVERLAP OR REBAR REQUIRED.
2. OPEN FACE CATCH BASIN TO BE USED ONLY AT THE CITY ENGINEERS DISCRETION.





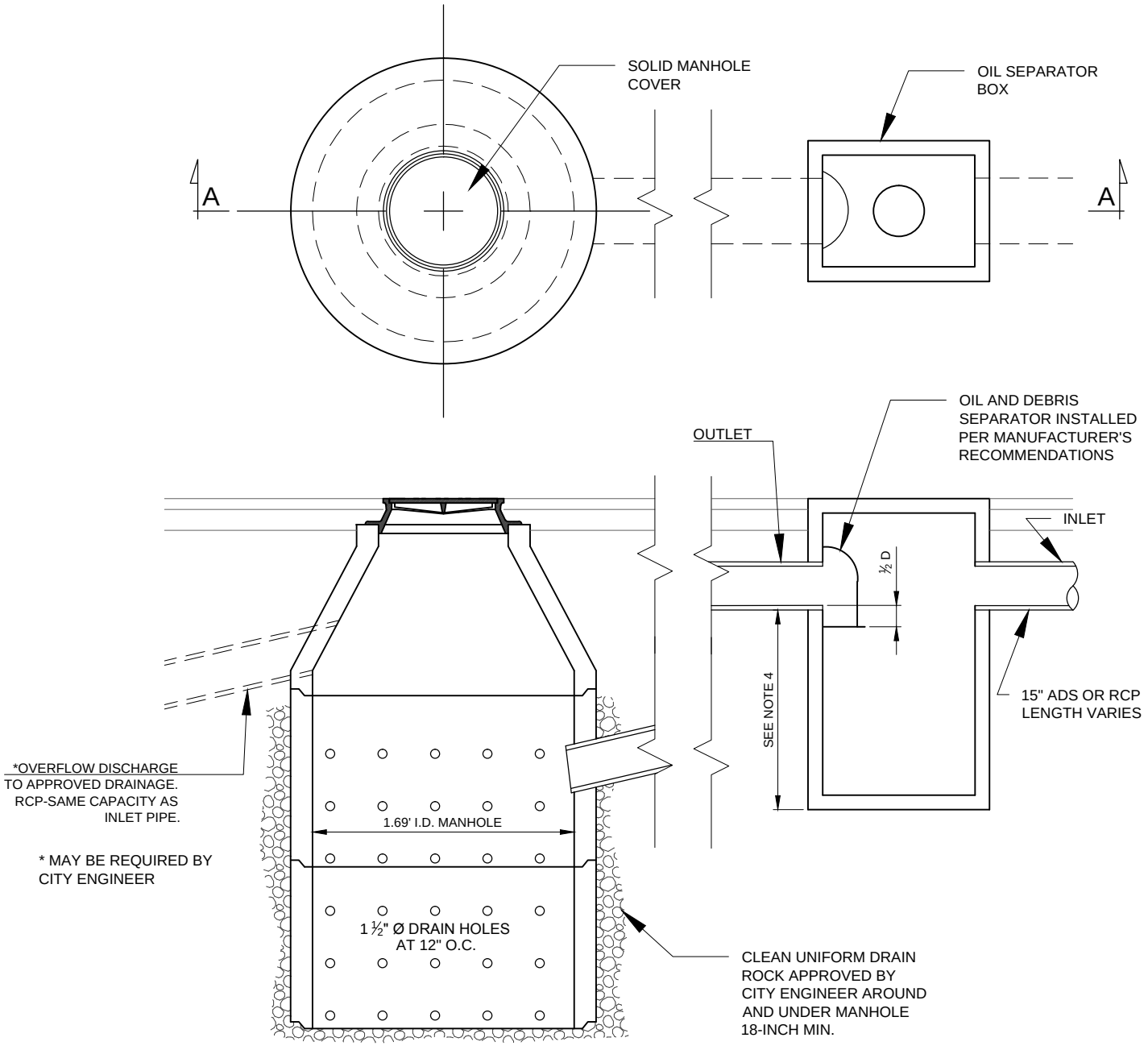
CURB FACE DROP INLET BOX

N.T.S.

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

STORM DRAIN - 3



SECTION A-A

NOTES:

1. CONSTRUCT DROP INLET BOX TO MATCH WIDTH OF CURB & GUTTER. MATCH INSIDE LENGTH OF BOX TO INSIDE LENGTH OF FRAME.
2. D & L I-3516 WITH ADJUSTABLE CURB BOX.
3. STANDARD CAST IRON MANHOLE RING & LID.
4. SUMP DEPTH = 36" MIN. FOR 12" DIAMETER OUTLET AND SMALLER, FOR OUTLET DIAMETER 15" AND LARGER, DEPTH = 2.5 TO 3 TIMES THE DIAMETER.

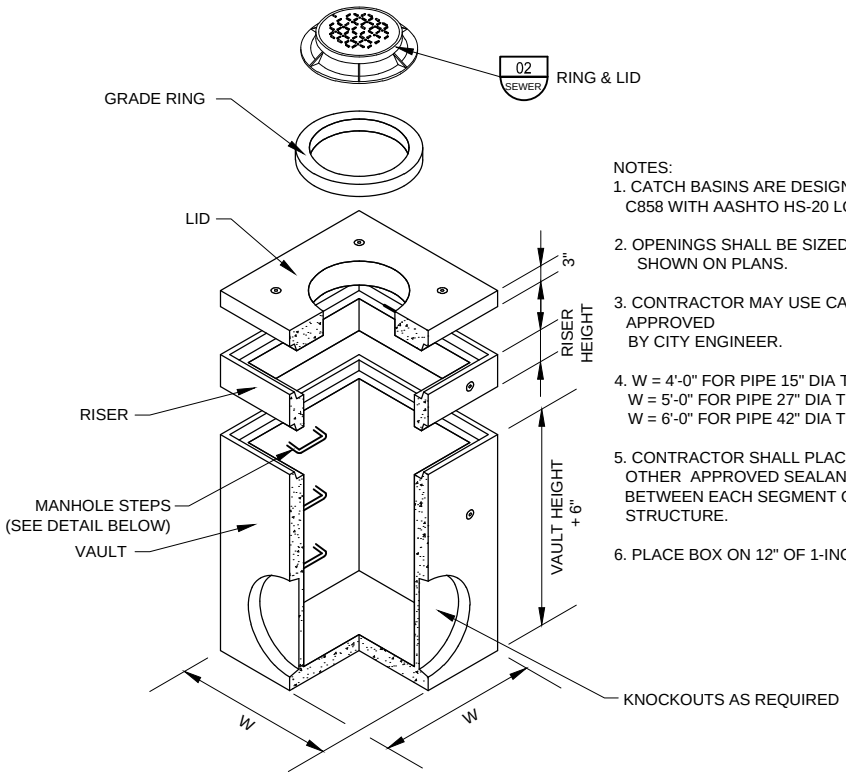
SUMP DISPOSAL & OIL SEPARATOR

N.T.S

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

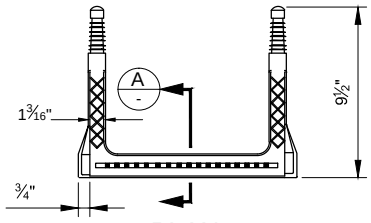
STORMDRAIN - 4



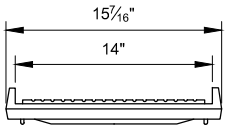
NOTES:
1. CATCH BASINS ARE DESIGNED TO MEET ASTM C858 WITH AASHTO HS-20 LOADING.
2. OPENINGS SHALL BE SIZED AND LOCATED AS SHOWN ON PLANS.
3. CONTRACTOR MAY USE CAST-INPLACE BOX APPROVED BY CITY ENGINEER.
4. W = 4'-0" FOR PIPE 15" DIA TO 24" DIA
   W = 5'-0" FOR PIPE 27" DIA TO 36" DIA
   W = 6'-0" FOR PIPE 42" DIA TO 48" DIA
5. CONTRACTOR SHALL PLACE MASTIC OR OTHER APPROVED SEALANT MATERIAL BETWEEN EACH SEGMENT OF PRE-CAST STRUCTURE.
6. PLACE BOX ON 12" OF 1-INCH DRAIN ROCK.

PRECAST STORM DRAIN BOX

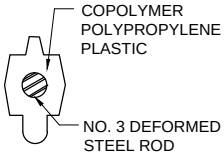
N.T.S.



PLAN

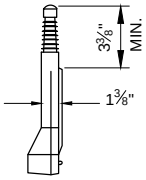


END VIEW

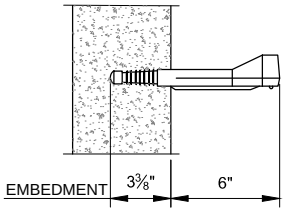


A - SECTION

NTS



RIGHT SIDE VIEW



EMBEDMENT DETAIL

NOTES:
1. MANHOLE STEPS: CAPABLE OF WITHSTANDING A SINGLE CONCENTRATED LOAD OF 300 POUNDS APPLIED AT A DISTANCE OF 5 INCHES FROM THE FACE OF THE STRUCTURE WALL.
2. STEPS ARE TO BE VERTICALLY ALIGNED AND UNIFORMLY SPACED WITH A MINIMUM SPACING OF 12 INCHES AND A MAXIMUM SPACING OF 16 INCHES UNLESS SHOWN OTHERWISE ON STRUCTURE PLANS.
3. USE EITHER MANHOLE STEPS CAST-IN-PLACE, OR GROUTED INTO STRUCTURE WALL IN SUCH A MANNER AS TO PREVENT PULLOUT UNDER A LOAD OF 300 POUNDS APPLIED 5 INCHES FROM THE FACE OF THE STRUCTURE WALL.
4. STEEL REINFORCING OF MANHOLE STEPS: CONFORM TO AASHTO DESIGNATION M 31, GRADE 60, DEFORMED STEEL BAR. PLASTIC COATING OF MANHOLE STEPS: CONFORM TO ASTM DESIGNATION D 2146, TYPE II, GRADE 16906.
5. MANHOLE STEPS: CONFORM TO AASHTO DESIGNATION M 199 UNLESS NOTED OTHERWISE.
6. DIMENSIONS MAY VARY WITH MANUFACTURES DESIGN. USE ALTERNATIVE DESIGN WITH THE APPROVAL OF THE ENGINEER.

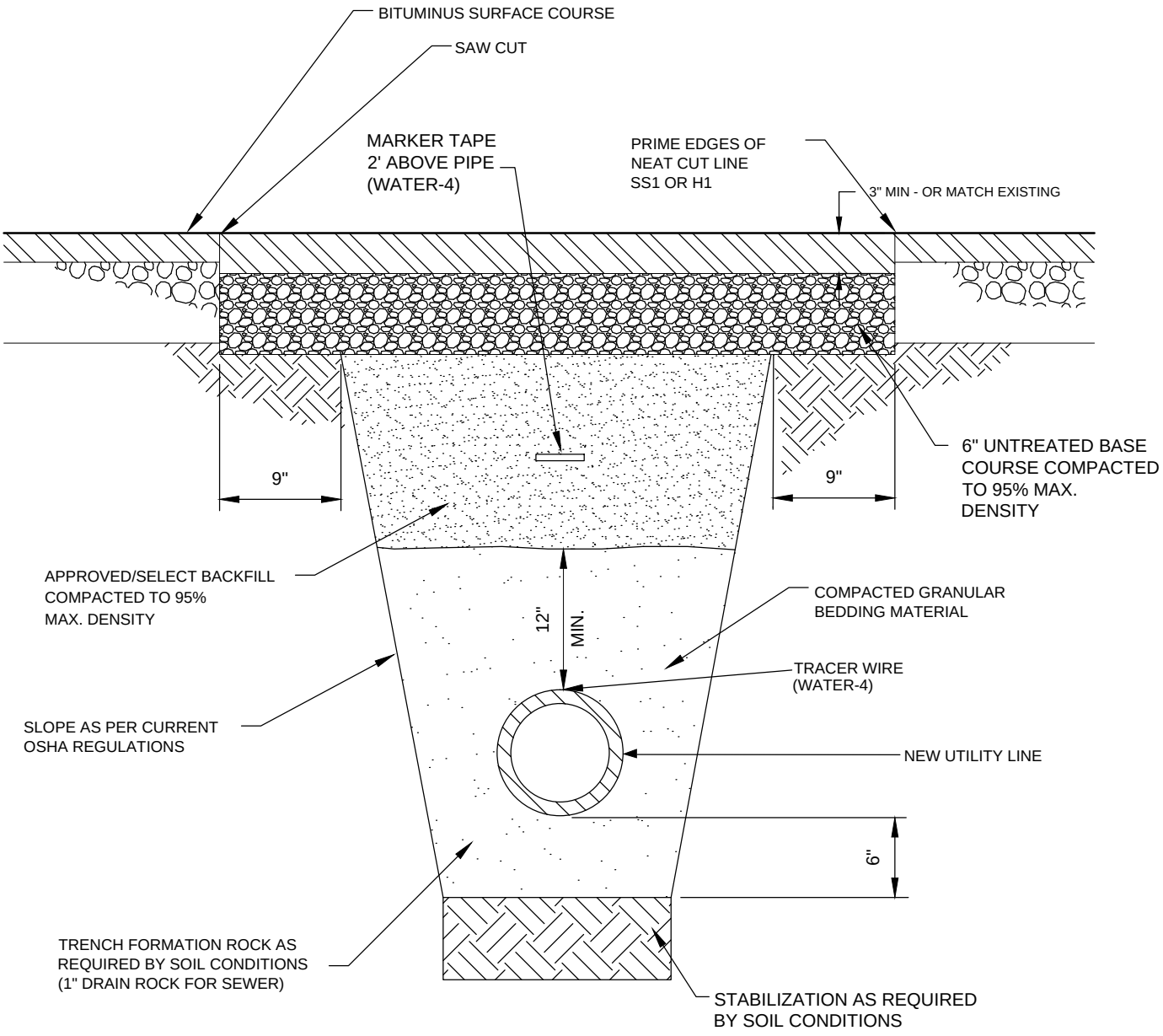
MANHOLE STEPS

N.T.S.

ADDED SEPTEMBER 2015

ROOSEVELT CITY STANDARD DRAWINGS

STORM DRAIN - 5



NOTES:

1. COMPACTED GRANULAR BEDDING MATERIAL SHALL CONSIST OF SAND, PEA GRAVEL, OR WELL GRADED CRUSHED ROCK. MATERIALS, METHOD OF COMPACTION, AND DEGREE OF COMPACTION SHALL BE APPROVED BY CITY ENGINEER.

2. FOR WATER/SECONDARY INSTALLATION IN SOIL THAT HAS BEEN CONTAMINATED WITH PETROLEUM, REFER TO SECTION 02 97 00 OF THE STANDARD SPECIFICATIONS. PIPE SHALL BE DUCTILE IRON WITH NITRILE GASKETS WRAPPED IN POLY WRAP, AND BEDDING SHALL BE FLOWABLE FILL.

3. USE OF NATIVE MATERIAL FOR BACKFILL IS PROHIBITED (EXCEPT AS APPROVED BY THE CITY ENGINEER).

UTILITY INSTALLATION IN EXISTING ROADWAYS

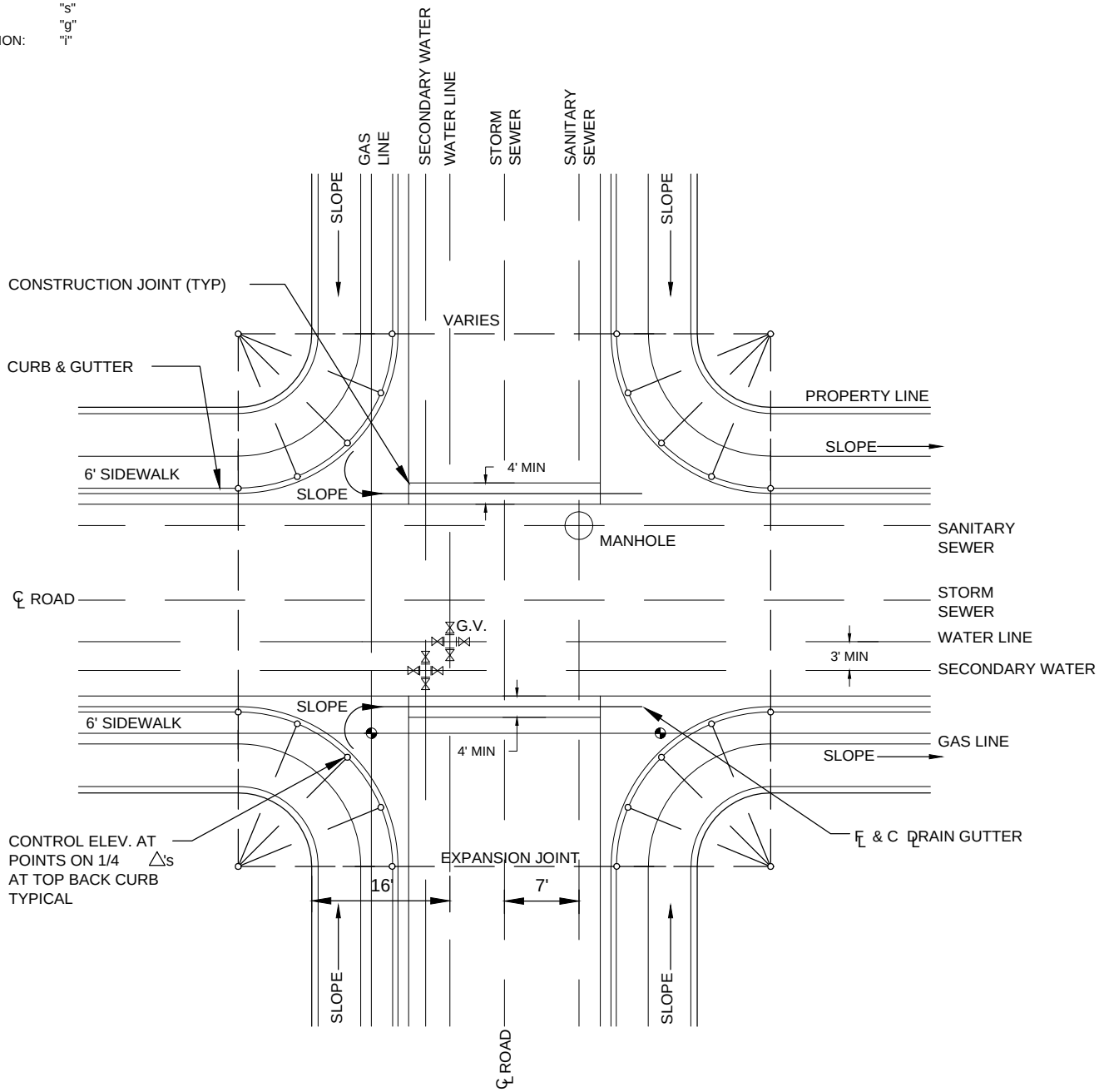
N.T.S.

MARCH 2014

ROOSEVELT CITY
STANDARD DRAWINGS

WHERE A UTILITY CROSSES CURB & GUTTER, A LETTER WILL BE SCRIBED INTO THE FACE OF THE CURB OVER THE UTILITY AS FOLLOWS:

WATER:	"w"
SEWER:	"s"
GAS:	"g"
IRRIGATION:	"i"



STANDARD STREET INTERSECTION AND UTILITY LOCATION

N.T.S.

MARCH 2014

ROOSEVELT CITY STANDARD DRAWINGS

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