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SECTION 00700

GENERAL IMPROVEMENT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 GENERAL REQUIREMENTS

- A. The Developer is responsible to comply with the standard specifications in force at the time each improvement is made.
- 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. Layout must provide for future extension to adjacent development and to be compatible with the contour of the ground for proper drainage.
- D. All water lines, sewer lines, and any other buried conduit shall be installed to the boundary lines of the subdivision.
- E. If construction requires a specification not found herewith and is deemed necessary by Town Engineer, the Town Engineer will be allowed two weeks to provide an adequate specification to control and provide guidelines for construction.
- F. All cables, conduits, or pipelines to be buried in the Town right-of-way for utility purposes shall be a minimum of 24-inches below final grade and in a location approved by the Town.

PART 2 SUBMITTALS

2.1 CONSTRUCTION DRAWINGS:

Complete and detailed construction plans and drawings of improvements shall be submitted to the Town Engineer prior to commencing construction. No construction shall be started until plans have been checked and approved by the Town Engineer.

2.2 CUT SHEETS:

Two (2) sets of cut sheets and profiles shall be submitted for sewer, stormwater, culinary water, auxiliary lines, and curb & gutter. Allow 7 days for Town Engineer review. No construction shall be started until plans have been checked and approved by the Town Engineer.

PART 3 REQUIREMENTS

3.1 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. Four (4) sets of the construction plans shall be submitted with two (2) sets to be retained by the Town Engineer at least one at which shall be 11" x 17" and two (2) sets returned to the Subdivider with approval mark of the Town Engineer and appropriate department superintendent.
- B. One approved set shall be kept available at the construction site at all times.
- 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 1/2" on top, bottom, and right sides, left side 1 1/2".
 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 Town
 - Project title (subdivision, etc.)
 - Specific type and location of work
 - Space for approval signature of Town Engineer and date
 - Name of engineer or firm preparing drawings with license number.
- D. Separate drawings of elements of the Construction Specifications for Francis Town shall not be required to be redrawn and submitted with the construction drawings unless specific deviations from the Standards are requested for approval, however, the construction drawings shall refer to

the specific items of the Standards that are to be incorporated into the work. The construction plans shall be submitted in triplicate (minimum) with one set being returned to the Subdivider, Developer, Contractor or Project Manager. This approved set shall be kept available at the construction site. Prior to final acceptance by Town, the Subdivider, Developer, Contractor or Project Engineer shall submit to the Town Public Works Department a set of "as constructed" drawings for permanent Town file record. In addition

3.2 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 variation
- J. Street survey monument locations.
- K. Plan and profile of existing ground and purposed profiles extending 200' beyond the proposed project.

3.3 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 flowline elevation.
- D. Type of pipe.

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

3.4 CULINARY WATER DRAWING REQUIREMENTS

- A. Scale (not specified).
- 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.

3.5 IRRIGATION WATER FACILITY DRAWING REQUIREMENTS

- A. Scale (not specified)
- B. Size and location of water mains, valves, hydrants, and related appurtenances.
- C. Type of pipe.
- D. Minimum cover.
- E. Location, size and slope of irrigation pipe and related appurtenance.
- F. Clean out and control box locations.
- G. B.M. location and elevation (use U.S.G.S datum).
- H. Utility conflict details.

3.6 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 Francis Town Standard Specifications.
- C. All structural drawings shall contain the following:
 - 1. Drawing size: 11" x 17" (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 EXECUTION

4.1 PRECONSTRUCTION CONFERENCE:

A preconstruction conference shall be held before any excavation or other work is begun in the subdivision or project. The meeting will be held in the Town Office and will include: (a) Francis Town Mayor or Council representative, (b) Town Engineer; (c) Developer or Project Manager; (d) Subdivision or Project Engineer; (e) all Contractors and Subcontractors involved with installing the subdivision or project improvements; (f) a representative of Francis Town Inspection Department; (g) representatives of local utility companies as may be required by Francis Town. Items pertaining to the construction and inspection of the subdivision or Project Improvements will be discussed.

4.2 INSPECTION - GENERAL

- A. All construction work involving the installation of improvements in subdivisions shall be subject to inspection by the Town.
- B. Certain types of construction may be continuous inspection while others may have only periodic inspections.
 1. Continuous inspection may be required on the following types of work:
 - a. Laying of street surfacing.
 - b. Placing of concrete for curb and gutter, sidewalks and other structures.
 - c. Laying of sewer pipe, drainage pipe, water pipe, auxiliary pipe, valves, hydrants and testing.
 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 continuous inspection, no work shall be started except in the presence of, or with the prior approval of the Town Engineer.
- D. The presence of a Town Inspector shall not relieve the Developer/Contractor of any requirements in these Construction Specifications.

4.3 REQUESTS FOR INSPECTION

- A. Requests for inspections shall be made to the Town, 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 two (2) working day in advance of the required inspection (subsequent inspections and reinspection shall require the same notification period.)
- D. After hour and/or weekend inspections are available under extreme conditions for \$75 per hour.

4.4 CONSTRUCTION COMPLETION INSPECTION

- A. An inspection shall be made by the Town 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 Town Engineers Inspection Report defining the faulty or defective work.
- C. The Developer shall furnish reproducible "As-Constructed" drawings of all improvements that shall be approved by the Town Engineer, prior to subdivision final approval.
- D. The Developer shall furnish tie sketches for sewer laterals, water laterals, manholes, and valve boxes, prior to subdivision final approval.

4.5 GUARANTEE OF WORK

- A. The Developer shall warrant and guarantee and post a cash bond equivalent in value to 110% 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 Final Acceptance by the Town 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 Town.
- B. The determination for necessity of repairs and maintenance of the work rests with the Town 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 Town Engineer, said work shall be in need of repairs, maintenance, or rebuilding.

- C. If the Developer fails to do so within ten (10) days form the date of the service of such notice, the Town 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.
- D. Town's Protective Liability Insurance: The Permittee shall indemnify and hold the Town harmless from and against any and all liability, damages, claims, demands, costs and expenses of whatsoever nature, including court costs and counsel fees, arising from or growing out of any injury to or death of any person or persons, whomsoever, or for loss of or damage to any property whatsoever, (including loss or damage to the tools, plant, or equipment of the Permittee) resulting directly or indirectly from the carrying on of the work herein specified, and to that end will purchase on the Town's behalf, Town's Protective Liability Insurance with limits of \$100,000.00 for injury to or death of one person, and \$300,000.00 for one accident; and Property Damage Liability Insurance with limits of \$100,000.00 for each accident and \$100,00.00 aggregate.

4.6 SUBDIVISION ORDINANCES

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

4.7 ROADWAY PERMITS

- A. PURPOSE OF INTENT
 1. The purpose of this section is to describe Francis Town's Department of Public Work's policies for issuing permits and to control any excavation and construction operations in the public way in Francis Town. All contractors and utility companies proposing to construct, repair or replace any facility within the public way, shall contact the **Francis Town Department of Public Works** and complete all permit requirements prior to commencing proposed work as outlined in this section.
 2. Work by utility companies and contractors in constructing facilities in new subdivision streets shall not be required to obtain a "Public Way Permit", but will still be subject to Town inspection and compliance with subdivision requirements.

B. POLICIES

1. Permittee must be licensed with the State of Utah: It is the Policy of Francis Town that contractors desiring to perform work in the Town’s public way shall be properly licensed in the State of Utah. The acceptable licenses include:

<u>TYPE OF WORK</u>	<u>LICENSE</u>
Any type of concrete work	E100 or S260
Paving	E100 or S400
Landscaping	E100 or S330
Buried gas, telephone, water, irrigation and power lines	E100 or S410
Sanitary sewer and storm drains	E100 or S390
Asphalt patching	E100 OR S400
Trenching	E100 Or S310
Highway sign installation	E100
Manhole covers	E100
Paint striping highways	E100

2. Exceptions: A license shall not be required by the Town when the Permittee is:
 - a. A public utility company
3. Policy for determining when “permit waivers” can be granted: Working within the public way without a permit violates Francis Town ordinances unless the permit is waived by the **Public Works Department**. Waivers can be granted by the **Public Works Department** when any of the following conditions occur:
 - a. When routine maintenance work which is being done by the Town, State and utility personnel does not involve excavations in the Town’s public way, i.e., crack sealing, street resurfacing and repair, snow plowing, sanding, sweeping, garbage collection, storm drain cleaning, leaves pickup, above grade work, etc.
 - b. When a permittee allows other contractors or utility companies to perform work in the permitted trench limits.
 - c. When utilities must be relocated or adjusted in conjunction with a **Town Public Works** Department sponsored project

provided the utility work is being accomplished within one week of the time the Town or its Contractor is scheduled to begin construction at that location and provided the work is coordinated and approved by the **Town's Public Works Department**.

4. Policy for issuing no fee permits: The Public Works Department reserves the right to issue "no fee permits" for work in the public way when the following conditions are met.
 - a. When abutting property owners are repairing or replacing any existing public facilities such as drive approaches, curb and gutter, or sidewalk, construction of new facilities or any combination thereof.
 - b. When utility companies are doing excavation work and such work is required in conjunction with a Town Public Works Department project, and the work is required to be accomplished prior to the execution of the Public Works Department contract.
 - c. When the Town Public Works Department is repairing or maintaining public way facilities such as curbs, gutters, cross drains, storm drains, traffic facilities, driveway, sidewalk, etc, and such work requires excavation.
 - d. When frames and lids in paved surfaces are raised or lowered providing the work does not disturb the underlying roadbase material.
5. Policy for revoking "Permit Waivers" and "No Fee Permits": "Permits Waivers" and "No Fee Permits" will be revoked by the Public Works Department if the work is defective or requires action or supplemental inspection by the Public Works Department. In the revocation proceedings, the Public Works Department shall serve written notice which defines the problems encountered and the time (at least one day) the Permittee has to correct the problem. If the work is not satisfactorily completed within the time specified, the "Permit Waiver" or the "No Fee Permit" shall be revoked. The Permittee will be required to secure a Fee Permit before proceeding to complete the work.
6. Policy for extending permit construction time limits: Subject to the Public Works Department's approval, permits which expire may be extended by paying a \$10.00 permit extension fee. The length of the extension determined by the Permittee shall be subject to the approval of the Public Works Department.

C. GENERAL CONDITIONS

1. Permit: When the work is in progress, the Permittee shall have at the work site a copy of the permit and his Contractor's License Number.
2. Emergency work: Maintenance of pipelines or facilities in the public way may proceed without a permit when emergency circumstances

- demand the work be done immediately provided a permit could not reasonably and practicably have been obtained beforehand.
3. In the event that emergency work is commenced on or within any public way of the Town, the Public Works Department shall be notified within one-half hour when the work commences or as soon as possible from the time the work is commenced. If emergency work is commenced during off business hours, the **Public Works Department** will be notified within one (1) hour of the start of work on the first regular business day on which Town offices are open after such work commences, and, at the discretion of the Public Works Department, a permit may be issued which shall be retroactive to the date when the work was begun. Before commencing and while conducting emergency work, all necessary safety precautions for the protection of the public and the direction and control of traffic shall be taken. None of the provisions of these regulations are waived for emergency situations except the prior permit requirements.
 4. Private access: Temporary, all weather roadways, driveway, walks, and right-of-ways for vehicles and pedestrians shall be constructed and continuously maintained where required.
 5. Street excavation in winter: Excavation of Town streets during the winter months (herein defined as October 15 to April 1) will be allowed only if the work is a new service connection, required maintenance or emergency, or otherwise approved by the Public Works Department. Permanent patching of Town streets excavated in the winter may be delayed until April 1, provided the Permittee provides/maintains a temporary surface until such time as the permanent surfacing is accomplished. This provision applies regardless of whether the Permittee or Town crews are performing the permanent resurfacing.
 6. Existing utilities: The Contractor shall use extreme caution to avoid a conflict, contact or damage to existing utilities, such as power lines, sewer lines, storm drains, street lights, telephone lines, television lines water lines, gas lines, poles or other appurtenances during the course of construction of this project. Any such conflict, contact or damage shall be immediately communicated to the Public Works Department.
 7. Preconstruction pictures of existing public way improvements: The Permittee may secure pictures of the conditions of the existing public way improvements such as curbing, sidewalk, landscaping, asphalt surfaces, etc. In the event that public way improvements are damaged and no pictures are taken, the Public Works Department will assume the correction of the damage is the responsibility of the Permittee.

D. EXCAVATION OPERATIONS

1. Blue stakes: Before commencing excavation operations, the Permittee shall call “ Blue Stakes” and all Francis Town Utility Departments.
2. Traffic control devices: Traffic control devices such as barricades and cones must be in place before excavation begins.
3. Protection of paved surfaces outside of excavation area: In order to avoid unnecessary damage to paved surfaces, backhoes, outriggers, track equipment or any other construction equipment that may prove damaging to asphalt shall use rubber cleats or paving pads when operating on or crossing said surfaces.

E. ENVIRONMENTAL CONTROL

1. Dust and debris: The Permittee or Contractor shall keep dust and debris controlled at the work site at all times. If necessary, wet down dusty areas with water and provide containers for debris. The Town Engineer reserves the right to shut down the work or issue a citation if dust is not controlled.
2. Noise: The Permittee or Contractor shall keep neighborhood free of noise nuisance in accordance with **the Town Ordinances**.
3. Cleanup: The Permittee or Contractor shall remove all equipment, material, barricades and similar items from the right-of-way. Areas used for storage of excavated material will be smoothed and returned to their original contour.
4. Vacuum sweeping or hand sweeping shall be required when the Public Works Department determines cleaning equipment is ineffective.

F. 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. Manuel on Uniform Traffic Control Devices (MUTCD).

4.8 BUILDING PERMIT AND OCCUPANCY

- A. Subdivisions and other large scale development shall be “substantially completed,” as defined below before a building permit will be issued. Such substantial completion shall be certified in writing by the Town 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 Town 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 Town Engineer.
- B. Occupancy will not be allowed without the sewer lateral and water service being inspected by a Town representative.
- C. Occupancy will be allowed only upon compliance with Francis Town Ordinances.

4.9 UNUSUAL LOADINGS

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

4.10 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 Town Engineer.
- B. The fire hydrants shall be cleared for at least three (3) feet in all directions.
- C. A reflective fiberglass marker at least six (6) feet in height shall be installed on all fire hydrants.

END OF SECTION

SECTION 01450

TESTING AND PROCESS CONTROL

PART 1 GENERAL

1.1 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 Town with manufacturer's certifications of material quality.

1.2 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 Town at no charge to the Town. Testing and certifications reports shall be approved by the Town as to conformance to Town standard specifications prior to final inspection and/or acceptance by the Town of any materials or workmanship.

1.3 SUBMITTALS

- A. Field Test Report: When possible submit original report immediately to Engineer or inspector, but in no case later than end of following day.
- B. Laboratory Test Report: Submit original report to Engineer within 48 hours after test results are determined.

PART 2 EXECUTION

2.1 SAMPLING

- A. Sampling of materials shall be as specified in each test.
- B. The Town Engineer or Town 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 Town for construction, as applicable.
- C. The presence of a Town Inspector shall not relieve the Developer/Contractor of any requirement in this Section.

- D. Each sample or test shall be accompanied by the following written data, which shall be reported to the Town 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

2.2 TESTING AGENCY

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

2.3 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 Town 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 Town.

2.4 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 $\frac{1}{2}$ 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 subplot.
 - 4. The location of sampling sites within the subplot 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 subplot 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 tons for untreated road base.
- D. The test results of all samples tested shall be reported to the Town Engineer. 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.

2.5 TEST ROLL OF ROADWAY SUBGRADE

- A. Roll Test shall be performed when required by Town 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 Town Engineer.

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

2.6 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 Town 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.

2.7 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 Town Engineer.
- B. Mix design shall be submitted to the Town Engineer for approval 5 working 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 asphalt is less than 2.5% of optimal content, the Contractor may be required to lay an additional lift or slurry seal, based on the Town Engineer's recommendation.

2.8 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 subplot(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 subplot, 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 02504.
- 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 subplot. 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 subplot shows a deficient thickness of more than 1/2 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 Engineer.
5. The removed core will be replaced with low strength concrete.

2.9 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 Town 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 Town 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 Town. 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	As needed to establish laboratory density
	Embankment & Base Course Field Density- Portable Nuclear Equipment or AASHTO T-191	1 test plus minimum one test per 1,000 cu.yds.
Base Course Gradation	Backfill Field Density- Portable Nuclear Equipment or AASHTO T-191	1 test plus minimum one test per 200 cu.yds.
	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	Lab Density- Marshall Test, ASTM D-1559	1 test per pavement construction day

Test Subject	Specific Test	Number of Tests
Course	Field Density- Portable Nuclear Equipment	1 test per 1600 square yards subplot
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 02150

SHORING AND UNDERPINNING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shoring for open excavations requiring a protective system.

1.2 REFERENCES

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

1.3 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.

1.4 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 and 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 on 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.

1.5 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.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials shall be as per 1.05 of this section

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 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 02205
COMMON FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Common fill material requirements.

1.2 REFERENCES

- A. AASHTO M 145: Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
- B. AAHSTO T-27: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

1.3 DEFINITIONS

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

1.4 ACCEPTANCE

- A. Acceptance of common fill shall be determined by Engineer and based upon 1 subplot 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

2.1 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
4 inches	99
No. 4 (4.75 mm)	30 to 70
No. 200 (75 micro m)	3 to 15

2.2 NATIVE MATERIAL

- A. Sound, earthen material passing 2 inch sieve.
- B. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with AAHSTO T-27.

2.3 SAND

- A. Clean, coarse, natural sand.
- B. Nonplastic when tested in accordance with ASTM D 4318.
- C. 100 percent shall pass a 1/2 inch screen.
- D. No more than 20 percent shall pass a number 200 screen.

2.4 SOURCE QUALITY CONTROL

- A. Verify gradation compliance in accordance with AAHSTO 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

3.1 INSTALLATION

- A. Excavation and Backfill Operations: In accordance with Section 02225.

END OF SECTION

SECTION 02206
SELECT FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Select fill material requirements.

1.2 REFERENCES

- A. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- B. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

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

1.5 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

2.1 AGGREGATES

- A. Clean, hard, tough, durable and sound mineral aggregates that consists of 95% crushed stone, crushed gravel or crushed slag; free of deleterious and organic matter; and complies with the following:
 - 1. Aggregate Wear Under AASHTO T-96: Less than 50 percent.
 - 2. Material shall be classified as A-1 material.
 - 3. Aggregates - master grading band limits
 - a. The following limits are based on fine and coarse 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				PEA GRAVEL	
	Type 1-1/2		Type 1		Min	Max
	Min	Max	Min	Max		
1-1/2"	100	--	--	--	--	--
1"	--	--	--	--	--	--
3/4"	--	--	100	--	--	--
1/2"	--	--	--	--	--	--
3/8"	81	91	--	--	--	--
No. 4	100	--	--	--	100	--
No. 16	67	77	79	91	--	3
No. 200	--	--	--	--	--	2
	78	92	--	--		
	43	53	49	61		
	55	67				
	23	29	27	35		
	28	38				
	6	10	7	11		
	7	11				

4. 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.

2.2 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:

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

2.3 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 ASTM C 131.
 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

PART 3 EXECUTION

3.1 INSTALLATION

- A. Excavation and Backfill Operations: In accordance with Section 02225.

END OF SECTION

SECTION 02225

EXCAVATION AND BACKFILL OPERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requirements for trenching and backfilling for underground pipelines.
- B. Excavating and backfilling operations adjacent to and under structures including boxes, headwalls, or other structures as required by Town Engineer.
- C. Backfilling and compacting operation for construction and reconstruction of roadways, embankments, streets, parking lots, and other paved surface areas.
- D. Excavation permit requirements.

1.2 REFERENCES

- A. UBC Chapter 33.

1.3 DEFINITIONS

- A. Pipe Zone: That zone in an excavation which supports, surrounds, and extends to 1 foot above the top of the pipe barrel.
- B. Bedding: Process of preparing the trench bottom to receive the pipe and the backfilling on each side of the pipe to 12 inches over the top of the pipe.
- C. Roadway: Area within the street right-of-way, including the area under the street, curb, gutter, and one (1) foot behind curb.

1.4 SUBMITTALS

- A. Cut Sheets: In accordance with Section 00700.
- B. Material Analysis Reports: In accordance with Sections 02205 or 02206 as applicable.
- C. Density Test Reports: In accordance with Section 02250.

- D. Depth of backfill lift. This information shall be contingent upon type of equipment used in compaction operation. Engineer may order lesser thickness if compaction is not achieved.

1.5 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.

1.6 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. 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.
- C. 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.
- D. 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.
- E. Grading: In compaction operations, do not vary the surface of finished aggregate base course more than 1/4" above or below grade.

PART 2 PRODUCTS

2.1 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 Town.

2.2 SOIL MATERIALS

- A. Over-excavation Fill: Select Fill: in accordance with Section 02206.
- B. Common Fill: in accordance with Section 02205.
- C. Select Fill: in accordance with Section 02206.
- D. Native Backfill:
 - 1. When approved by Town Engineer, native backfill material obtained from project excavations may be used as backfill, provided organic material, rubbish, debris, rocks larger than 8 inches, 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 02205.2.01 gradation.

PART 3 EXECUTION

3.1 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.

3.2 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. When excavation is required in jurisdictions other than Town, satisfy all conditions of the appropriate agencies.
- D. Identify required lines, grades, contours, and benchmarks.
- E. Notify all affected utility companies and Blue Stakes prior to commencing excavation operation.
- F. 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.

3.3 CONTROL OF GROUNDWATER

- A. All trenches shall be kept free from water during excavation, fine grading, pipe laying, jointing, and embedment 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.

3.4 SHORING

- A. Comply with Section 02150 when required by field condition.

3.5 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. Notify Engineer of unexpected subsurface conditions.
- D. Underpin adjacent structure which may be damaged by excavation work, including service utilities and pipe chases.
- E. 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 Town.

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

3.6 EXCAVATION FOR PIPELINES

- A. 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 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.
 - 4. A bedding of special material shall be placed and thoroughly compacted with pneumatic tampers in 4-inch lifts to provide a smooth, stable foundation.
 - 5. Special foundation material shall consist of suitable earth material free from roots sod or vegetable matter.
 - 6. Trench bottoms shall be hand shaped as specified in paragraph (2) above.
 - 7. 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.
 - 8. 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 Town Engineer.
- B. Grade bottom of trenches to provide uniform bearing surface.
- C. If necessary, make bellholes and depressions required to complete joining of pipe or box.
- D. In public thoroughfares and 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.

- E. Close trenches during nighttime conditions.

3.7 GRAVEL FOUNDATION FOR PIPE

- A. Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load; where water must be drained to maintain a dry bottom for pipe installation and at other locations as previously defined, the subgrade shall be excavated to a minimum of 12 inches and replaced with crushed rock or gravel.
- B. Gravel for pipe foundations shall conform Drain Rock in Section 02206.
- C. Drain Rock material shall be deposited over the entire trench width in 6-inch maximum layers, each layer shall be compacted by tamping, rolling, vibrating, spading, slicing, rodding or by a combination of one or more of these methods.
- D. The material shall be graded to produce a uniform and continuous support for the installed pipe.

3.8 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. Bedding requirements: 6 inches below the pipe and 12 inches above the pipe.
- C. Trench backfilling above the level of the pipe bedding shall normally be accomplished with native excavated materials and shall be free from rocks larger than 6-inches in diameter.
- D. Compaction Requirements
 1. Under pavements, shoulders, 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-99.
 2. In 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 Town Engineer.

3.9 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 Town 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 BACKFILLING FOR STRUCTURES

- A. Do not fill adjacent to structures until approval is obtained from 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-99.
- O. Restore any damaged structure to its original strength and condition and rebackfill to specifications.

3.11 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

Road Subgrade Preparation Schedule

Soil Classification	Requirement
A-1	The subgrade shall be scarified to a depth of 8" and the loosened material shall be moistened and compacted to the equivalent of 95% of maximum dry density as measured by AASHTO T-99.
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 12" subgrade scarified and compacted, replaced with A-1 granular material, and be moistened and compacted as above.

- 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 unless permission is granted from the Town Engineer. 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 02206.
 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 02504 of these specifications.
5. The Town Engineer shall inspect all work.

3.12 SUBGRADE PREPARATION

- A. Compact subgrade surfaces to density specified for overlying backfills. Refer to Section 02250.
- B. If areas of subgrade not readily capable of in-situ compaction, secure Town Engineer's authorization for extra excavation and backfill.
- C. Maintain minimum overburden cover of 2 feet over pipelines or conduits during subgrade preparation.

3.13 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 02250.
- G. Prior to placing pavements, proof roll in accordance with Section 01450.

3.14 BLASTING

- A. Blasting will not be allowed except by permission from the Town 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.

3.15 COMPACTION OF BACKFILL

- A. In accordance with Section 02250.

3.16 IMPORTED BACKFILL MATERIAL

- A. In the event the native excavated material is not satisfactory for backfilling as determined by the Town Engineer, the Contractor shall provide imported granular fill in accordance with Section 02205.

3.17 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 02250

SOIL COMPACTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Compaction control of native and imported backfill material.

1.2 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).

1.3 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.

1.4 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 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 Engineer for final acceptance when such defective work or material is discovered.

PART 2 EXECUTION

2.1 COMPACTION REQUIREMENTS

- A. The Developer\Contractor shall be responsible to perform and pay for all testing of earth materials.
- 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 sheepfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers of a size and type approved by the City 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 compactive effort necessary to attain the specified minimum relative density.
- H. Approval of equipment, thickness of layers, moisture content and compactive effort shall not be deemed to relieve the Contractor of the responsibility for attaining the specified minimum relative densities.
- I. The Contractor in planning his work shall allow sufficient time to perform the work connected with test sections and to permit the City Engineer to make tests for relative densities.

2.2 FIELD QUALITY CONTROL

- A. Optimum Soil Density: Unless indicated otherwise.

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

2.3 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.
- B. Compaction shall extend one foot beyond proposed curb line.

2.4 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.

2.5 COMPACTION OF OTHER FILLS AND EMBANKMENTS

- A. Fill or embankment materials other than those mentioned above shall be compacted to not less than 92% of maximum dry density as measured by AASHTO T-180.

END OF SECTION

SECTION 02504

ASPHALT CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 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.

1.3 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.

1.4 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).
 - a. 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 Town approved mix design, submit name and address of supplier for each mix design 3 days prior to using asphalt concrete mix.

1.5 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 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 or grades.
- F. Gradation, asphalt content, marshall density, and maximum density shall be determined by extraction tests.

PART 2 PRODUCTS

2.1 PAVING ASPHALT

- A. Provide type and grade indicated.
- B. The mix design shall target 3% voids. However, the percent asphalt or fines may need to be adjusted to achieve optimal strength.

2.2 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.

2.3 AGGREGATES - MASTER GRADING BAND LIMITS

- A. Gradation D/M-1/2 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.

MASTER GRADING BAND LIMITS				
Sieve Size	DENSE MIXTURES			
	Type DM-3/4 Min Max		Type DM-1/2 Min Max	
1"				
3/4"	100	----		
1/2"	----	----	100	----
3/8"	75	91	----	----
# 4	46	62	60	80
# 8	----	----	----	----
# 16	22	34	28	42
# 50	11	23	11	23
# 200	5	9	5	9

2.4 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
≥ 1/2	± 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

2.5 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.

2.6 MIXING PLANT

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

2.7 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.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Plant Mix Bituminous Paving: In accordance with Section 02510.

END OF SECTION

SECTION 02510

ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

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

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 Town Engineer and shall meet the requirements of the gradation selected.
- B. Test Reports: Submit test reports as requested by Town Engineer verifying compliance with specified standards.

PART 3 EXECUTION

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

- A. 6-inch minimum untreated 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 than 3 inches.

3.2 BASE COURSE

- A. Base for all streets shall consist of select material, as specified in Section 02206.
- B. Base shall be laid in accordance with Section 02225.

- 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.

3.3 BITUMINOUS SURFACE COURSE

- A. Base coarse shall be free of any contamination prior to laying surface coarse.
- B. The surface course shall consist of a mixture of mineral aggregate and binder.
- C. Gradation of aggregate shall conform to Section 02504.
- D. Regardless of the bituminous content there shall be between 3% and 5% voids in the mix.
- E. The bituminous material for surface course shall be AC-5, AC-10 or AC-15 asphalt cement conforming to the requirements of ASTM D-445. 85-100 penetration asphalt cement conforming to the requirements of ASTM M20-60 may be used when specifically approved by the Town 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. Tack coat shall be SS-1 or 1-H.
- 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 fractures, cracked or damaged asphalt.
 - 1. Asphalt shall be saw cut in straight lines.

3.4 CONSTRUCTION METHODS AND EQUIPMENT

- A. All asphalt will be laid using a lay down machine unless written approval by Town Engineer.
- B. 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.

- C. 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.

3.5 SPREADING

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

3.6 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 AAHSTO T-245 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 conform with surrounding area.
4. The Developer/Contractor shall be responsible to test bituminous mixtures for compaction in accordance with Section 01450, TESTING AND PROCESS CONTROL.

3.7 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 Town Engineer.
- B. The air temperature shall be measured in the shade.

3.8 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 Town 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 02512

RESTORATION OF SURFACE IMPROVEMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Restoration of surface improvement requirements

1.2 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.

PART 2 PRODUCTS

- A. Select Fill: In accordance with Section 02206.
- B. Asphalt Concrete: In accordance with Section 02510.
- C. Concrete: In accordance with Section 03304.

PART 3 EXECUTION

3.1 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 gravel shall be placed deep enough to provide a minimum of 6-inches of material.
 - 2. The gravel shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding gravel, etc., to maintain a safe uniform surface satisfactory to the 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 02206.

3.2 BITUMINOUS SURFACE REPAIR

- A. Where trenches are excavated through bituminous surfaced roads, driveways or parking areas, the surface shall be restored and maintained as follows:
 1. Trenches shall be backfilled with untreated base course from the pipe bedding to within 3 inches of existing asphalt surface or match existing asphalt thickness with a minimum thickness of 3 inches.
 2. Pavement restoration shall include priming of pavement edges with bituminous material and placing and rolling plant mix bituminous material to the level of the adjacent pavement surfaces.
 3. Asphalt shall be saw cut back 12 inches from existing trench wall's and compacted as shown on standard drawing.

3.3 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 03310 of these Specifications.

END OF SECTION

SECTION 02528

CONCRETE DRIVEWAY, SIDEWALK, CURB AND GUTTER

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 SUBMITTALS

- A. Cut sheets: Curb and gutter cut sheets must be submitted to the Town Engineer to be reviewed and approved. Allow 7 days for each review and approval.
- B. Concrete mix design must be submitted 48 hours before placement and physical-chemical analysis of aggregates, in accordance with Section 03304.
- C. Test reports: Submit test reports as requested by Engineer verifying compliance with specified standards.

PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

- A. Common fill, in accordance with Section 02205.
- B. Select fill, in accordance with Section 02206.

2.2 MATERIALS:

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

- A. In accordance with Section 03304.
- 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 AASHTO M-55.

2.3 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 and on winding roads, unless continuous lay down machine is used, or as directed by Town engineer.
- C. Continuous curb lay down machine shall be used on all winding roads over 100 feet long, unless otherwise approved by Public Works Director.
- D. All edge forms for sidewalk pavements, curbs and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade.
- E. 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.
- F. Exposed vertical and horizontal edges of the concrete in structures shall be chamfered by the placing of moldings in the forms.

2.4 PORTLAND CEMENT CONCRETE

- A. In accordance with Section 03304.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

- A. A minimum slope of 0.5 % shall be maintained on all concrete used for drainage purposes unless discussed with and approved by the Town Engineer.
- 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 additional cost to Town. When connecting to existing curb and gutter or waterways, the existing concrete shall be drilled and dowels inserted to make the connection.
- 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 02250.
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 02250.
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 02250.

- 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 at least 6 inches beyond the back of the sidewalk 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 02250.
- E. Select Backfill: Unless indicated otherwise, provide 6" minimum of select fill below curbs, gutter, driveway approaches, alley intersections, and 4" below 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.

3.3 CONCRETE PLACEMENT

- A. Place in accordance with Section 03310.
- B. No concrete shall be placed until the surfaces have been inspected and approved by the Public Works Director or Inspector.
- 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 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.
 - 2. 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.
 - 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 insulated 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 100 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 the concrete shall be kept above 40 degrees F and below 100 degrees F.

3.4 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 or exceed water - cement ratio.
- 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 (AASHTO M-157).
- 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 Town rights-of-way.

3.5 CONTRACTION JOINTS

- A. Sidewalks shall have contraction joints with the following requirements:
 - 1. 10 foot intervals.
 - 2. Approximately 3/16 inch wide.
 - 3. Approximately one-half of slab thickness.

3.6 EXPANSION JOINTS

- A. One-half (1/2) inch expansion joints shall be provided at 100 foot intervals in addition to locations where sidewalks adjoin existing sidewalks, curbs, or driveways.
- B. Material for one-half (1/2) 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 and extend to the bottom of the concrete.

3.7 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 Public Works Director concerning the types of material and procedure of installation.

3.8 FINISHING

- A. Refer to Section 03345 for finishing requirements.
- B. Slabs
 1. The concrete shall be brought to established grade and screened, 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 (1/2) 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 tamped 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.
- D. Sidewalk
 1. The sidewalk shall not hold water to a depth of more than one-fourth (3/16) 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 side walk parallel to the centerline of the street nor shall any part of the exposed surface present a wavy appearance.

3.9 CURING

- A. Apply curing compound in accordance with Section 03310 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 and kept wet for at least three (3) days.
- C. When authorized by the Town Engineer, a chemical curing agent may be used, provided it is applied in accordance with the manufacturers 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 Town Engineer.

END OF SECTION

SECTION 02607

MANHOLES AND COVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

1.3 REFERENCES

- A. ASTM A48 - Gray Iron Castings.
- B. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- C. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

1.4 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.

1.5 QUALIFICATIONS

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

1.6 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 Town Engineer.
- B. Manholes shall be furnished complete with cast iron rings and covers.

- C. Manhole spacing shall not exceed 400 lineal feet.
- D. Manholes shall be extended at the end of each line exceeding 150 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 every 100 feet and at all bends.
- G. Flow Channels
 1. The flow channel through manholes shall conform to the sewer pipe.
 2. The depth of flow channels should be up to one-half to three-quarters of the diameter of the sewer pipe.
 3. The invert channels shall have a minimum slope of 0.05 feet per diameter foot.
 4. The floor of the manholes outside the flow channels shall be smooth and slope toward the channel at not less than 1/4 inch per foot.
- H. Manhole Steps are required on 12 inch centers.

PART 2 PRODUCTS

2.1 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.
- B. Manhole Sections: Reinforced precast concrete in accordance with ASSHTO M-199 with gaskets in accordance with ASTM C923.
- C. Mortar and Grout: Type S.

2.2 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 ASSHTO 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 taper section shall be a maximum of 3 feet in height, shall be of eccentric conical design, and shall taper uniformly from 48 inches to 30 inches inside diameter.
 - c. 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.
 - d. 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.
 - e. 18" space maximum between cone and lid.
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 03310 of these Specifications.
2. Where sewer lines pass through or enter manholes the invert channels shall be smooth and semi-circular in cross section.
3. Changes of direction of flow within the manholes shall be made with a smooth curve with as long a radius as possible and a minimum of 0.2 feet of fall.
4. The floor of the manhole outside the flow channels shall be smooth and slope toward the channel at not less than ½ inch per foot.
5. For high ground water areas, precast manholes and bases shall be required.

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 233 pounds.

3. The foundry name, year of manufacture, and "SEWER", "STORM DRAIN", or "IRRIGATION" shall be marked on the cover.
4. All manhole rings shall be carefully set to the grade shown on the approved drawings or as directed by the Town Engineer.
5. The manhole covers shall be so installed to be within 1/4" from the asphalt surface.
6. A concrete ring 18" wide and 8" thick will be poured around lid in accordance with Section 03304.
7. All manhole lids shall be vented unless directed by the Town Engineer.

PART 3 EXECUTION

3.1 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.

3.2 PREPARATION

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

3.3 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.

3.4 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.

3.5 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 02660

PIPELINE TESTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Testing requirements for potable and non-potable water piping systems and sanitary sewers.

1.2 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.

1.3 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 Town Engineer, Inspector, or Town Water Superintendent witnessing and approving the test.
 9. One copy of video tape.

1.4 PROJECT CONDITIONS

- A. After construction of sanitary sewer lines, they shall be thoroughly cleaned and test for leakage and alignment in the presence of the Town Engineer or the Town Inspector before acceptance by the Town.
- B. Repair pipeline system at no additional cost to Town until it passes subsequent retesting.
- C. Recording Equipment:

1. Supply all necessary equipment to perform pressure testing.
2. Secure Town'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 Town.

PART 2 PRODUCTS

2.1 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

3.1 PREPARATION

- A. Notify Town Engineer or Town Water Superintendent 48 hours in advance of test.
- B. Carry out tests as pipeline construction progresses to ensure construction methods are producing satisfactory results.

3.2 PRESSURE TEST

- A. 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.
- B. A minimum pressure of the designated class rating of the pipe being tested or a minimum pressure of 50% in excess of the maximum line operation pressure, which ever is greater, shall be maintained on the portion being tested for a minimum period of two hours, using hydraulic means to maintain the pressure.
- C. Maximum leakage during the test shall not exceed one-half (1/2) gallon per inch of diameter per 1000 feet of pipe.
- D. Suitable means shall be provided by the Contractor for determining water lost by leakage under the test pressure.

- E. Locate and repair the defective joints and retest until the leakage is within the specified allowance.
- F. Repair any noticeable leakage even if total leakage is less than allowable.
- G. 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	1567

3.3 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 1/2" maximum provided that such variation shall not result in a level or reverse sloping invert.
- B. The variation in the invert elevation between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surfaces shall not exceed 1/64" per inch of pipe diameter, or 1/2" maximum.

3.4 OBSTRUCTION TEST

- A. Visually examine pipe internally for obstructions by use of a high power light or mirror.
- B. When required by the Town Engineer, a round incompressible madrel which in 1" less in diameter than the internal diameter of the pipeline and 2 times the diameter in length will be passed through the pipeline.

3.5 NON-RIGID PIPE DEFLECTION TEST

- A. Test installed sections of non-rigid pipeline to ensure that circumferential

deflection of non-rigid pipe does not exceed 5 percent. Use mandrel of proper size.

3.6 INFILTRATION TEST

- A. No pipe section will be accepted if the infiltration rate exceeds 100 gallons per inch diameter per mile per 24 hours.

3.7 FLUSHING OF SANITARY SEWERS

- A. All sanitary sewer lines shall be flushed and cleaned prior to acceptance by the Town.
- 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 Town Engineer.
 - 4. After the lines have been thoroughly cleaned, they shall be tested between all manholes for displacement.

3.8 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 is the allowable leakage in gallons per minute per 1000 feet of sewer tested.
D is the internal diameter of the pipe in inches.
H is the difference in elevation in the water surface in the upper manhole and the invert of the pipe at the lower manhole (feet).

4. If the leakage from the sewer as shown by the test exceeds that allowed by the formula the Contractor shall make the necessary corrections to reduce the exfiltration to within permissible limits.
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 Town 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 Town Engineer.
2. The low pressure air test shall be conducted by the following method under the direction of the Town Engineer or Town 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 portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.003 cubic feet per minute per square foot of internal pipe surface of 2.0 cubic feet per minute minimum when tested at an average 3.0 psig greater than any back pressure exerted by ground water that may be over the

- pipe at the time of the test.
9. 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

10. If the installation fails to meet this requirement, the Contractor shall determine at his own expense the source of leakage.
11. The Contractor shall repair or replace all defective materials and/or workmanship.

3.9 VIDEO TEST

- A. The video test shall be supervised and witnessed by the Town Engineer or the Town Inspector and shall be done as follows:
 1. The lines and lateral connections will be televised.
 2. The Town may elect to be present during the television inspection process.
 3. All inspections shall be provided at the cost of the Developer until the lines are accepted by the Town.
 4. A flat or reverse grade will not be acceptable.
 5. If the pipeline is found unacceptable, the problem shall be corrected by the contractor and re-televised.
 6. The television inspection process shall be done while water is running in the pipes.
 7. Television inspection must be scheduled at least one (1) week in advance of date inspection is required.
 8. All video tapes shall be turned over to and become the property of the Town.
 9. 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. Obstruction test.
 - 2. Pressure test for gravity pipeline systems.
 - 3. Pressure test for pressure pipeline systems.
 - 4. 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 02668

WATER TRANSMISSION AND DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe and fittings for culinary water line.
- B. Valves, fire hydrants and water meters.

1.2 RELATED SECTIONS

- A. Section 02205: Common Fill.
- B. Section 02206: Select Fill.
- C. Section 02225: Excavating and Backfill Operations.
- D. Section 02250: Soil Compaction.
- E. Section 02660: Pipeline Testing.
- F. Section 02675: Disinfection.
- G. Section 03300: Cast-in-Place Concrete: Concrete for thrust restraints.

1.3 REFERENCES

- A. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
- B. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- C. ASTM B88: Seamless Copper Water Tube.
- D. ASTM D2241: Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
- E. ASTM D2855: Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and fittings.
- F. AWWA C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

- G. AWWA C105: Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.
- H. AWWA C110: American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
- I. AWWA C111: Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
- J. AWWA C151: Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- K. AWWA C500: Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.
- L. AWWA C502: Dry Barrel Fire Hydrants.
- M. AWWA C504: Rubber Seated Butterfly Valves.
- N. AWWA C600: Installation of Ductile-Iron Water Mains and Appurtenances.
- O. AWWA C900: Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
- P. UL 246: Hydrants for Fire - Protection Service.

1.4 SUBMITTALS

- A. Prior to construction submit 6 copies of the manufactures specification for all products to the engineer for approval.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.1 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 of 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.
- 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. 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. PVC 1120.
 - e. NSF Logo.
 - f. Identification Code.
- H. Minimum water main size is 8 inches for culinary water.

2.2 POLYVINYL CHLORIDE PIPE (PVC)

- A. All PVC pipe used for transmission lines shall be AWWA C-900, DR-18 or as determined by the Town Engineer. All PVC pipe used for secondary irrigation lines shall be AWWA C-900, DR-18 Purple pipe or as determined by the Town Engineer.
- B. 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.

- C. 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).
 - 4. Minimum water main size is 8 inches for culinary water.

- D. 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.

- E. 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.

- F. Concrete Blocking
 - 1. All fittings at bends and branches in water pipe lines shall be provided with concrete thrust blocking as shown on the Standard Drawings.
 - 2. All bolts shall be greased and bends will be wrapped with 8 mil plastic.
 - 3. Blocking shall be of concrete specified in Section 03300, 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.

2.3 GATE VALVES

- A. Gate valves may be used when application is 10" diameter or less.
- B. Furnish gate valves that conform to the requirements of AWWA C-500, with cast iron body, bronze mounted, double disc, parallel seat, non-rising stem design with "O" ring seals.

- C. Operating Direction: Open counterclockwise.

- D. Buried Valves: Unless otherwise shown or specified, valves shall be of Mechanical Joint connection design for buried service.

- E. Buried Valves shall have 2" operation nuts.

2.4 BUTTERFLY VALVES

- A. Butterfly valves shall be used for application greater than or equal to 12" in diameter.
- B. Material, in accordance with AWWA C-504.
- C. Body Type
 - 1. Valves shall be high strength cast iron ASTM A-126, Class B with 18-8 Type 304 stainless steel body seat.
 - 2. Valve vane shall be mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel nylon locked screws.
 - 3. Both valve ends shall be mechanical joint per AWWA Specification C-111 and accessories (bolts, glands, and gaskets) shall be included.
 - 4. All butterfly valves shall be of the rubber-seated tight-closing type. The rubber seat shall be a full circle 360° seat not penetrated by the valve shaft.
- D. Valve Shafts
 - 1. The valve shaft shall be one piece extending full size through the entire valve and operator with no neckdown, keyways, or holes to weaken it.
 - 2. The valve shaft shall have 304 stainless steel journals rotating in reinforced Teflon bearings.
 - 3. Valves shall have permanently set two-way thrust bearing.
 - 4. Packing shall be "triple-seal" rubber designed for permanent duty in underground service.

2.5 VALVE BOXES

- A. All buried valves shall be installed complete with a cast iron, 2 piece, screw type, 5 1/4 inch shaft valve box.

2.6 TAPPING SADDLES

- A. For tapping saddles used for service connections to plastic pipe, provide full circle saddles. For all other pipe provide double strap bronze alloy, ductile iron, or stainless steel saddles.
- B. Provide tapping saddles that have a minimum rated working pressure of 300 psi, neoprene Buna N gaskets, and bronze tapered threads.

2.7 LATERAL SERVICE CONNECTIONS

- A. Provide and install according to standard drawings.
- B. Service Pipe:
 - 1. Provide single length (no splices) of PEP pipe (iron pipe size) with compression fittings.
 - 2. 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.
 - 3. Service saddles are required on all taps unless indicated otherwise.
 - 4. In subdivision developments, the contractor shall be responsible to furnish and install the corporation type stop and laterals to a point on private property 10 feet past the street right-of-way line.
- C. Meter Boxes: Asphalt-dipped corrugated metal or ADS. Fiber meter boxes are not acceptable. Provide a meter box with ring and cover of sufficient strength to withstand vehicle loadings without breaking. Boxes are prohibited in driveways.
- D. Coppersettors or meter setters shall be manufactured by Ford series 70.
- E. All materials to be supplied by the Contractor, except for the meter.

2.8 HYDRANT

- A. In accordance with AWWA C502 and pattern approved by Owner.
- B. 6-inch cast iron hydrant as manufactured by Waterous.
- C. 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" 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 indicated otherwise.
 - 7. Connection to Main: O-ring seals and a 6" ASA 125 pound flanged inlet.
 - 8. Pressure: Designed for a 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.
- D. Mechanical joint or flanged in accordance with AWWA C110 and AWWA C111
 - E. Hydrant spacing shall not exceed 500-feet.

PART 3 EXECUTION

3.1 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.2 BEDDING

- A. Excavate pipe trench in accordance with Section 02225 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Form and place concrete for pipe thrust restraints at any change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil according to standard drawings.
- C. Place bedding material at trench bottom, fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact to 95 percent.
- E. Maintain optimum moisture content of bedding material to attain required compaction density.

3.3 INSTALLATION - PIPE

- A. The bottom of the trench shall be cut flat, true and even to provide uniform bearing for the full length of the pipe barrel.

- B. 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.
- C. Pipe bedding and trench backfill shall be as defined in the previous sections.
- D. As work progresses, interior of pipe shall be cleared of dirt and other superfluous materials.
- E. Trenches shall be kept free from water until pipe jointing has been completed. Pipe shall not be laid when condition or trench or weather is unsuitable for such work.
- F. 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.
- G. Maintain separation of water main from sewer piping in accordance with Utah State Plumbing Code.
- H. Install pipe to indicated elevation to within tolerance of 5/8 inches.
- I. Install ductile iron piping and fittings to AWWA C600.
- J. Route pipe in straight line.
- K. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- L. Install access fittings to permit disinfection of water system performed under Section 02675.
- M. Slope secondary irrigation water pipe and position drains at low points. Drains shall discharge into storm drain system or other stream course that will not adversely impact adjacent properties.
- N. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
- O. Establish elevations of buried culinary piping to ensure not less than 5 feet of cover.
- P. Establish elevations of buried irrigation piping to ensure not less than 2 feet of cover.

- Q. Install metallic tape continuous over top of pipe buried 12 inches above pipe line.
- R. Backfill trench in accordance with Section 02250.
- S. 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 repaired, 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.
- T. 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.
 - 3. All defective, damaged or unsound pipe shall be rejected.
- U. Location of Stub Pipes
 - 1. The location of each 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.
 - 2. The portion of the 2 x 4 extending above ground, shall be painted as follows:
 - a. GreenRed - indicating sewer stub.
 - b. Blue - indicating water.
 - 3. 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.

3.4 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on solid bearing.
- B. Locate valves on property lines, at each intersection, and not more than 500 feet between.

- C. Center and plumb valve box over valve. Set box cover flush with finished grade with concrete collar as per standard drawings.
- D. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- E. Paint hydrants Red.
- F. 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.

3.5 INSTALLATION - SERVICE CONNECTIONS

- A. The contractor or home owner must provide and install all parts according to the standard drawings.
- B. The Engineer or Public Works Department must inspect the installation before burying or backfilling. The Contractor shall conform to the following requirements before a water meter shall be installed by Francis Town:
 1. Notify the Water Department at least five working days prior to the time the meter is to be installed and before backfilling.
 2. The water lateral should be exposed in the street right-of-way one foot outside the property line, even if the lateral extends onto the property.
 3. The end of the house lateral should be within 2 feet of the service lateral.
 4. Both laterals should be exposed freely in the center of the excavation.
 5. To prevent damage from possible freezing, the water lateral may be covered with materials such as sand, light gravel, straw, insulation, or similar light materials.
 6. To establish the correct street right-of-way line, the property line pins must be in place on the sidewalk.
- C. All of the above requirements must be complied with to the satisfaction of the Town before the water meter will be installed.
- D. A service charge will be assessed for crew time when the prerequisites are not met before the scheduled item for setting a meter. This fee must be paid before the meter installation will be rescheduled.
- E. Any required re-setting of the water meter following initial installation shall be done by the Town at the expense of the Developer or Contractor.

- F. Place meter can in 1 foot behind property line, park strip or 1 foot behind sidewalk.
- G. Install setter no closer than 24" of ground surface.
- H. Lids shall be flush with the finished ground elevation or the top of sidewalk elevation.

3.6 DISINFECTION OF CULINARY WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 02675.

3.7 TESTING OF WATER PIPING SYSTEMS

- A. Test pipeline system in accordance with Section 02660.

3.8 TRACER WIRE INSTALLATION

- A. Copper tracer wire to be installed the total length of pipeline with a branch to each tee, cross, and fire hydrant. (See Detail).
 - 1. Copper wire should be #14 gauge single strand jacketed wire, manufactured for underground service.
 - 2. Wire shall be continuous without breaks. Splices shall be made with petroleum filled wire nut caps.
 - 3. Tracer Wire to be secured to top of pipe at a minimum of every Ten feet, by means other than metallic.
 - 4. Tracer Wire should be brought up in all firehydrants in culinary water lines, and in the first lateral of each street for pressurized irrigation (not to exceed 500 feet).
- B. A continuity test shall be performed by the contractor in the presence of the Town engineer prior to paving.

3.9 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with section 02250.
- B. If tests indicate Work does not meet specified requirements, remove work, replace, and retest.

END OF SECTION

SECTION 02675
DISINFECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Disinfection of potable water system.
- B. Test and report results.

1.2 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.

1.3 DEFINITIONS

- A. Disinfectant Residual: The quantity of disinfectant in treated water.
- B. ppm: Parts per million.

1.4 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.

1.5 QUALITY ASSURANCE

- A. Affidavit by manufacturer that disinfectant conform to AWWA standards.
- B. Bacteriological Laboratory: Certified by State of Utah.

1.6 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.

1.7 REGULATORY REQUIREMENTS

- A. Conform to State of Utah public drinking water regulations.

PART 2 PRODUCTS

2.1 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 gas according to manufacturer's specification.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to starting the disinfection procedure ensure the potable water system is completed, cleaned, tested in accordance with Section 02660 and ready for disinfection.
- B. Ensure that the pipeline to be disinfected is not connected to the existing system.

3.2 DISINFECTION OF WATER LINES

- A. Use one of the approved methods in AWWA C651.
- B. 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.
- C. 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.)
- D. 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

- E. 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.

3.3 DISINFECTION OF CULINARY WELLS

- A. Use one method defined under AWWA A100 as approved by Town Engineer.
- B. Do not start disinfection until well is thoroughly cleaned.
- C. Use a disinfecting solution containing a minimum of 50 ppm residual chlorine.

3.4 DISINFECTION OF WATER STORAGE RESERVOIRS

- A. Use one method defined under AWWA C652, as approved by Town 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.

3.5 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.

3.6 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. Failing to flush the line may require Contractor to replace all gaskets and valves within the system at Contractor's expense.

END OF SECTION

SECTION 02720

SANITARY SEWER AND STORM DRAIN SYSTEMS

PART 1 GENERAL

1.1 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.

1.2 REFERENCES

- A. AASHTO-291: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- B. ASTM D 1248: Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
- C. ASTM D 2239: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter.
- D. ASTM D 2321: Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- E. ASTM D 2657: Standard Recommended Practice for Heat Joining of Thermoplastic Pipe and Fittings.
- F. ASTM D 2774: Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
- G. ASTM D 3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- H. ASTM D 3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- I. ASTM F 405: Standard Specification for Corrugated High Density Polyethylene (PE) Tubing and Fittings.
- J. ASTM F 667: Standard Specification for Large Diameter Corrugated High Density Polyethylene Tubing and Fittings.

- K. ASTM F 1055: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

1.3 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).

1.4 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

2.1 CONCRETE SEWER AND STORM DRAIN 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.

2.2 REINFORCED CONCRETE SEWER AND STORM DRAIN 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.

2.3 CORRUGATED METAL CULVERT PIPE

- A. Galvanized or aluminized steel
 - 1. Material according to ASTM A-929
 - 2. Pipe according to ASTM A-760
 - 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 Town Engineer.
- D. Minimum No. 14 gage plate thickness.

2.4 SUBSURFACE DRAIN PIPE

- A. Pipe
 - 1. Perforated PVC (ASTM D-1784).
 - 2. Perforated Concrete Sewer Pipe (ASTM C-14 or C-76).
 - 3. Corrugated polyethylene piping (ASTM F-405-77a).
- B. Bedding shall be drain rock.

2.5 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 Town Engineer for approval and his approval shall be obtained before pipe is purchased.
- C. This pipe shall be homogeneous throughout and free from 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 and 6-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 shall have the following minimum 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

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 Town Engineer's approval and his approval must be obtained before purchase of the wyes.

2.6 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 electrofusion 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: Bell and Spigot Type.
- 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.

2.7 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. 6-inch laterals shall connect in to the main line through sewer man holes.
- E. Service lateral shall be laid at a uniform grade and in a straight alignment insofar as possible.
- F. Clean outs shall be placed at a minimum of 5' feet from the structure being serviced, one every 100' and at all changes in direction.
- G. No more than one residential connection per lateral.
- H. SDR-35 PVC pipe shall be used on all laterals.
- I. Connection to the mainline shall be done in the top 1/3 of the pipe.

PART 3 EXECUTION

3.1 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.
- 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 re-jointed 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. Install metallic tape continuous over top of pipe buried 12 inches above pipe line.

3.2 GRAVEL FOUNDATION FOR PIPE

- A. Refer to Section 02225

3.3 COMPACTION

- A. Refer to Section 02250.

END OF SECTION

SECTION 02772

PONDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clear pond site and dispose of debris and unsuitable material.
- B. Materials for dike.

1.2 REFERENCES

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

1.3 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.

1.4 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.

1.5 JOB CONDITIONS

- A. Do not interrupt surface drainage systems at site without Town Engineer's approval.
- B. Correct any damage caused by runoff or erosion during construction.

PART 2 PRODUCTS

2.1 BACKFILL SOILS

- A. NativeFill: In accordance with Section 02205.
- B. Common Fill: In accordance with Section 02205.
- C. Select Fill: In accordance with Section 02206.
- 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 7×10^{-6} cm/sec.
- E. Obtain Town Engineer's approval of the material to be supplied prior to beginning construction.

2.2 GEOTEXTILE MATERIALS

- A. Non-biodegradable 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

3.1 DETENTION AND RETENTION PONDS

- A. Freeboard: 2 foot on dikes, 1 foot on excavations.
- B. Slopes: 4:1 side slopes minimum, 2% bottom slope.
- C. Landscaping: Grass or other suitable landscaping materials should be used and irrigation systems installed. Developers will be required to escrow funds to landscape ponds when located on private lots for reimbursement when the landscaping is complete.
- D. Easements: Provide 20' easements for pipelines and access to maintain pond.

3.2 EXCAVATION AND PREPARATION

- A. In accordance with Section 02225.
- 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 02250.
- D. Ponds shall be designed for a minimum of 25 year 24 hour storm with capabilities of 100 year overflows.

3.3 EMBANKMENT CONSTRUCTION

- A. Compact backfills to an average Standard Proctor density of 96 percent in accordance with Section 02250 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. Top of bank shall not be less than 10' wide with a 2% slope toward pond.
- E. Overflow shall be provided by safety weir or a 5 fps max overflow outlet.

3.4 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.

3.5 FINISHING

- A. After pond and slopes have been constructed to the lines and grades indicated, spread topsoil 6" deep on dikes and grade to uniform slope
- B. Pond shall be landscaped as approved by the City Engineer.
- C. Dispose of excess or unsuitable materials and level all affected areas.
- D. Leave site free of excess fill material and debris.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 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.

1.2 REFERENCES

- A. AASHTO M 254: Standard Specification for Corrosion Resistant Coated Dowel Bars.
- B. ACI 301: Specifications for Structural Concrete for Buildings.
- C. ACI 315: Details and Detailing of Concrete Reinforcement.
- D. AASHTO M-32: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- E. AASHTO M-55: Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
- F. AASHTO M-55: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- 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 Document: Manual of Standard Practice.

1.3 SUBMITTALS

- A. 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.

1.4 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

2.1 MATERIALS

- A. Reinforcing Steel: In accordance with AASHTO M-31 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 AASHTO M-55 plain type; in flat sheets or coiled rolls either uncoated or as indicated.
- C. Stirrup Steel: In accordance with AASHTO M-32.
- D. Plain Dowel Bars for Expansion Joints: In accordance with AASHTO M-31, 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 1/2".
 3. For load transfer bars, paint with 1 coat of lead or tar paint conforming to AASHTO M 254 and coat 1/2 with grease.

2.2 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 installation and placement of concrete.

2.3 FABRICATION

- A. Fabricate reinforcement in accordance with ACI , providing for the concrete cover specified in Section 03304.
- 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

3.1 PLACING

- A. All reinforcement to be free of loose mill scale, loose or thick rust, dirt, paint, oil or grease.
- B. Place all reinforcement in the exact position indicated. With tie wire tie bars together at alternate intersections.
- C. 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.
- D. 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.
- E. 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.

3.2 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 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.

3.3 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.

END OF SECTION

SECTION 03304

PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Portland cement concrete material requirements.
- B. Mix design requirements.

1.2 REFERENCES

- A. AASHTO T- 26: Standard Method of Test for Quality of Water to be used in Concrete.
- B. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass 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. AASHTO M-157: Standard Specification for Ready-Mix Concrete.
- G. AASHTO M-85: Standard Specification for Portland Cement.
- H. AASHTO M-152: Standard Specification for Air-Entraining Admixtures for Concrete.
- I. AASHTO M-194: Standard Specification for Chemical Admixtures for Concrete.
- J. AASHTO M-295: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.3 DEFINITIONS

- A. Average Strength (f_{cr}): The required average strength for 3 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.

1.4 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.

1.5 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 AASHTO M-157 and requirements in this Section.
- F. Testing Concrete: In accordance with Section 01450.

PART 2 PRODUCTS

2.1 CEMENT

- A. Type II (moderate), in accordance with ASTM M-185.

2.2 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. Clean, non-staining and not detrimental. Comply with AASHTO T 26.

2.3 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.

2.4 ADMIXTURES

- A. Air Entrainment: pH 2.0 maximum type in accordance with AASHTO M-152.
- B. Water Reducing and Water Retarding Agents: In accordance with AASHTO M-194.
 - 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 C1-) 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 10 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 10% fly ash will be allowed.

2.5 ENTRAINING AGENT

A. An air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to AASHTO Designations M-152.

2.6 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			
	Concrete Class		
Properties	4000	3000	2500
Specified Compressive Strength f_c' at 28 days, psi	4000	3000	2500
Compressive Strength at 7 days, psi (a)	2350	2000	1675
Cement content (94 lb. sacks of cement per cubic yard of concrete)	6	5.5	5
Entrained air content, (% by volume)	4 to 6	5 to 7	5 to 7
Slump Range, in. (b)	2 to 4	2 to 4	2 to 4

(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. 4000 psi: Reinforced structural concrete.
 - 2. 4000 psi: Sidewalks, curb and gutter, cross gutters, pavements and unreinforced footings and foundations.
 - 3. 3000 psi: Thrust blocks, anchors and mass 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.
 - 4. The maximum permissible water cement ratio (including free moisture of aggregates shall be 5 and 5 3/4 gallons per bag of cement respectively for 4000 and 3000 psi air entrained concrete.

2.7 HAND MIXING

- A. Do not hand mix batches exceeding 0.5 cubic yards.

2.8 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.

PART 3 EXECUTION

3.1 DELIVERY

- A. Slump: Do not transport concrete to the work location if concrete 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.

3.2 RE-TEMPERING

- A. Adding Water: When concrete arrives at site with slump below specified, water may be added once if neither the maximum approved water/cement ratio nor the maximum slump is exceeded provided that the drum turns a minimum of 90 revolutions.
- 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.

3.3 CONCRETE PLACEMENT

- A. In accordance with Section 03310.

END OF SECTION

SECTION 03310

CONCRETE WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete placement operations for slabs on grade, slabs on fill, structural building frame, and other concrete components.

1.2 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.

1.3 RELATED WORK

- A. Manufacture of Portland cement concrete and its delivery to site, in accordance with Section 03304.

1.4 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.

1.5 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 03305.

1.6 WARRANTY

- A. Repair or replace defective or damaged work at no additional cost to Town.

PART 2 PRODUCTS

2.1 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 02528 and ACI 315.

- D. Reinforcement: In accordance with section 03200.
- E. Covering: Waterproof paper, polyethylene sheet or burlap cloth complying with AASHTO M 182, Class two.

2.2 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.

PART 3 EXECUTION

3.1 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 work placed at ambient temperatures above 50 degrees F.
- F. Use of admixtures will not relax cold weather placement requirements.
- 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.

3.2 JOINTS

- A. Saw cut patterns where indicated. Saw cut control joints without raveling of the concrete. A maximum of 24 hours after pouring the concrete and prior to occurrence of any surface cracking.

3.3 CONSOLIDATION

- A. In accordance with ACI 309.
- B. Keep spare vibrator available during concrete placement operations.

3.4 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 03345. 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 matrix terrazzo, or setting beds for tile, terrazzo, vinyl flooring, or like items.

3.5 CURING

- A. 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.
- B. 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.
- C. 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 kept continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

3.6 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. Three (3) - 4-inch cylinders shall be taken and a slump and air test shall be done at the beginning of concrete placement and every 50 cubic yards thereafter.

3.7 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. Three (3) standard 4-inch cylinder samples of concrete from trucks receiving water after addition of water.

3.8 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 03345 requirements.

3.9 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.

3.10 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.

END OF SECTION

SECTION 03345

CONCRETE FINISHING

PART 2 GENERAL

1.1 SECTION INCLUDES

- A. Application procedure for concrete surface finishes.

1.2 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 form work construction, concrete placement schedule, and form work removal to ensure that surfaces are blasted at same age for uniform results.

PART 2 EXECUTION

2.1 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. Feathered edges 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. Whereas-cast finishes are indicated, total patched area may 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.

2.2 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.

2.3 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, bush hammer, 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.

2.4 RUBBED FINISHING

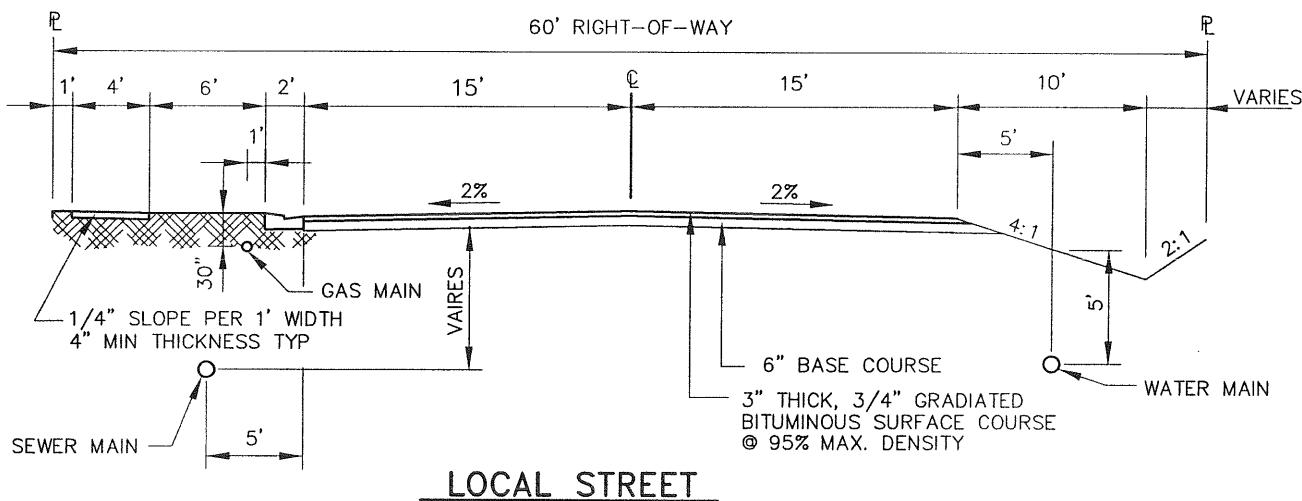
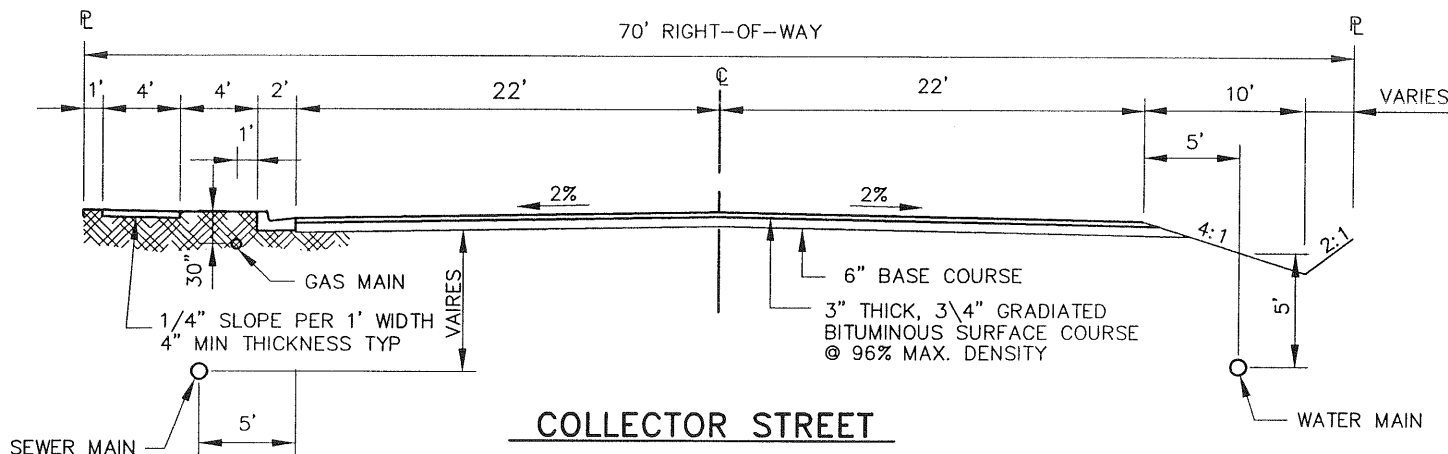
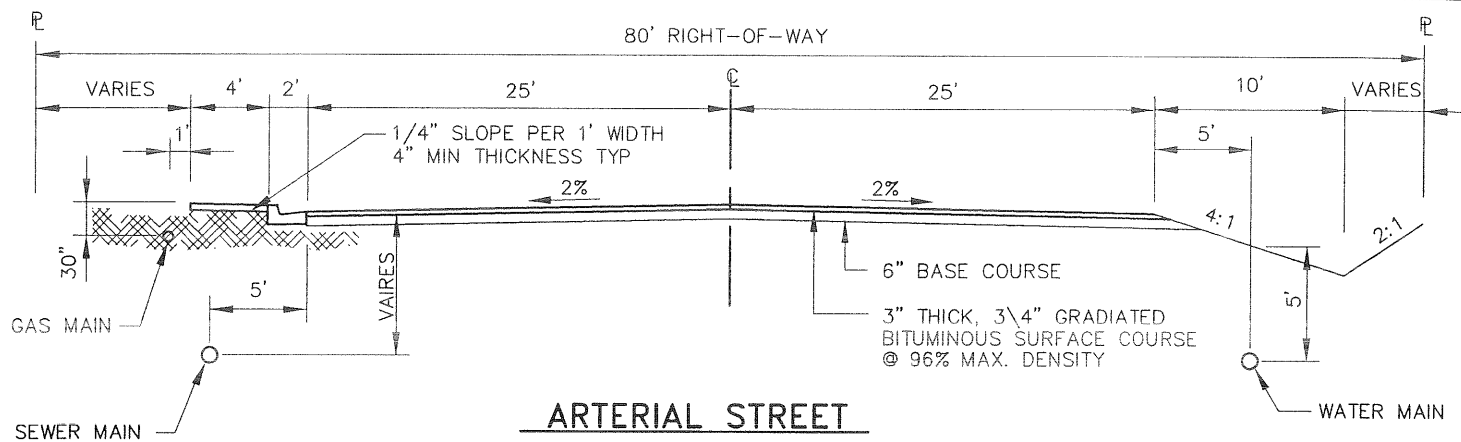
- A. Produce following finishes on concrete with a smooth form finish.
1. Smooth Rubbed: Remove forms and perform necessary patching as soon after placement as possible.
 2. Finish newly hardened concrete no later than 24 hours following form removal.
 3. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
- B. 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.
7. Cork Floated: Remove forms within 2 to 3 days of placement where possible.
8. Remove ties.
9. Remove all burrs and fins.
10. Dampen wall surface.
11. Apply mortar with firm rubber float or with trowel, filling all surface voids.
12. Compress mortar into voids.
13. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer.
14. Produce final texture with cork float using a swirling motion.

2.5 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 unformed surfaces.

END OF SECTION



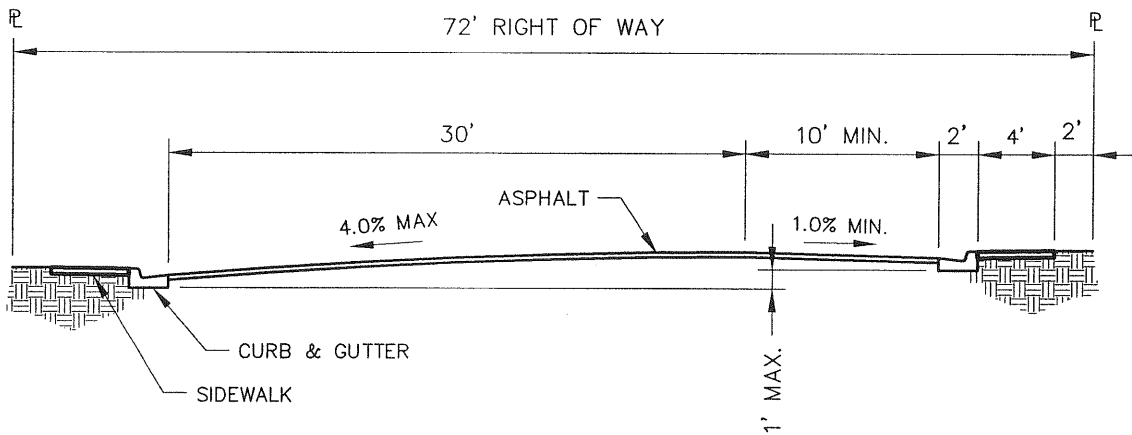
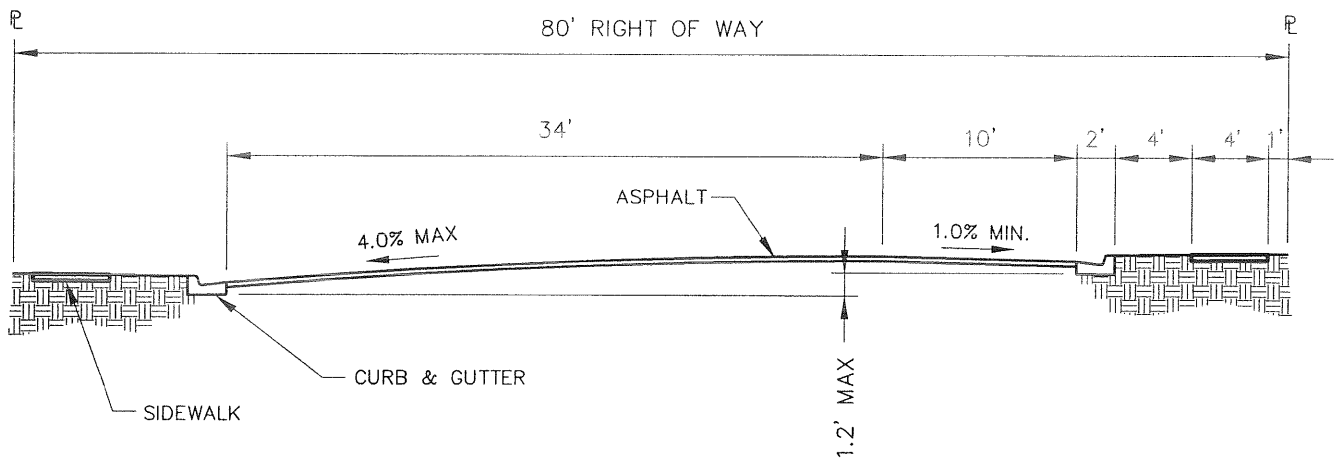
NOTES:

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 APPROVED.
3. NO WATER AND SEWER LINE SMALLER THAN 8-INCH DIA. SHALL BE INSTALLED.
4. A-1-a GRADIATED SUBBASE MAY BE REQUIRED WHEN EXISTING SUBBASE IS DETERMINED BY THE CITY ENGINEER TO BE UNSUITABLE.
5. CURB, GUTTER AND SIDEWALK IF REQUIRED.
6. SIDE SLOPE: 4:1 ON FILL, 3:1 ON CUTS UP TO 5' AND 2:1 THEREAFTER.

**STREET CROSS-SECTIONS
& UTILITY LOCATIONS**

N.T.S.

FRANCIS TOWN
STANDARD DRAWING
STREETS-1



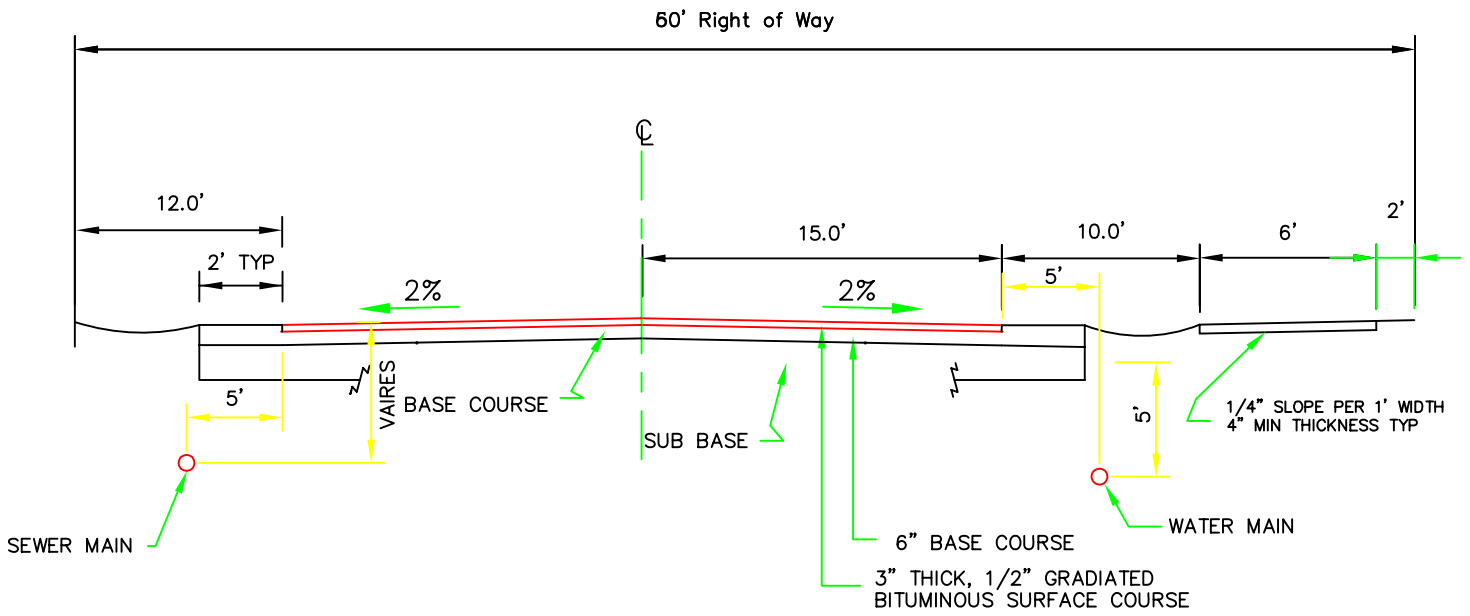
STREET CROSS-SECTIONS

(CURBS AT UNEQUAL ELEVATIONS)

N.T.S.

FRANCIS TOWN
STANDARD DRAWING

STREETS-2



STREET CROSS-SECTIONS & UTILITY LOCATIONS

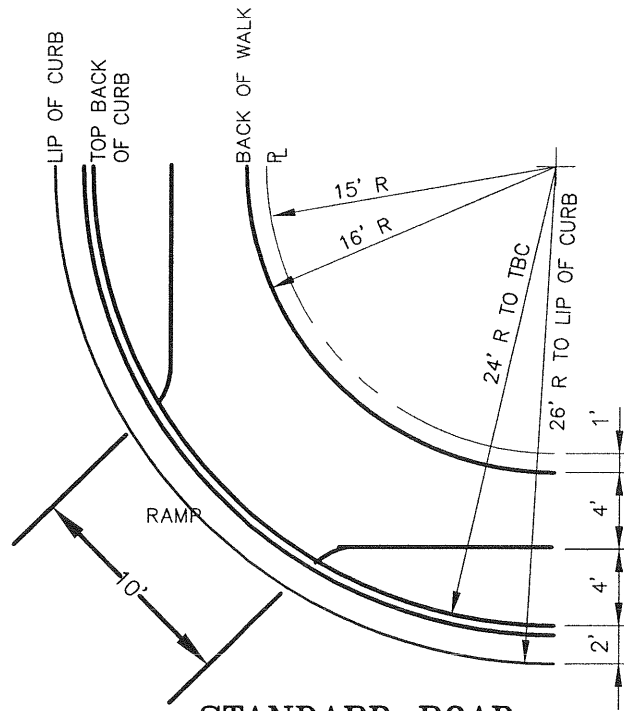
N.T.S.

APRIL 2007

FRANCIS TOWN
STANDARD DRAWING

STREETS-3

DIMENSIONS AT CORNERS OF STANDARD STREET INTERSECTIONS SHOWING WHEEL CHAIR RAMP

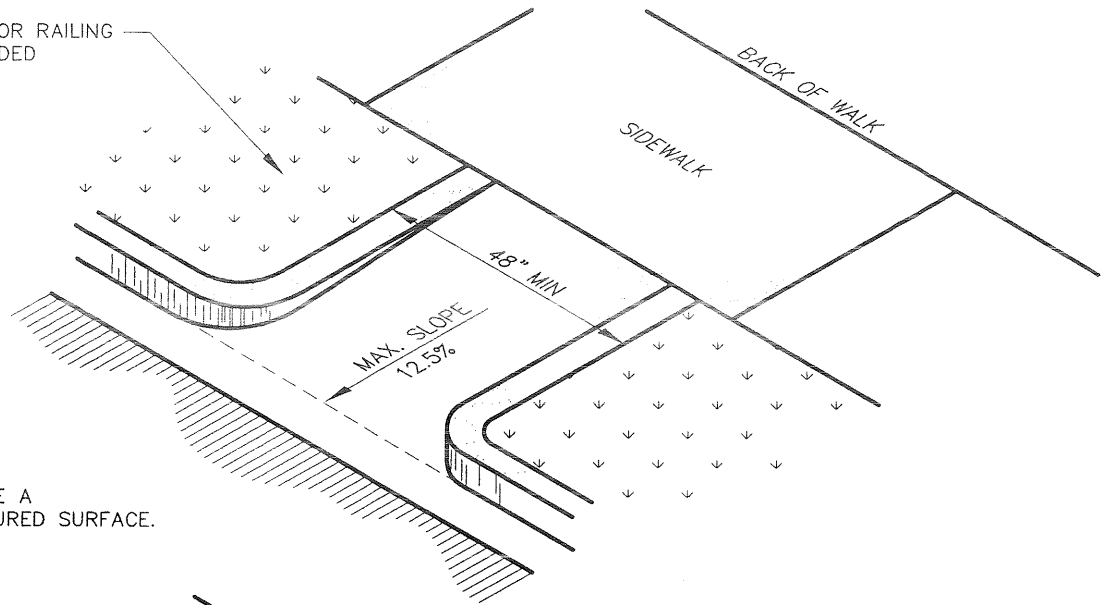


STANDARD ROAD WITH PLANTER STRIP

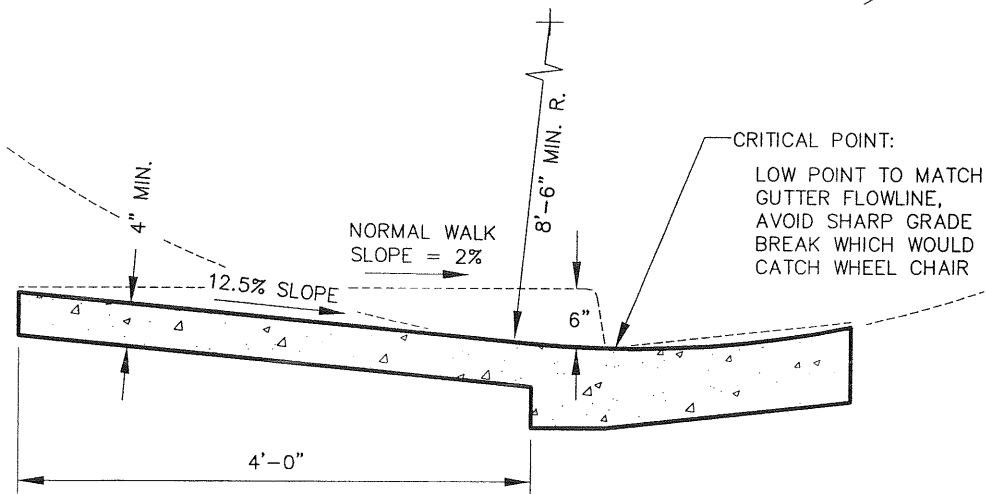
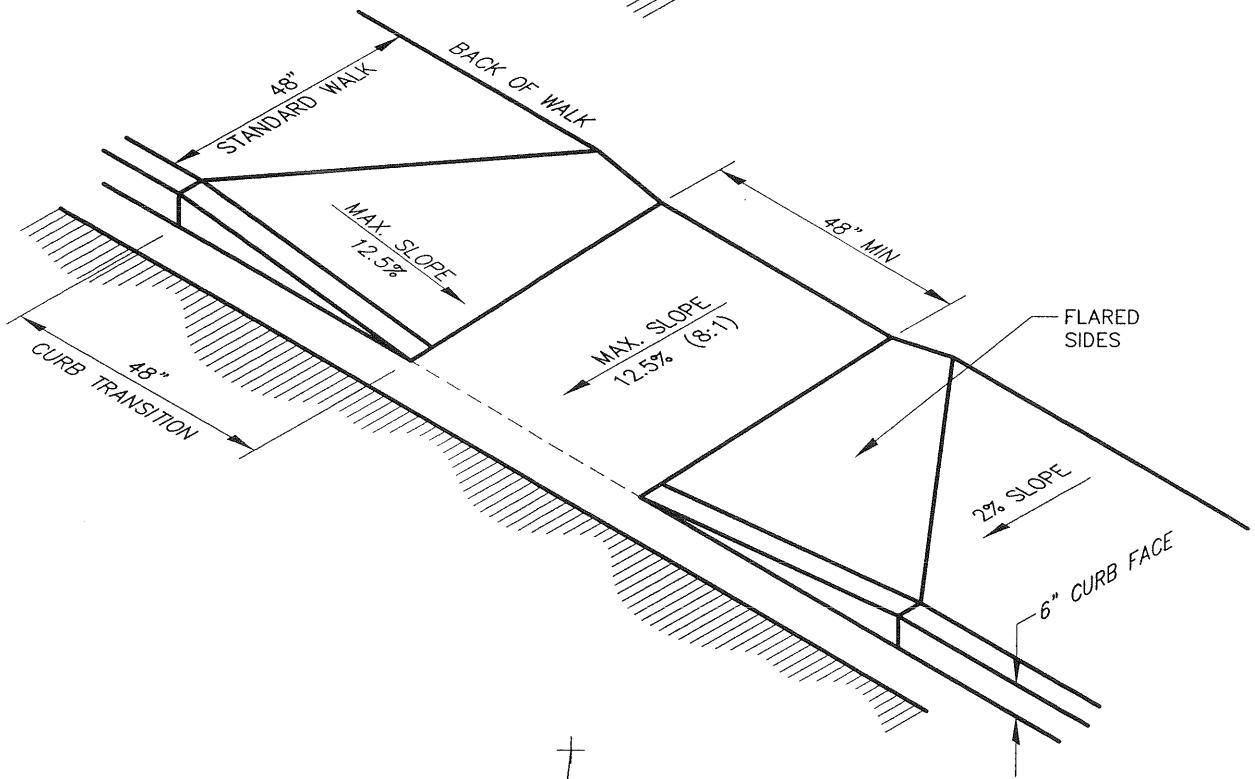
Notes

1. Ramp should be stamped with ADA approved texture

PLANTING OR RAILING RECOMMENDED



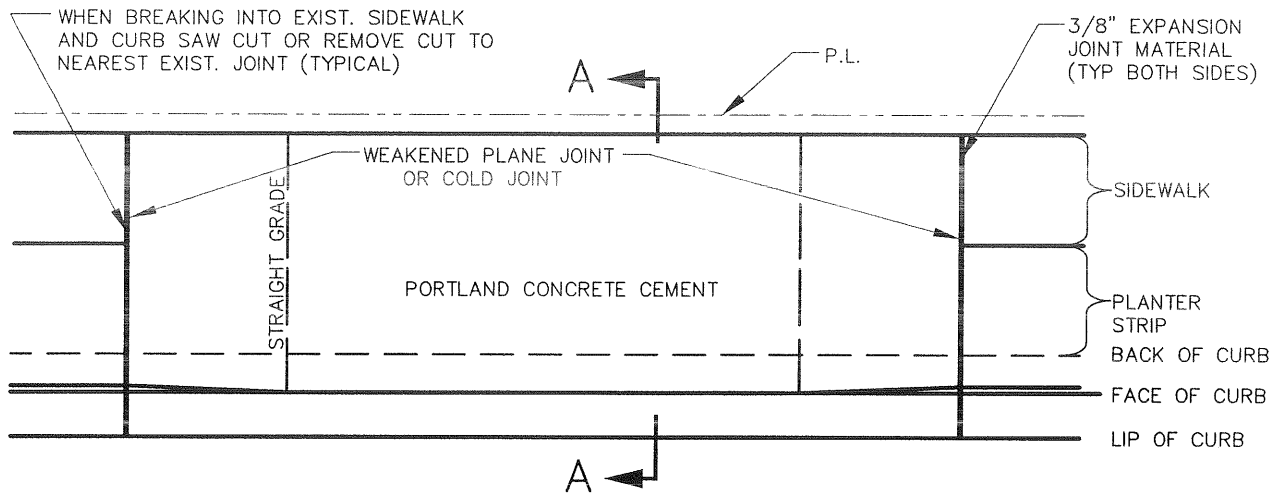
NOTE:
RAMPS SHALL HAVE A
BROOMED OR TEXTURED SURFACE.



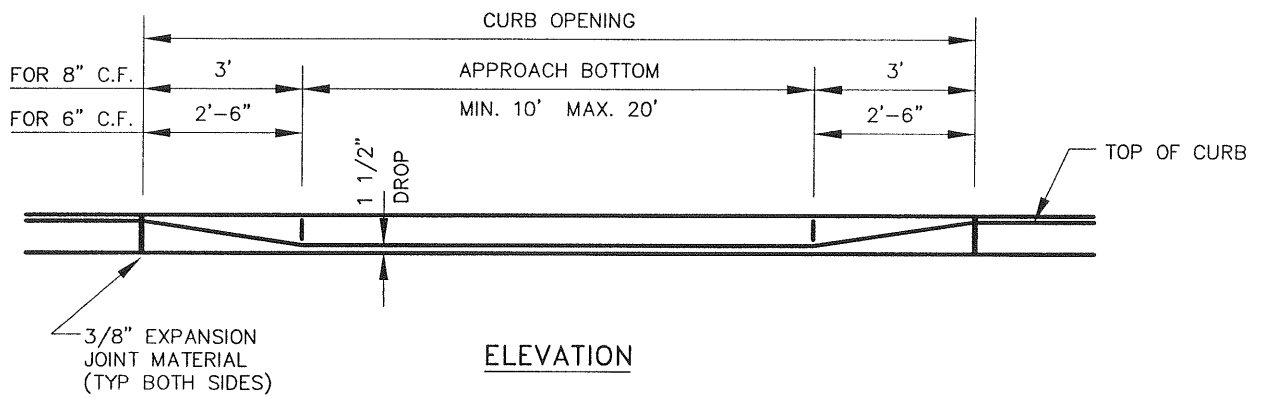
WHEEL CHAIR RAMP

N.T.S.

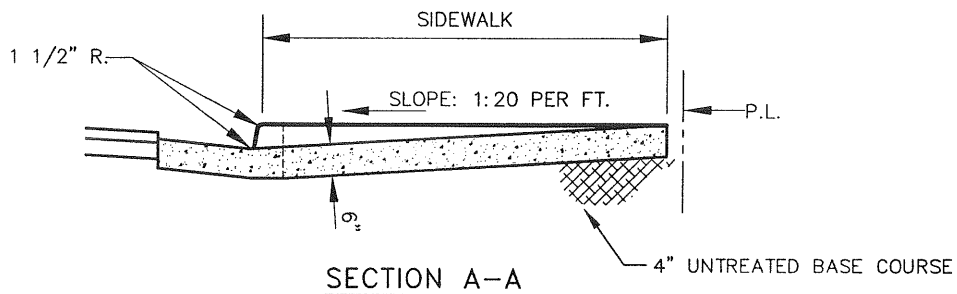
FRANCIS TOWN
STANDARD DRAWING
STREETS-5



PLAN



ELEVATION



SECTION A-A

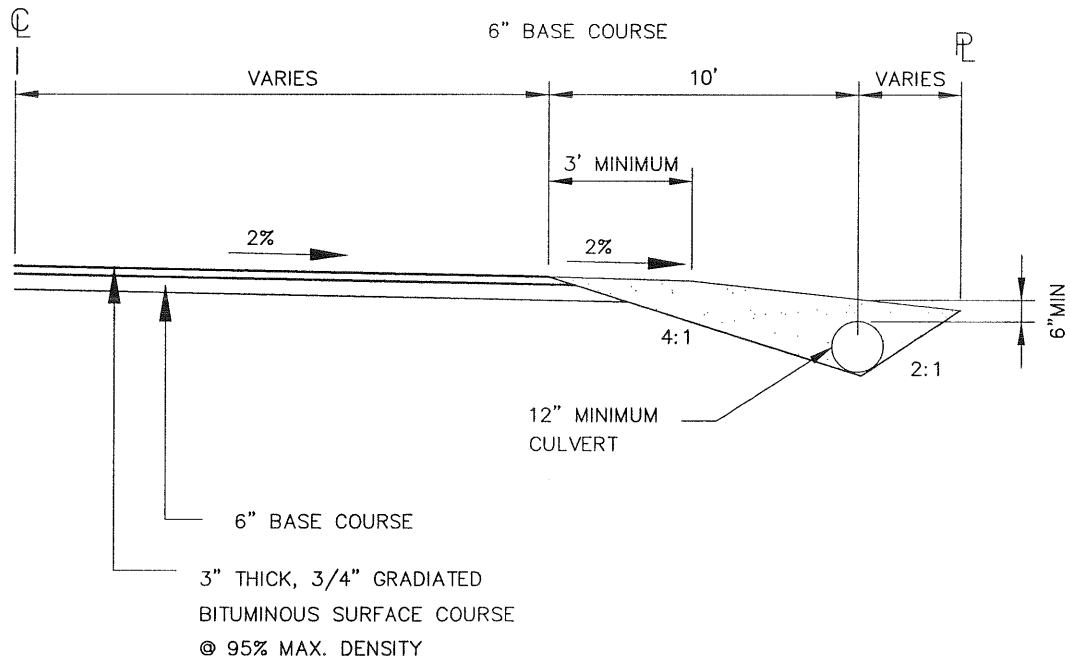
NOTE:
CURB OPENING SHALL HAVE A COURSE BROOM FINISH.
C.F. = CURB FACE

RESIDENTIAL DRIVEWAY APPROACH WITH CURB & GUTTER

N.T.S.

FRANCIS TOWN
STANDARD DRAWING

STREETS-6



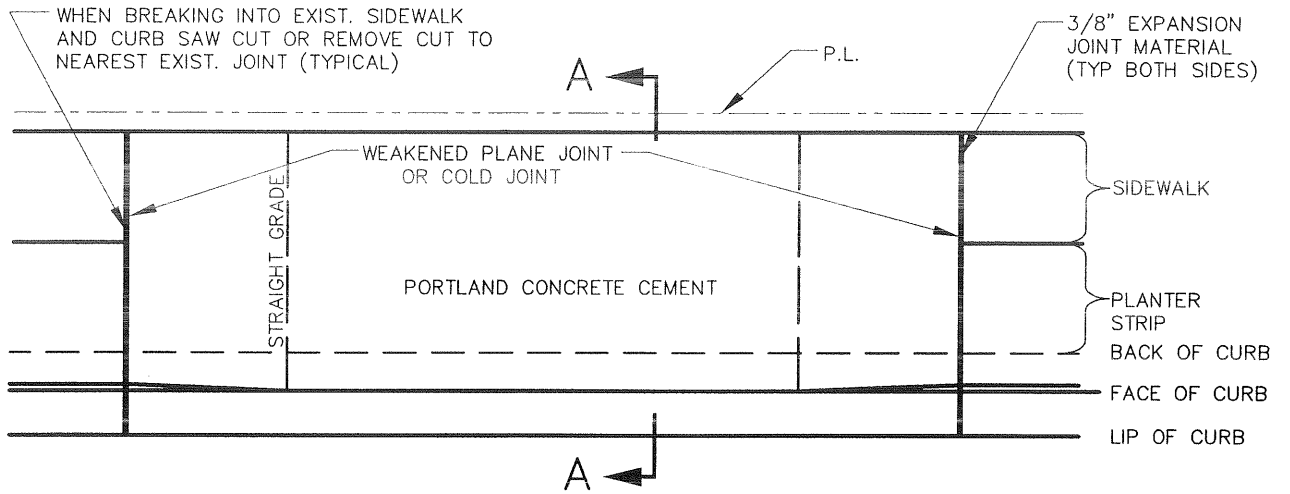
NOTES:

1. PROPERTY OWNER SHALL MAINTAIN A 2% GRADE FOR A MINIMUM OF 3 FEET BEYOND THE EDGE OF THE ROAD.
2. PROPERTY OWNER SHALL PROVIDE A 12 INCH MINIMUM CULVERT AS SHOW IN THE DRAWING.
3. DRIVEWAYS SHALL BE 1/4" BELOW THE EDGE OF ASPHALT.
4. SIDE SLOPE: 4:1 ON FILL, 3:1 ON CUTS UP TO 5' AND 2:1 THEREAFTER.

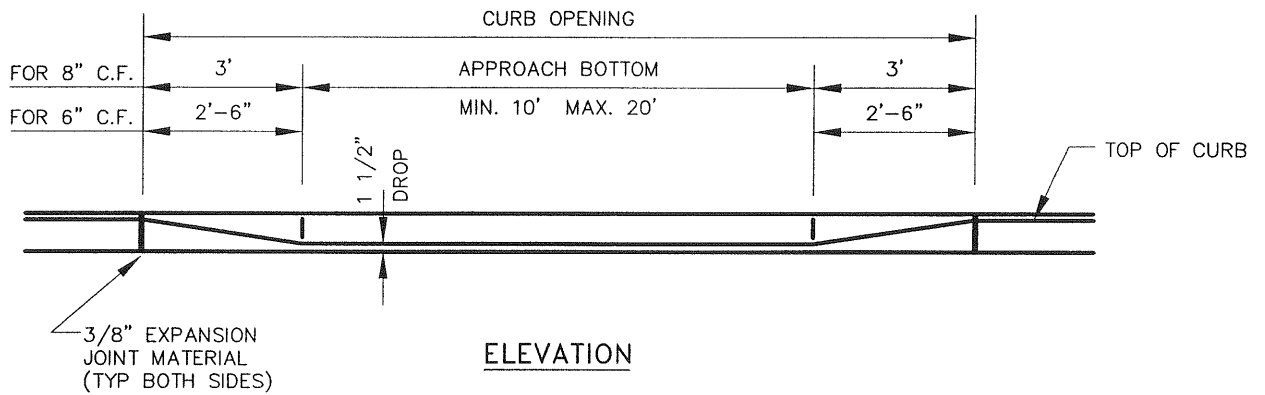
RESIDENTIAL DRIVEWAY APPROACH WITHOUT CURB & GUTTER

N.T.S.

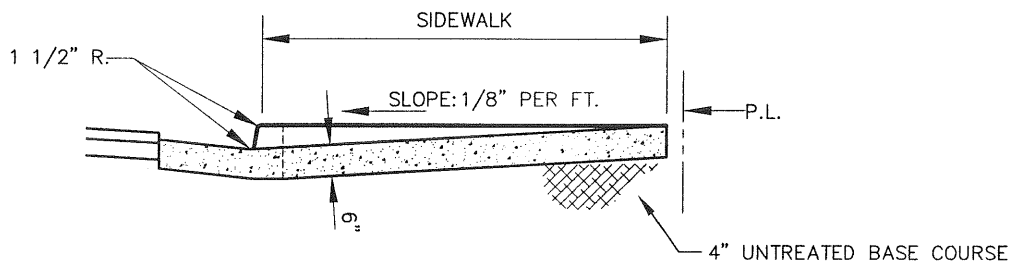
FRANCIS TOWN
STANDARD DRAWING
STREETS-7



PLAN



ELEVATION



SECTION A-A

NOTE:
 CURB OPENING SHALL HAVE A COURSE BROOM FINISH.
 C.F. = CURB FACE

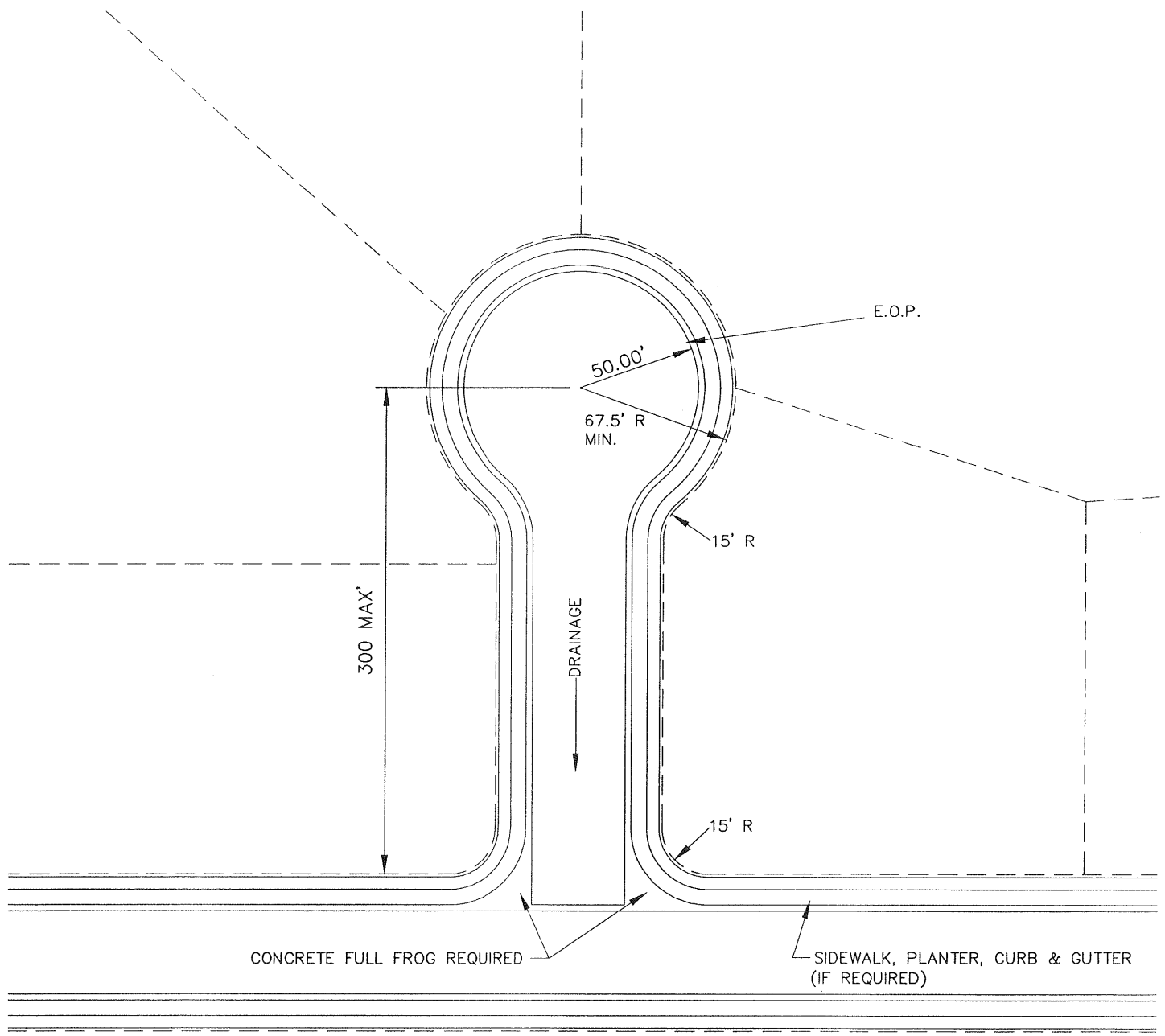
COMMERCIAL DRIVEWAY APPROACH

N.T.S.

FRANCIS TOWN
 STANDARD DRAWING

STREETS-8

60 ft EOP
72.5 ft ROW

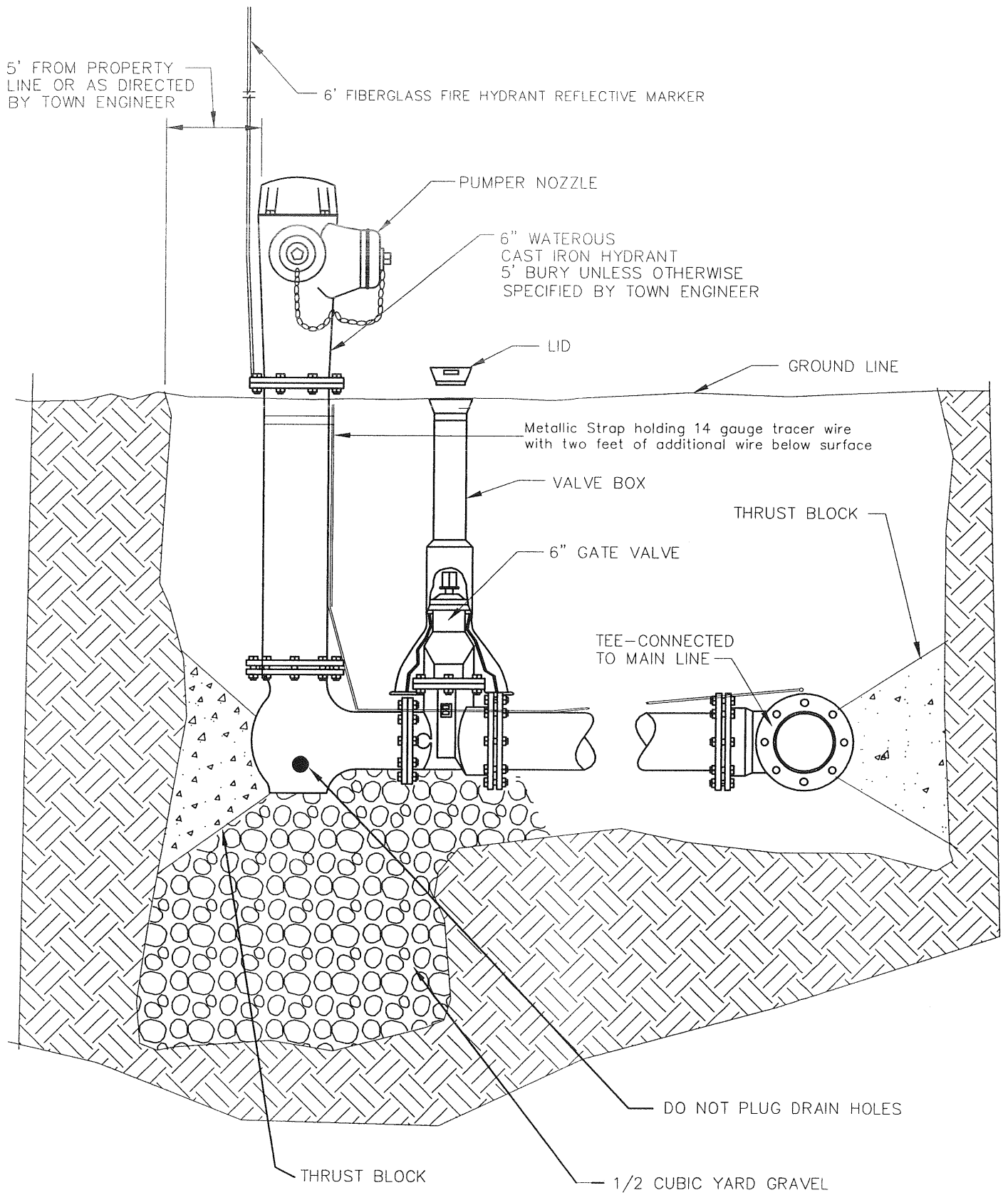


CUL-DE-SAC PLANS

N.T.S.

FRANCIS TOWN
STANDARD DRAWING
STREETS-9

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STANDARD FIRE HYDRANT DETAIL

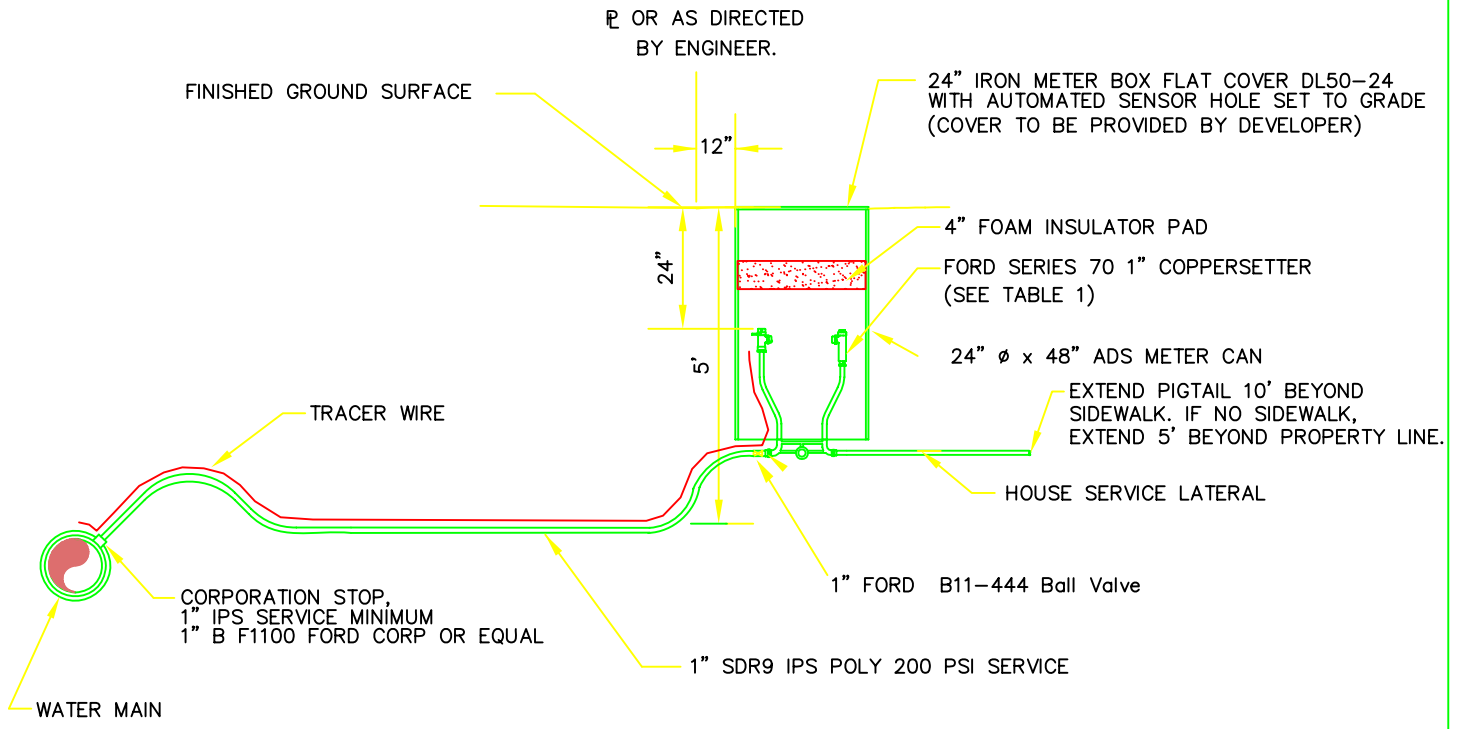
N.T.S.

FRANCIS TOWN
STANDARD DRAWING

WATER-1

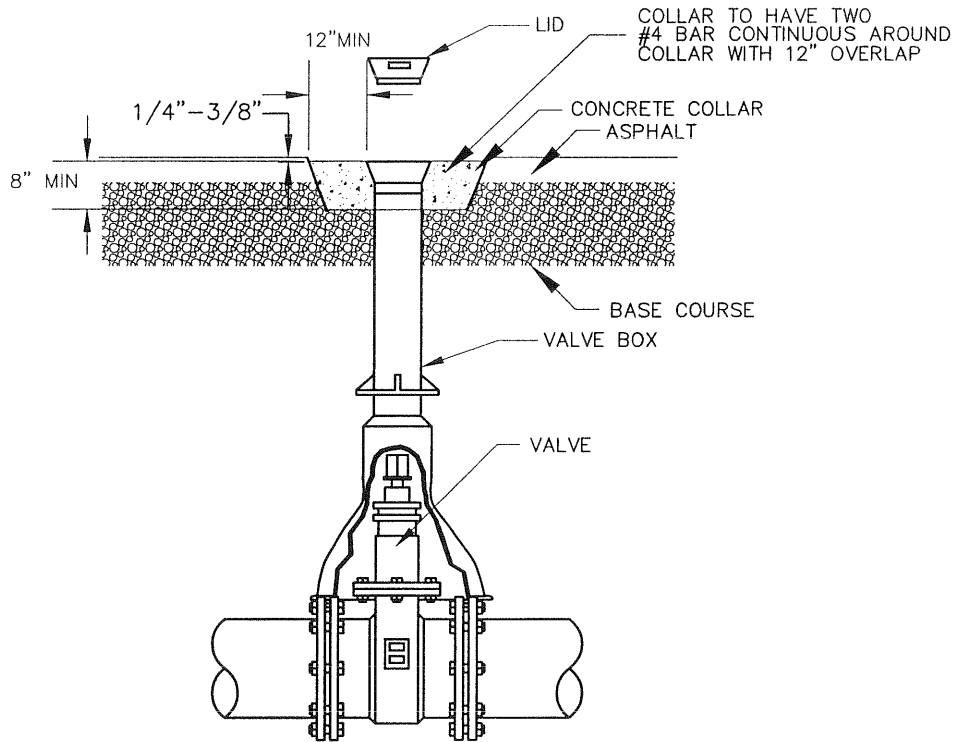
TABLE 1

METER SIZE	SETTER MODEL
1"	VHC74-24W-11-44



- NOTE: 1. METER BOX, COVER, COPPERSETTER, CORPORATION STOP, & SERVICE LINES TO BE FURNISHED AND INSTALLED BY DEVELOPER.
2. STAINLESS STEEL STIFFENERS ON ALL POLY CONNECTIONS
3. FORD BALL VALVE SHOULD BE ACCESSIBLE FROM INSIDE CAN
4. BOXES ARE PROHIBITED IN DRIVEWAYS
4. DEVELOPER SHALL SUPPLY THE TOWN WITH 1" X3/4" METER ADAPTER. TOWN WILL INSTALL WHEN THE METER IS INSTALLED.

WATER SERVICE CONNECTION
N.T.S.



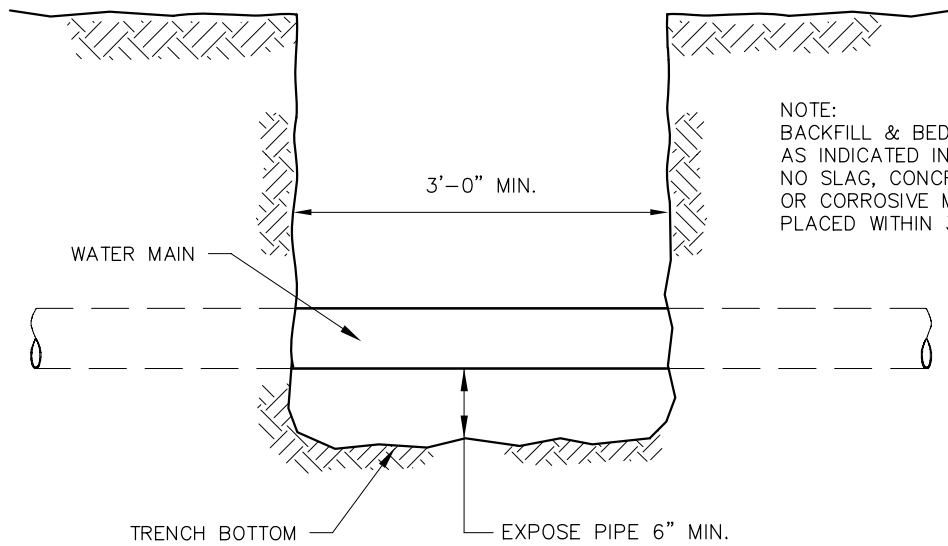
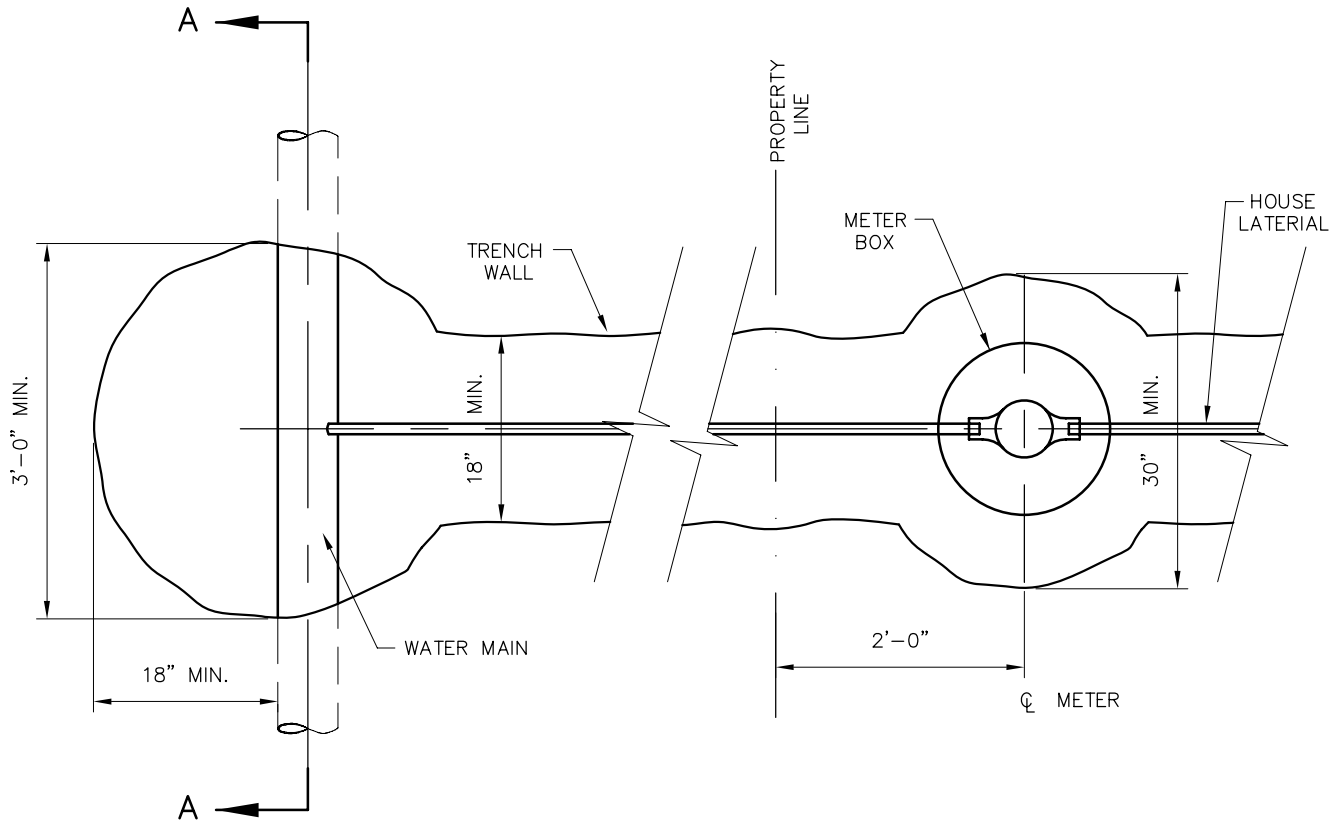
- NOTE: 1. RAISE VALVE BOX TO GRADE AFTER PAVING OPERATIONS ARE COMPLETED.
2. INSTALL VALVE EXTENSION IF VALVE NUT IS 2' BELOW THE LID.

VALVE BOX COLLAR DETAIL

N.T.S.

FRANCIS TOWN
STANDARD DRAWING

WATER-3

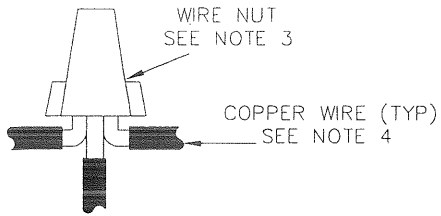


SECTION A-A

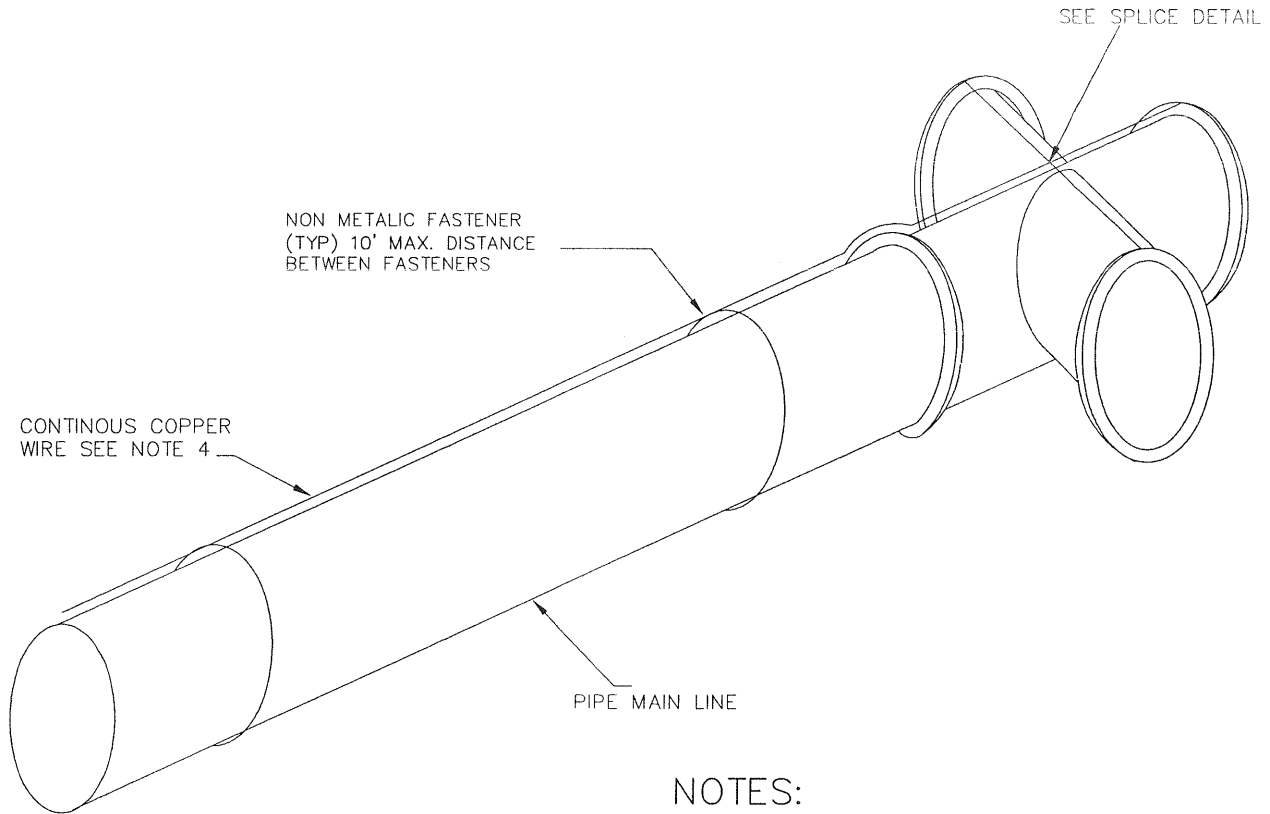
1" SERVICE CONNECTION TRENCH

N.T.S.

FRANCIS TOWN
STANDARD DRAWING
WATER-4



SPLICE DETAIL



NOTES:

1. COPPER TRACER WIRE TO BE INSTALLED THE LENGTH OF PIPELINE AND TO THE END OF EACH FIRE HYDRANT ON CULINARY LINES (NOT TO EXCEED 500 FEET).
2. TRACER WIRE TO BE INSTALLED AND MAINTAINED ON TOP OF PIPE CENTERLINE DURING BACKFILL
3. TWO, THREE AND FOUR WIRE CONNECTIONS: STRIP WIRE ENDS, INSTALL GREASED FILLED WIRE NUTS, AND WRAP WITH THREE LAYERS OF SCOTCH 33 OR EQUAL, ELECTRICAL TAPE. OVERLAP THE TAPE WRAPPING, 6" ONTO THE WIRE INSULATION.
4. COPPER WIRE SHALL BE #14 AWG SOLID UF TYPE WITH CROSS-LINKED POLYETHYLENE INSULATION.
5. CONTRACTOR SHALL TEST TRACER WIRE FOR CONTINUITY PRIOR TO PAVING IN THE PRESENCE OF THE ENGINEER.
6. THE TEE/CROSS IS SHOWN WITHOUT VALVES AND IS INTENDED TO SHOW TRACER WIRE ROUTING ONLY.

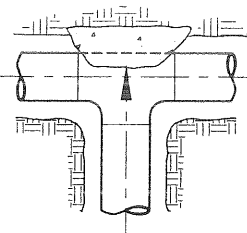
TRACER WIRE INSTALLATION

N.T.S.

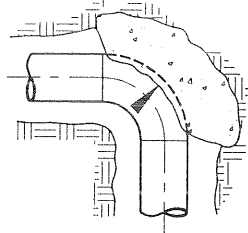
FRANCIS TOWN
STANDARD DRAWING

WATER 5

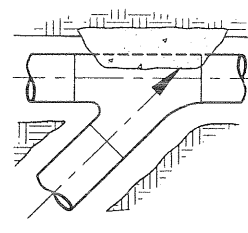
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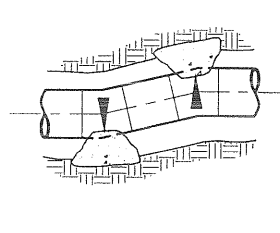
CONDITION 1



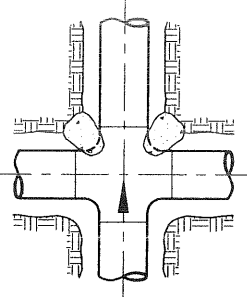
CONDITION 2



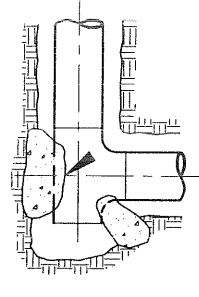
CONDITION 3



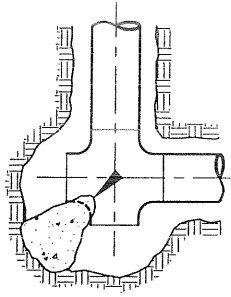
CONDITION 4



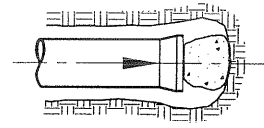
CONDITION 5
(INCLUDES REDUCER)



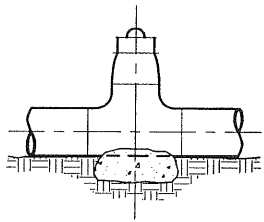
CONDITION 6



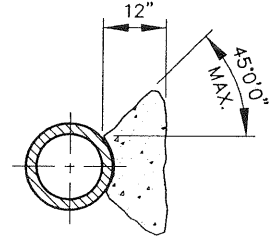
CONDITION 7



CONDITION 8



ANCHOR REQ'D. FOR VALVES 12" OR LARGER



TYPICAL SECTION THRU THRUST BLOCK

THRUST BLOCK BEARING AREA IN SQ. FT.								
PIPE SIZE	CONDITION							
	1	2	3	4	5	6	7	8
4	2.6	3.3	2.6	1.3	1.3	2.0	3.3	2.6
6	4.6	6.5	3.9	2.0	2.6	3.3	6.5	4.6
8	7.8	11.0	5.9	3.3	3.9	5.9	11.0	7.8
10	12.4	17.5	9.8	5.2	6.5	9.1	17.5	12.4
12	17.5	24.8	13.6	7.8	9.1	12.3	24.8	17.5
14	24.0	33.8	18.2	9.7	12.3	16.9	33.8	24.0
16	31.1	44.0	23.8	12.7	15.5	23.2	44.0	31.1
20	48.6	68.8	37.2	19.8	24.2	36.3	68.8	48.6
24	89.8	90.1	48.8	24.9				

NOTES:

1. ALL THRUST BLOCK BEARING FACES SHALL BE POURED AGAINST UNDISTURBED SOIL OR APPROVED COMPACTED BACKFILL.
2. CONCRETE SHALL BE CLASS 5.0-B-2500.
3. ALL THRUST BLOCK SIDES SHALL BE FORMED.
4. CALCULATED ON 225 LB. TEST PRESSURE AND ALLOWABLE BEARING PRESSURE OF 2000 LBS. PER SQUARE FEET.
5. IN POORER SOILS SPECIAL DESIGN IS REQUIRED.

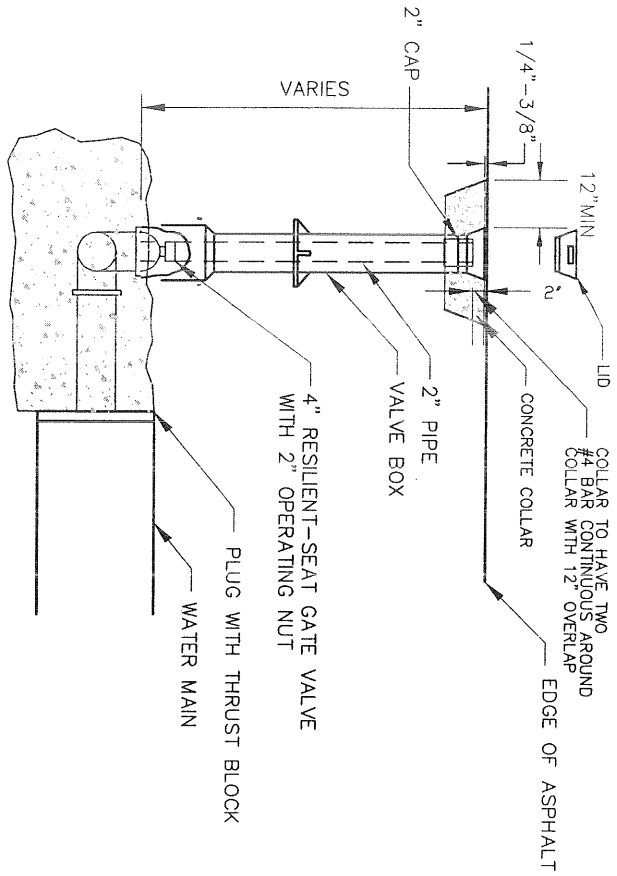
TYPICAL PIPE THRUST BLOCKING

N.T.S.

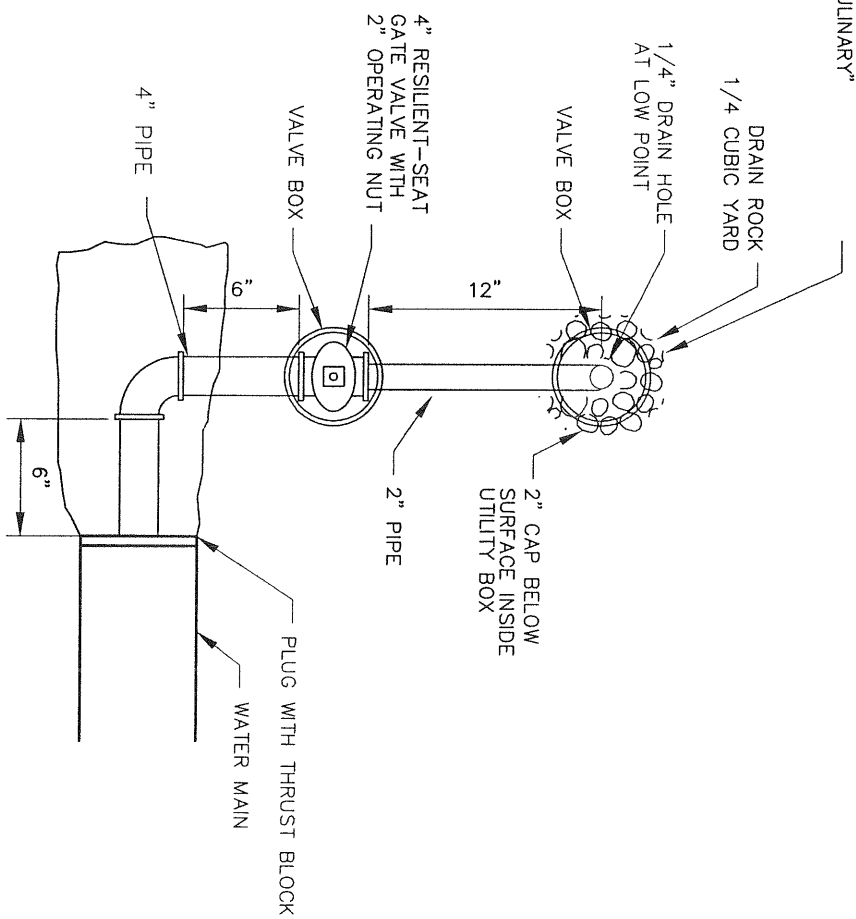
FRANCIS TOWN
STANDARD DRAWING
WATER-6

Note: All pipe to be galvanized after fabrication.

BROOKS 1419 SERIES UTILITY BOX
TOP OF LID LABELED "CULINARY"



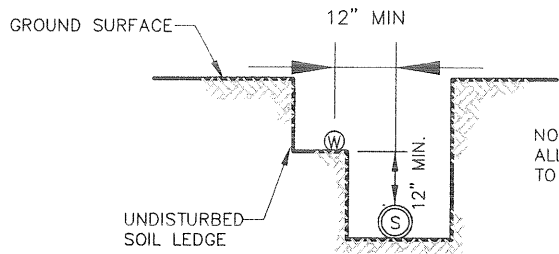
PROFILE



PLAN VIEW

FLUSH VALVE

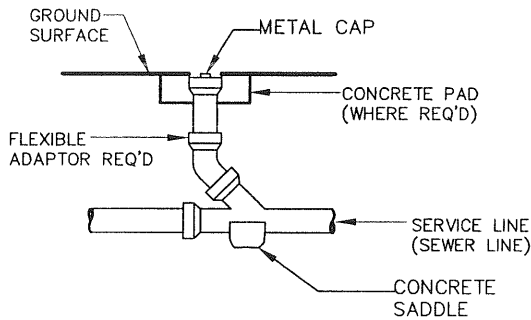
N.T.S.



NOTE:
ALL PLUMBING PRACTICES SHALL CONFORM
TO THE UTAH STATE PLUMBING CODE.

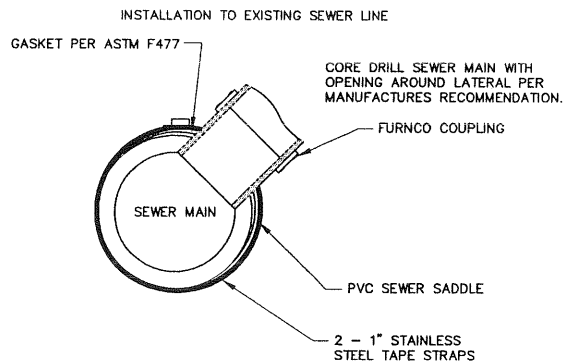
SEWER AND WATER LATERALS IN COMMON TRENCH

N.T.S.



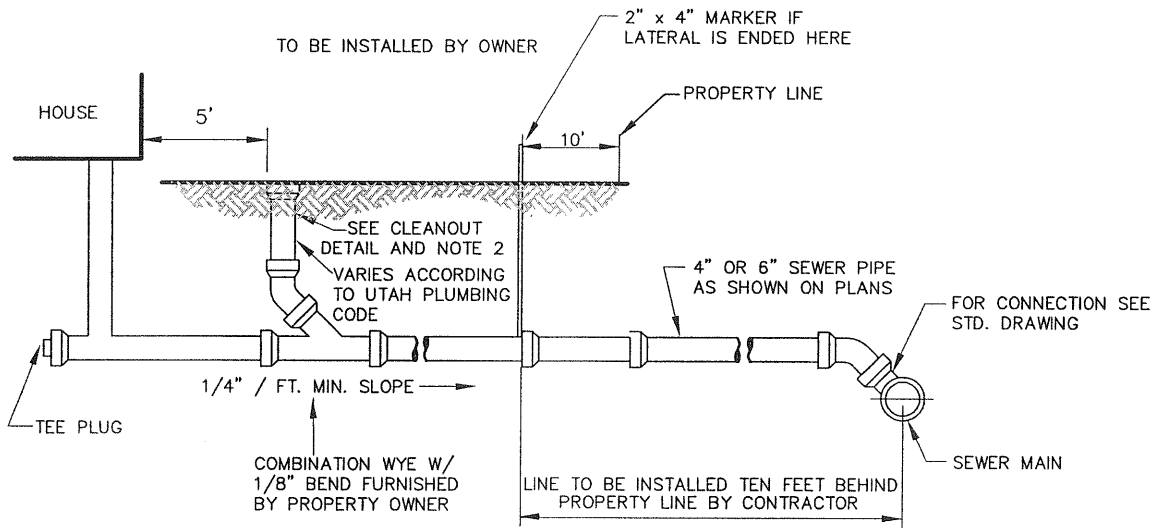
CLEANOUT DETAIL

N.T.S.



SEWER SERVICE LATERAL

N.T.S.



NOTES:

1. OCCUPANCY PERMIT SHALL NOT BE ISSUED UNTIL SERVICE LATERAL HAS BEEN INSPECTED BY A TOWN REPRESENTATIVE.
2. CLEAN OUTS SHALL BE PLACED AT A MINIMUM OF ONE 5' FROM THE STRUCTURE TO BE SERVICED, ONE EVERY 100' AND AT CHANGES IN DIRECTION.
3. SERVICE LATERAL SHALL BE LAID AT A UNIFORM GRADE AND IN A STRAIGHT ALIGNMENT INSOFAR AS POSSIBLE.
4. PIPE GRAPHICS DO NOT NECESSARILY INDICATE THE TYPE OF PIPE USED.

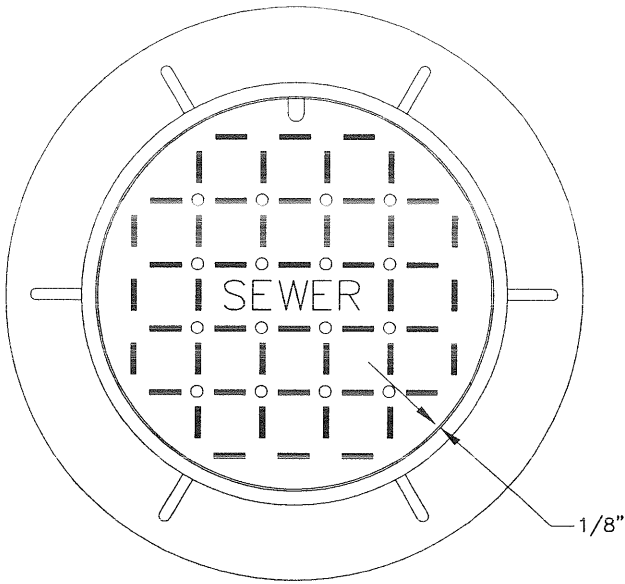
TYPICAL SEWER SERVICE CONN.

N.T.S.

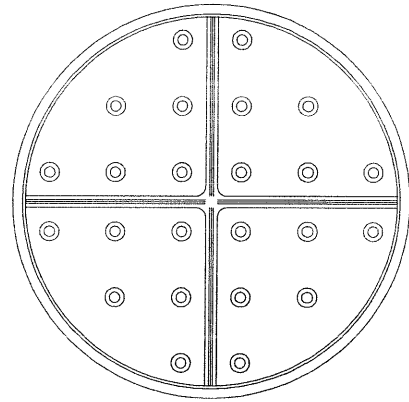
FRANCIS TOWN
STANDARD DRAWING

SEWER-1

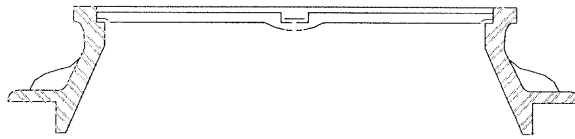
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PLAN OF COVER AND RING

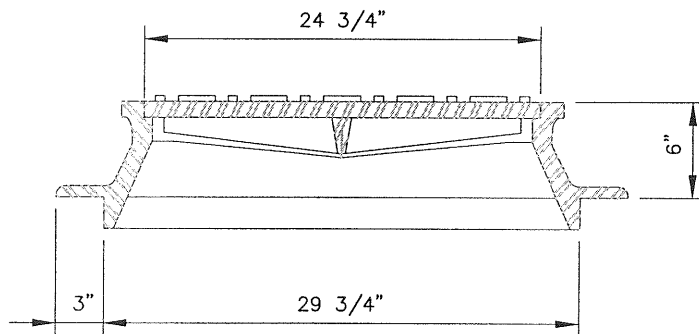


BOTTOM VIEW OF COVER



SECTIONS

D + L SUPPLY #A-1180
OR APPROVED EQUAL



HEAVY DUTY, 400 LB. MINIMUM, MANHOLE RING AND COVER

N.T.S.

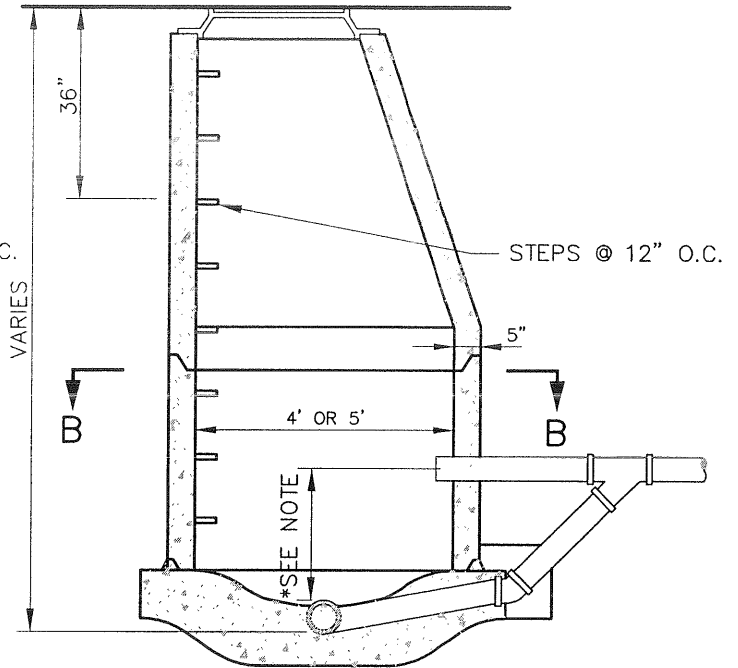
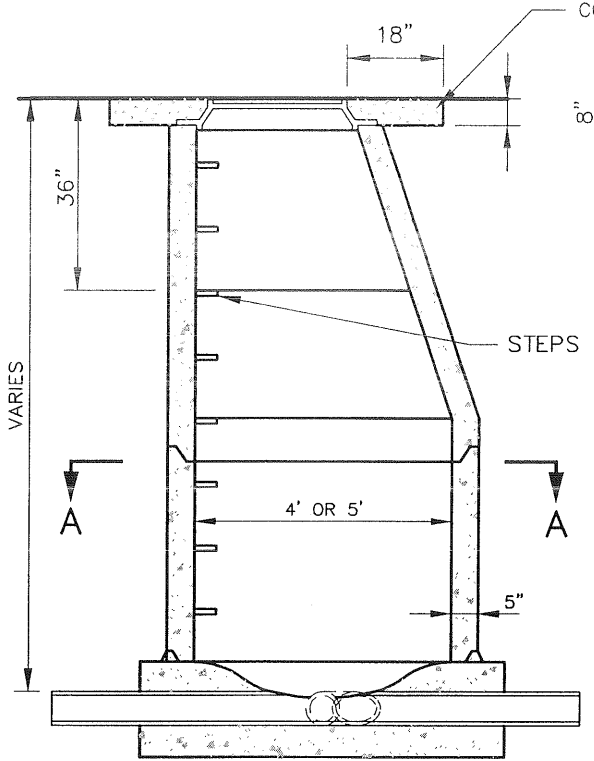
FRANCIS TOWN
STANDARD DRAWING

SEWER-2

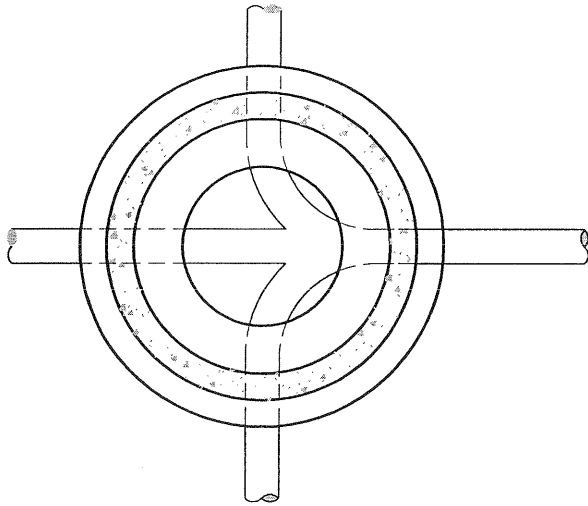
USE 5' DIA. MIN. FOR ALL PIPE 14" &
LARGER USE 4' MIN. DIA. FOR ALL PIPE
UP TO AND INCLUDING 12" DIA.

CONC. COLLAR

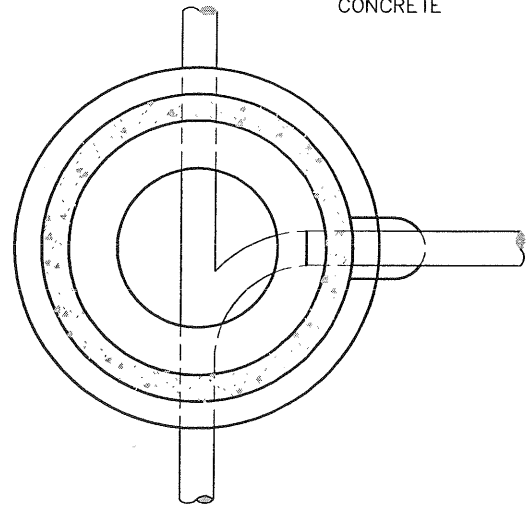
*NOTE:
MINIMUM AS DIRECTED BY
CITY ENGINEER



DROP PIPE
INSTALLED IN
CONCRETE



SECTION A-A



SECTION B-B

**TYPICAL JUNCTION
MANHOLE**

N.T.S.

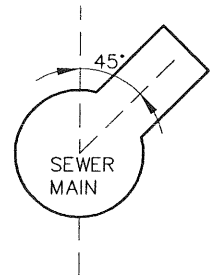
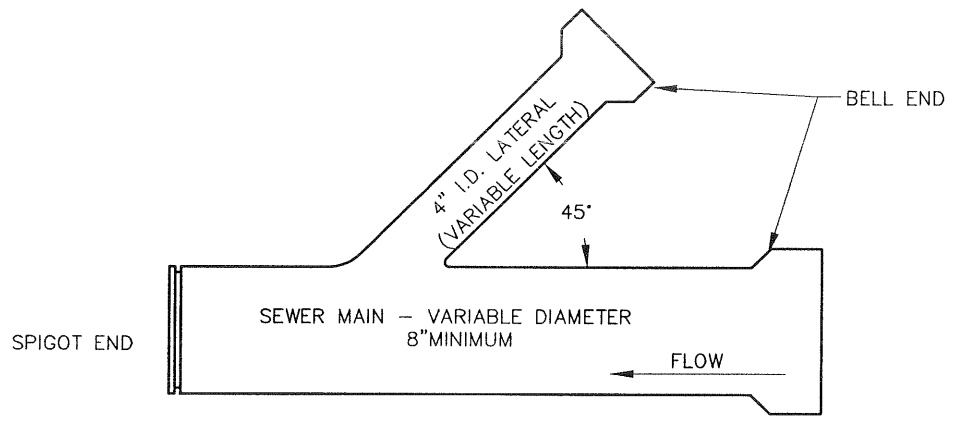
**TYPICAL DROP
MANHOLE**

N.T.S.

FRANCIS TOWN
STANDARD DRAWING

SEWER-3

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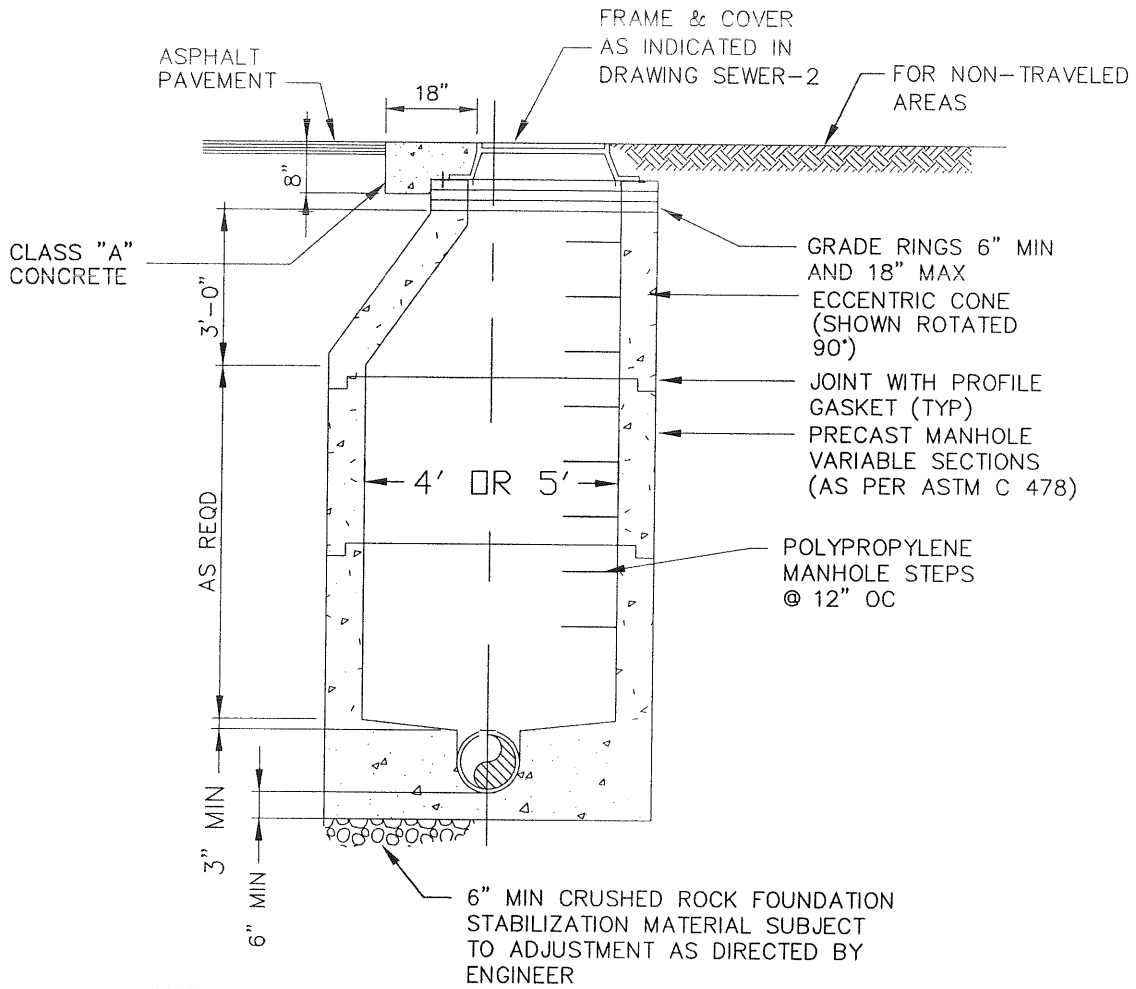


INSTALLATION END VIEW

PRE-CAST SEWER SERVICE LATERAL

N.T.S.

FRANCIS TOWN
STANDARD DRAWING
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 MANHOLE 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.

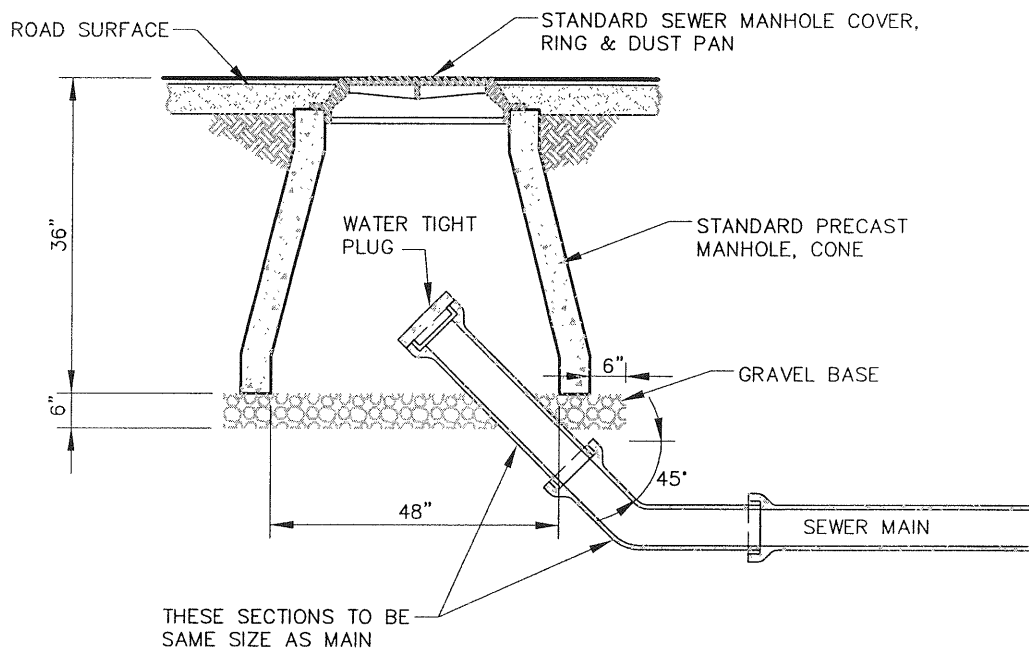
PRECAST CONCRETE SEWER MANHOLE

N.T.S.

FRANCIS TOWN
STANDARD DRAWING

SEWER-5

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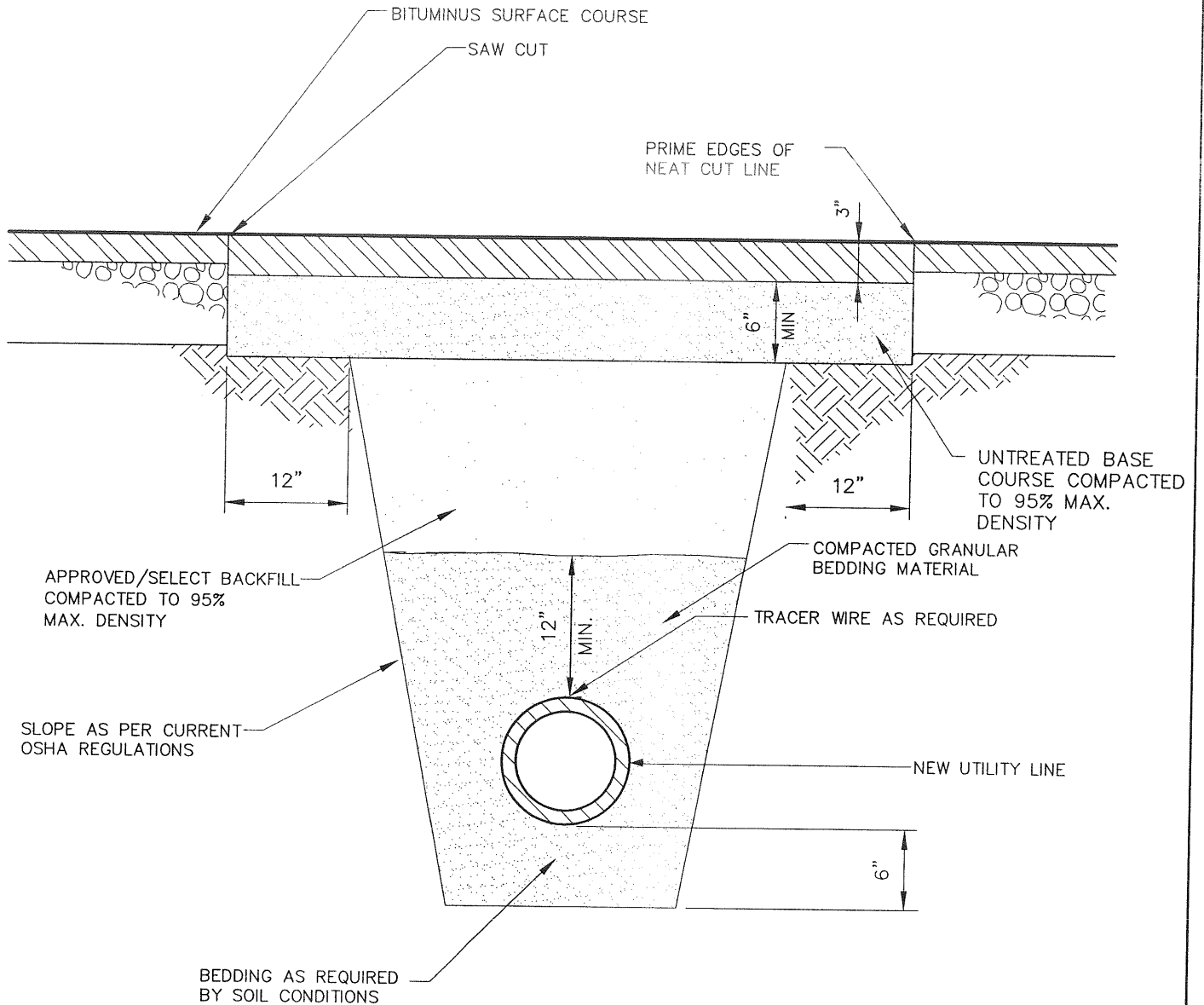


TEMPORARY SEWER MAIN CLEANOUT

N.T.S.

FRANCIS TOWN
STANDARD DRAWING

SEWER-6



NOTES:

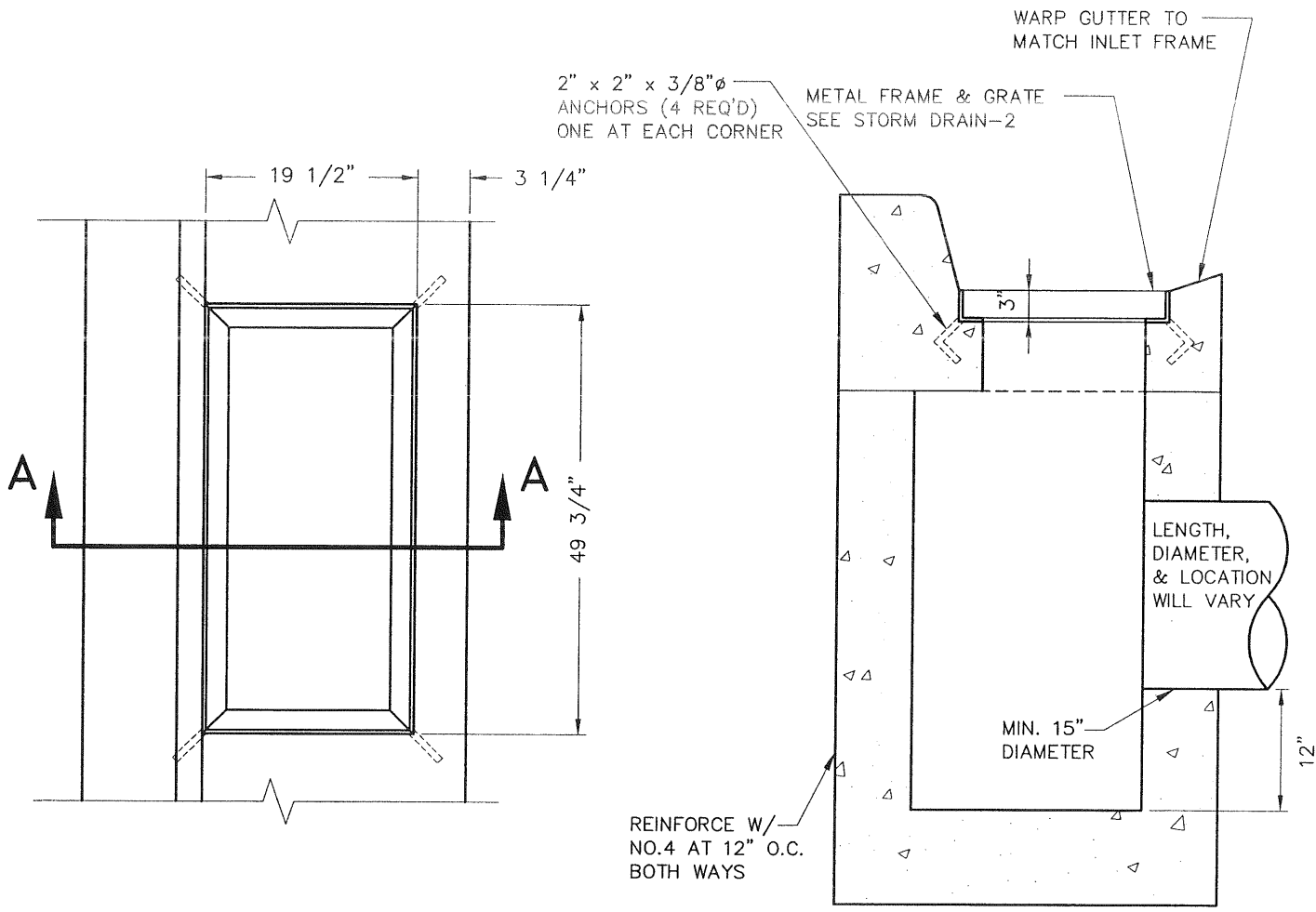
1. COMPACTED GRANULAR BEDDING MATERIAL SHALL CONSIST OF SAND, PEA GRAVEL, OR WELL COMPACTED CRUSHED ROCK. MATERIALS METHOD OF COMPACTION, AND DEGREE OF COMPACTION SHALL BE APPROVED BY THE TOWN ENGINEER.
2. METALLIC MARKING TAPE SHALL BE INSTALLED 12" ABOVE ALL PLASTIC PIPES.
3. INSTALL TRACER WIRE AS PER WATER-5 DRAWING ON ALL CULINARY WATER LINES.

UTILITY INSTALLATION IN EXISTING ROADWAYS

N.T.S.

FRANCIS TOWN
STANDARD DRAWING

UTILS-1



SECTION A-A

NOTES:

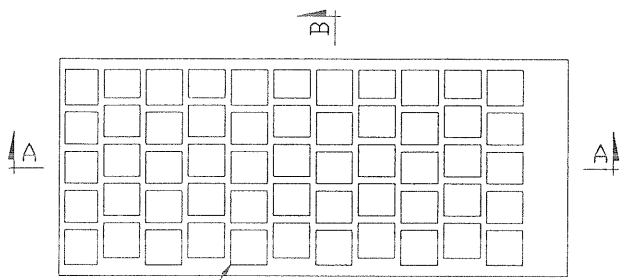
- 1 ALL FRAMES & GRATES TO BE GALVANIZED
- 2 CONSTRUCT BOX (WALL THICKNESS) TO MATCH EXISTING OR NEW TYPE OF CURB AS SHOWN

CURB DROP INLET BOX

N.T.S.

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STANDARD DRAWING
STORM DRAIN-1

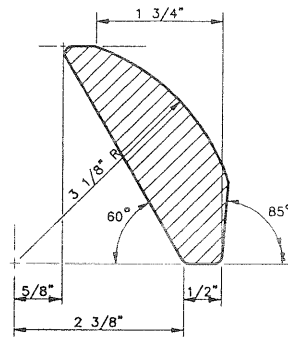
H:\Francis\0301-57\Construction Standards\Standard Drawings\Stormrain2.dwg 02/06/03 14:03 skettle



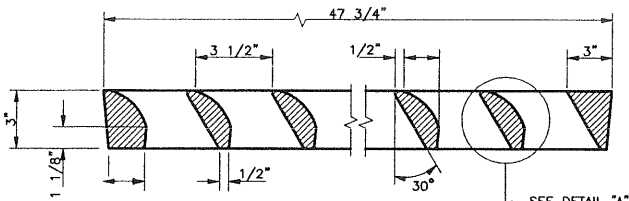
OFFSET OPENINGS
(AS SHOWN)

GRATE

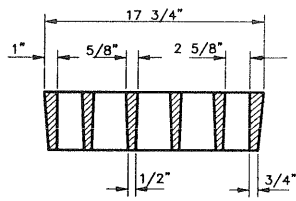
WEIGHT: 266 LBS.



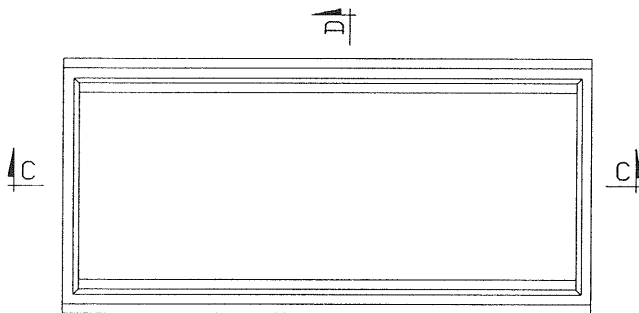
DETAIL "A"



SECTION A-A

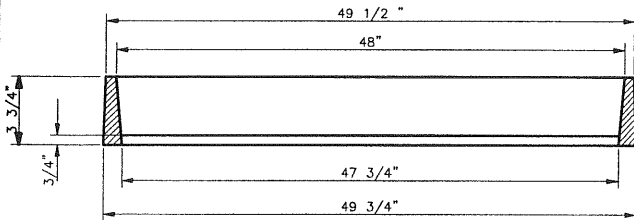
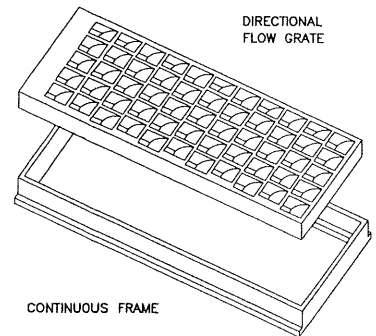


SECTION B-B

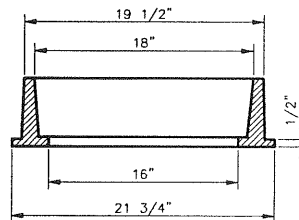


FRAME

WEIGHT: 160 LBS.



SECTION C-C



SECTION D-D

GENERAL NOTES

1. ALL DIMENSIONS ARE INCHES (in) 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

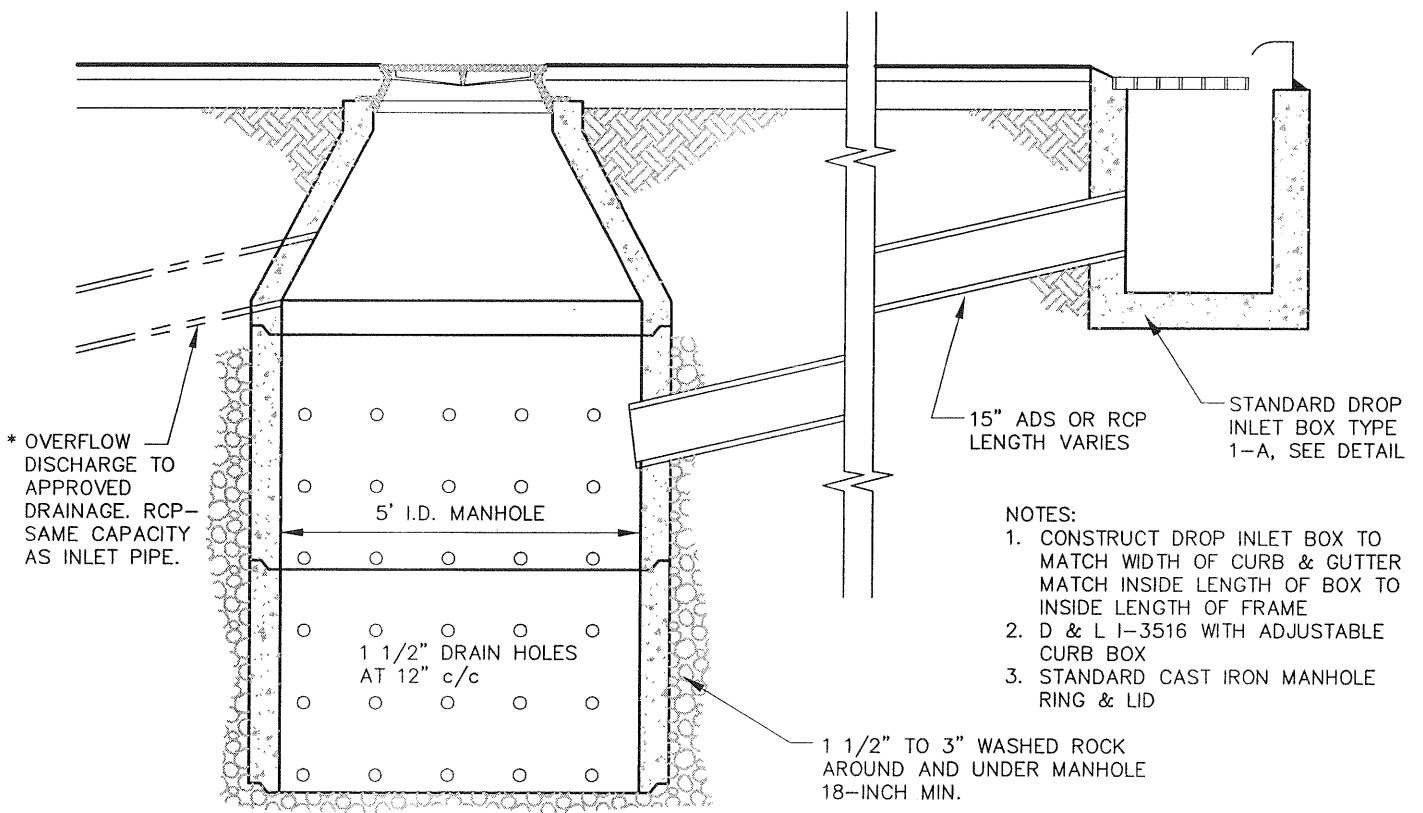
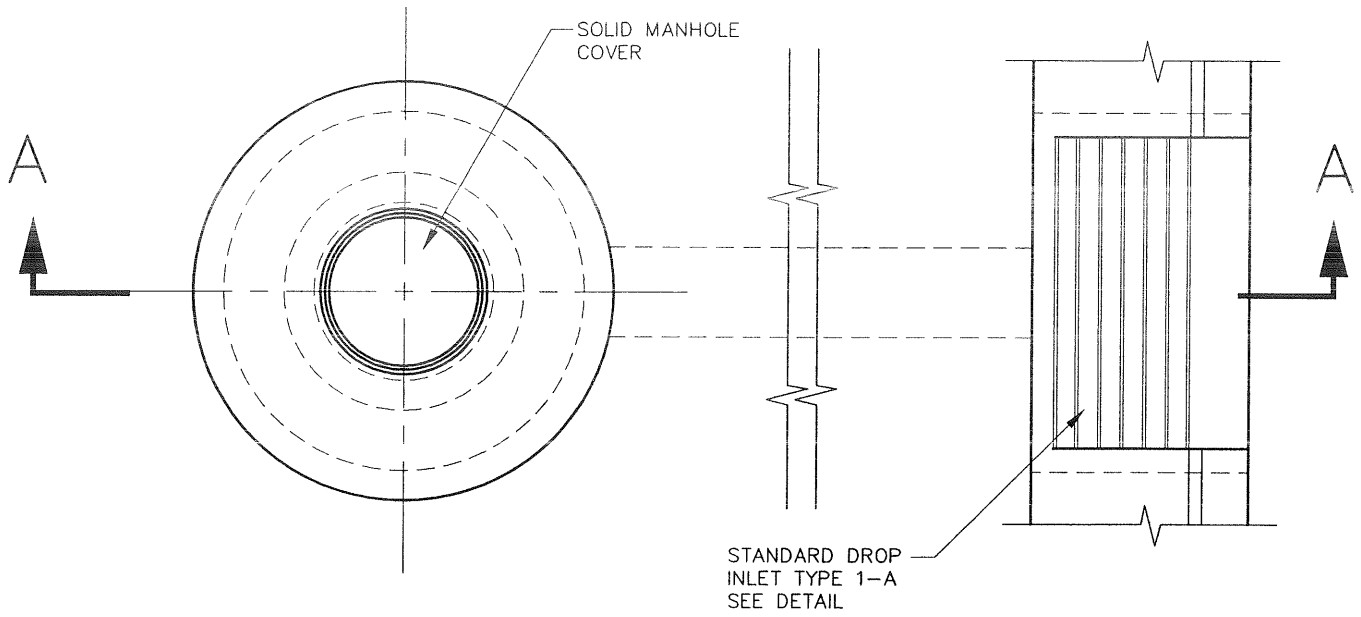
MS 18 (HS-20) OR INTERSTATE ALTERNATE LOADING IN ACCORDANCE WITH CURRENT AASHTO AND INTERIM SPECIFICATIONS.

DUCTILE IRON AND STRUCTURAL STEEL: f_t 138 MPa.

GRATE & FRAME

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STORM DRAIN-2

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- 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

* MAY BE REQ'D BY CITY ENGINEER

SECTION A-A

SUMP DISPOSAL

N.T.S.

FRANCIS TOWN
STANDARD DRAWING
STORM DRAIN-3