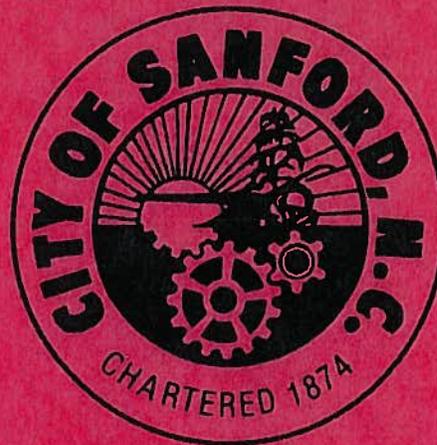


TECHNICAL SPECIFICATIONS  
GRAVITY SEWERLINE AND MATERIALS



CITY OF SANFORD  
SANFORD, NORTH CAROLINA

# **TECHNICAL SPECIFICATIONS**

## **GRAVITY SEWER LINE AND MATERIALS**

### **Scope of Work**

Work performed under this contract shall consist of furnishing and installing, complete and ready for service, the sewer main with various appurtenances as shown on the contract plans and as specified.

#### **A. MATERIAL**

1. V.C. Sewer Pipe - Vitrified clay sewer pipe shall be extra strength and shall conform to ASTM Specifications C-200-65 T, or latest revision thereof. Joints shall be the polyester ring-type conforming to ASTM Specifications C-425-66 T, latest revision.
2. Cast Iron Pipe - All cast iron pipe shall be manufactured in strict accordance with USA Specifications A 21.6 or A 21.8; AWWA Specifications C 106 or C 108; and Federal Specifications WW-P 421, and shall be class 150 or 200.

Joints for line pipe shall be mechanical joint or push-on joint in accordance with USA Specification A 21.11 (AWWA C-111) joints for plant pipe, where called for, shall be flanged joints. Flanged fittings shall be faced and drilled and conform to the 125-pound American Standard weight, classification, and flange dimensions.

The interior of all cast iron pipe shall have a cement lining of standard thickness in accordance with USA A 21.4 (AWWA C 104).

3. Ductile Iron Pipe - All ductile iron pipe furnished for diameters four inches (4") through twenty-four inches (24") shall be manufactured in accordance with ANSI Specifications A 21.51-1976, tentative (AWWA C151-76, tentative), or latest specifications, in eighteen foot (18') lengths with single rubber gasket joints in accordance with ANSI Specifications A 21.11-1972 (AWWA C111-72), or latest specifications. Four inch (4") diameter pipe shall be Class 51 wall thickness, and six inch (6") through twenty-four inch (24") diameter pipe shall be Class 50 wall thickness in accordance with ANSI Specification A 21.50-1976, tentative, (AWWA C150-76, tentative) or latest specification, unless otherwise specified or shown on the plans. All ductile iron pipe shall be cement lined in accordance with ANSI Specifications A 21-4-1971 (AWWA C104-71), or latest specifications.

4. PVC Pipe - All PVC pipe shall be manufactured in accordance with ASTM specification D-3034 for Type PSM polyvinyl chloride (PVC) and sewer pipe and fittings. All PVC pipe shall be either SDR 21 or SDR 26 wall thickness pipe. PVC sewer pipe shall be used only for eight inch (8") diameter sewer mains which will serve residential areas where further main extensions are not possible. No commercial applications shall be permitted.

All bell-and spigot joints shall meet ASTM specification D3212. All fittings shall use rubber gaskets which conform to the requirements of ASTM specification F477.

Deflection testing shall be performed on all PVC sewer pipe. No sooner than thirty (30) days after final backfill installation, a deflection test shall be executed on the sewer line. The maximum allowable deflection shall be five percent (5%) for PVC sewer pipes. The test shall use a nine-pronged mandrel pulled through the pipe. The contact length of the mandrel shall be at least two inches (2"). The 7.12 O.D. mandrel shall be furnished by the City of Sanford. All rope, floats, or other necessary equipment necessary to perform the deflection test shall be supplied by the Contractor. Any lines not meeting this test shall be corrected by the Contractor and the test repeated.

5. Fittings - All fittings shall be manufactured in accordance with ASA Specifications A 21.10-1964 and AWWA C-110 or latest revisions. Fittings shall be all bell mechanical joint, ASA Specifications A 21.10-1964, latest revision, unless otherwise noted, and shall have interior cement mortar lining in accordance with ASA Specification A 21.4-1964, latest revision.
6. Steel Pipe - Steel pipe used as gravity sewer line, encasement pipe, or for creek crossing installations on piers shall meet the requirements of AWWA C-202 and shall be manufactured from C-202 grade 3 steel. All pipe shall be coal tar enamel lined and fully coated and felt wrapped in accordance with AWWA C-203 Section 3.9. Pipe shall be 0.375" thick and shall have a clear inside diameter and thickness after applying lining as called for on the Plans. Ends of pipe shall be beveled for butt welding. Field welding shall be done by certified welders and shall develop the full strength of the pipe. All pipe shall be hydrostatically tested to 200 psi.
7. Concrete Block Manholes
  - a. Concrete Manhole Bases - shall have a 28-day compressive strength of 2500 psi and slump of not greater than four inches (4").

- b. Block Manhole Units - shall be steamed cured and shall have an individual compressive strength of 2500 psi of the cross sectional area of the unit as laid up in the wall. The maximum average absorption shall not exceed 7% by weight nor exceed 8% by weight of any individual unit. Test for strength and absorption shall be made on not less than two (2), nor more than three (3), specimens consisting of whole undamaged units and based on a twenty-four (24) hour immersion test.
- c. Mortar - used for sewer block masonry shall be composed of one (1) part Portland cement and two (2) parts sand. Portland cement shall meet the requirements of the latest ASTM Specifications C-150, Type 1. Sand shall meet requirements of ASTM Specifications C-144. Mortar shall be mixed in a clean tight mortar box or mechanical mixer, and shall be used within forty-five (45) minutes after mixing.
- d. Manholes- shall be constructed with eccentric tops, standard manhole rings and covers, and cast iron manhole steps equally spaced not to exceed sixteen inches (16") c/c not more than twelve inches (12") below rim (see detail).

Manhole block units shall be made by a manufacturer approved by the Engineer, and units shall be tested and certified to by a reputable testing laboratory approved by the Engineer.

- 8. Pre-Cast Concrete Manholes - Pre-cast reinforced concrete manhole units may be used in lieu of concrete block manholes as specified.

Pre-Cast manholes, when used, shall be constructed as follows:

- a. 4'-0 inside diameter barrel
- b. Monolithic base slab and lower barrel section.
- c. Eccentric cone section with a height of between two feet (2') and four feet (4').
- d. 2'-0 inside diameter top section with height not to exceed twenty-four inches (24").
- e. Standard manhole ring and cover.
- f. Equally spaced cast iron manhole steps not to exceed sixteen inches (16") c/c.

The manhole top elevations shall be set to the required elevation as indicated on the plans. Concrete grade rings or brick up to ten inches (10") and metal rings up to three inches (3") for a total of ten inches (10") may be used for final grade adjustment.

The design for the reinforced concrete manhole sections shall conform to ASTM designation C-478 and to all applicable sections of the ACL code. The manhole sections shall have a standard tongue and groove joint, and shall have a gasket conforming to ASTM designation C-443 or be sealed watertight with putty-type plastic cement. Shop drawings in accordance with the General Conditions of these Contract Documents will be required.

## B. CONSTRUCTION METHODS

1. Excavation - The Contractor shall do all excavation of whatever substances encountered to the depths shown on the plans or as directed by the Engineer. The width of the trench, one foot (1') above the top of the pipe to be installed at bell end shall not exceed the outside diameter of the pipe plus eighteen inches (18"). Where rock is encountered, the trench shall be excavated six inches (6") below the bottom of the pipe and this depth shall be refilled with suitable material and thoroughly tamped.

All excavation is unclassified. Cost of rock excavation and backfill to grade shall be included in unit price bid per foot for sewer pipe, complete and in place.

When foundation material has poor supporting value, the pipe foundation shall be reinforced by one of the following methods:

- a. By replacing the unsuitable material to a minimum depth of six inches (6"), or such other depth as directed by the Engineer, with gravel or crushed stone.;
- b. By constructing supporting cradles of Class C concrete under the pipe.

Excess excavation below grade shall be backfilled at the Contractor's expense with suitable material, as directed by the Engineer, and thoroughly tamped. The bottom of the trench shall be shaped by hand so that the sewer will have a firm and uniform bearing.

The Contractor will, at his expense, removed by pumping or other means approved by the Engineer, any water accumulated in the trench. The Contractor shall make every effort to prevent water and other materials

from entering the pipe. At the end of the day the pipe will be capped or plugged and the trench filled in if necessary.

All bands of trenches shall be vertical from the bottom to one foot (1') above the top of the pipe. The Contractor shall, at his expense, do all bracing, sheeting, and shoring necessary to perform and protect all excavations, as required for safety.

The excavation for manholes and lift station structure shall be in a vertical plane and shall be of sufficient width and depth to permit ready construction.

2. General Construction Safety

- a. The Contractor and any subcontractors shall be responsible for the total compliance to all federal, state, and local ordinances, laws and regulations as it relates to safe construction practices and to protecting the employees and public's general health.
- b. The Contractor shall ensure that all Occupational Safety and Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.
- c. The City shall not be responsible for making the Contractor adhere to these OSHA regulations and standards. However, the City may report known violations or unsafe practices to the appropriate enforcement agency.

3. Laying Pipe - Gravity flow sewer pipe may be laid by using "batter boards" furnished and erected by the Contractor, or by using an approved laser under the direction of a qualified operator. The trench shall be shaped by hand to line and grade, and the bedding surface shall provide a firm foundation for the full length of the body. Grooves shall be cut in the trench for the bells so that each joint of pipe shall be bedded for its full length. Pipes shall be laid with bells up grade and ends fully and closely jointed.

Pipe connections to existing manholes shall be made in such a manner that the finished work will conform as nearly as practicable to the essential applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe, but no larger than 1½ times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

One set of construction stakes consisting of offset hub and tack for each manhole will be provided by the Engineer. The Contractor shall protect these stakes and, should it become necessary to set new stakes, it shall be done at the expense of the Contractor.

4. **Backfilling** - All backfill shall be made using only suitable material. The backfill under and around the pipe shall be hand placed on both sides simultaneously, and thoroughly compacted to prevent displacement of the pipe or disturbance of the joints. The backfill shall be brought to a point at least one foot (1') above the tope of the pipe in this manner with the best backfill material available.

The balance of the backfill shall be placed and tamped to prevent excessive settlement in a manner satisfactory to the Engineer. If the trench backfilled is located under pavement, backfill material shall be placed in six inch (6") layers, loose measurement, and shall be thoroughly tamped and compacted with a rapid hitting mechanical tamper capable of exerting at least 185 pounds per square foot of tamping area per blow. Only the best available material, free from large stones or clods, shall be used and it shall be moistened, if necessary in the opinion of the Engineer, to obtain maximum compaction.

All backfilling of pipeline ditches where a drop hammer mechanical-type tamp is used shall be in accordance with the standard specifications for backfilling. In addition, the following criteria shall also apply. This criteria is intended as an absolute minimum of compactive effort and shall, in no way, relieve the Contractor of the responsibility of securing the percent compaction called for in the standard specifications. In addition, the Engineer or inspector may require additional compactive effort when, in his opinion, additional effort is needed in order to secure the desired degree of compaction.

- a. The backfill material shall be placed around and over the pipeline in six-inch (6") lifts to a point four feet (4') below the surface of the ground and compacted with approved mechanical tamps.
- b. The balance of the backfill material may be pushed into the ditch with a bulldozer or front end loader, provided the machine is operated parallel to the trench.
- c. The depth of the material pushed into the trench shall not exceed four feet (4').
- d. The entire length of the trench shall be compacted immediately using the drop hammer, followed by a second additional pass of the drop hammer over the entire length of the trench. The second

pass may be deferred until the following day; however, in no case shall the first pass not be made the same day that the material is pushed into the trench.

All trash, forms, debris, and other foreign material shall be cleared from around all pipes and structures before backfilling. Backfilling around structures shall be done symmetrically and tamped as provided herein. The Contractor shall dispose of surplus materials as directed by the Engineer. The area after backfilling shall be immediately cleared of all things resulting from the work of the Contractor.

5. Water Main Crossing Sewer - Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least eighteen inches (18") above the top of the sewer. If local conditions prevent an eighteen-inch (18") vertical separation, then both the water main and sewer main shall be constructed of ductile iron pipe materials with joints that are equivalent to water main standards for a distance of ten feet (10') on each side of the crossing. Both the water main and the sewer line shall be pressure tested to assure water tightness prior to backfilling.

Whenever it is necessary for a water main to cross under a sewer, both shall be constructed of ductile iron pipe materials with joints equivalent to water main standards for a distance of ten feet (10') on each side of the crossing. A section of water main pipe shall be centered at the crossing. Both the water main and sewer line shall be pressure tested to assure water tightness prior to backfilling.

6. Manholes

- a. Base - Concrete masonry manholes shall be built on a slab as specified and shown on the drawings.
- b. Laying the Masonry Units - Manhole masonry units shall be laid plumb and in full bed of mortar, a running bond will be used and the block will be laid on a radius so as to form a true circle (oblong or oval-shaped manholes will not be permitted unless approved by the Engineer). One (1) or two (2) course of 2 $\frac{1}{4}$ " high concrete brick may be used at the tope of the manholes to adjust height for placing manhole ring and cover. Concrete brick may also be used for closing openings around pipes and inverts. Buttering the manholes masonry unit on the end is not required. The cylinder which is formed when the ends of the masonry units meet must be completely filled with mortar so as to form a water-tight lock and joint. The thickness of the horizontal mortar joint will be left to the discretion of the Contractor, but shall not be less than 3/8" thick or

more than 3/4" thick. The joints shall be completely filled with mortar. No spalls or bats shall be used except for shaping around irregular openings or when unavoidable to finish out course. Competent bricklayers shall be employed on the work and all details of construction shall be in accordance with approved practice and to the satisfaction of the Engineer.

- c. Iron steps, as shown on the plans, shall be placed in all manholes when they are greater than four feet (4') in depth. The iron steps shall be set in the masonry as the work is built up, thoroughly bonded, and accurately spaced and aligned.
- d. Inverts in all manholes shall be shaped to form a smooth and regular surface, free from sharp or jagged edges. They shall be sloped adequately to prevent sedimentation.
- e. The castings shall be set in full mortar beds. All castings when set shall conform to the finish grade as established by the Engineer. Any castings not conforming shall be adjusted to the correct grade without extra compensation.
- f. Manhole exterior shall be plastered with a minimum of 3/4" of cement mortar.

Pre-Cast Concrete Manholes - Pre-cast reinforced concrete manholes may be used in lieu of concrete block manholes as specified. Manholes shall be constructed in accordance with the specifications on this item as included elsewhere in these specifications.

- 7. Service Taps - All service taps will be done according to City specifications as detailed in the attachment to this section. Any disturbed curbs, pavement, sidewalks, grass, etc., will be restored by the Contractor.
- 8. Test for Displacement of Sewers - Upon completion of sewer line construction, a displacement test shall be conducted by the Engineer in the presence of the Contractor. The test shall be conducted as follows: A light will be flashed between manholes; if the illuminated interior of the pipe shows any misalignment, displaced pipe, or any other defects, they shall be corrected by the Contractor at his expense.
- 9. Infiltration Tests - Where ground water is encountered during construction, all pipe joints for the sewer line shall be of such quality that there shall be no perceptible infiltration of ground water into the sewer from any single joint. The Engineer may conduct infiltration test if it is deemed necessary.

The Contractor shall furnish all labor and equipment, and shall assist the Engineering in making these tests. The length of line to be tested at a time shall be subject to the approval of the Engineer. Total infiltration in one (1) twenty-four (24) hour period shall not exceed two hundred (200) gallons/inch of diameter, per mile of sewer.

10. Protection of Construction - The Contractor shall provide and maintain when and where deemed necessary by the Engineer, warning signs, lights, and barricades at his own expense and cost, and shall take all necessary precautions to adequately protect life and property. If so ordered by the Engineer, he shall provide flagmen at the Contractor's expense.

#### C. METHOD OF MEASUREMENT

1. Sewer Pipe - For trenching, backfilling, clearing and grubbing right-of-ways furnishing and installing pipe by the linear foot, through intermediate manholes and to the center of the manholes, at the various depths and for the various sizes as stated in the proposal, depth shall be measured from the existing ground level to the flow line of the pipe.
2. Manholes - For manholes, by actual count at the various depths stated in the proposal, depth shall be measured from the tope of manhole casting to the invert.
3. Service Taps - Taps will be counted by unit, complete in place, and accepted including the restoration of pavement, curb, gutter, sidewalks, grass, etc.

#### D. ENGINEERING

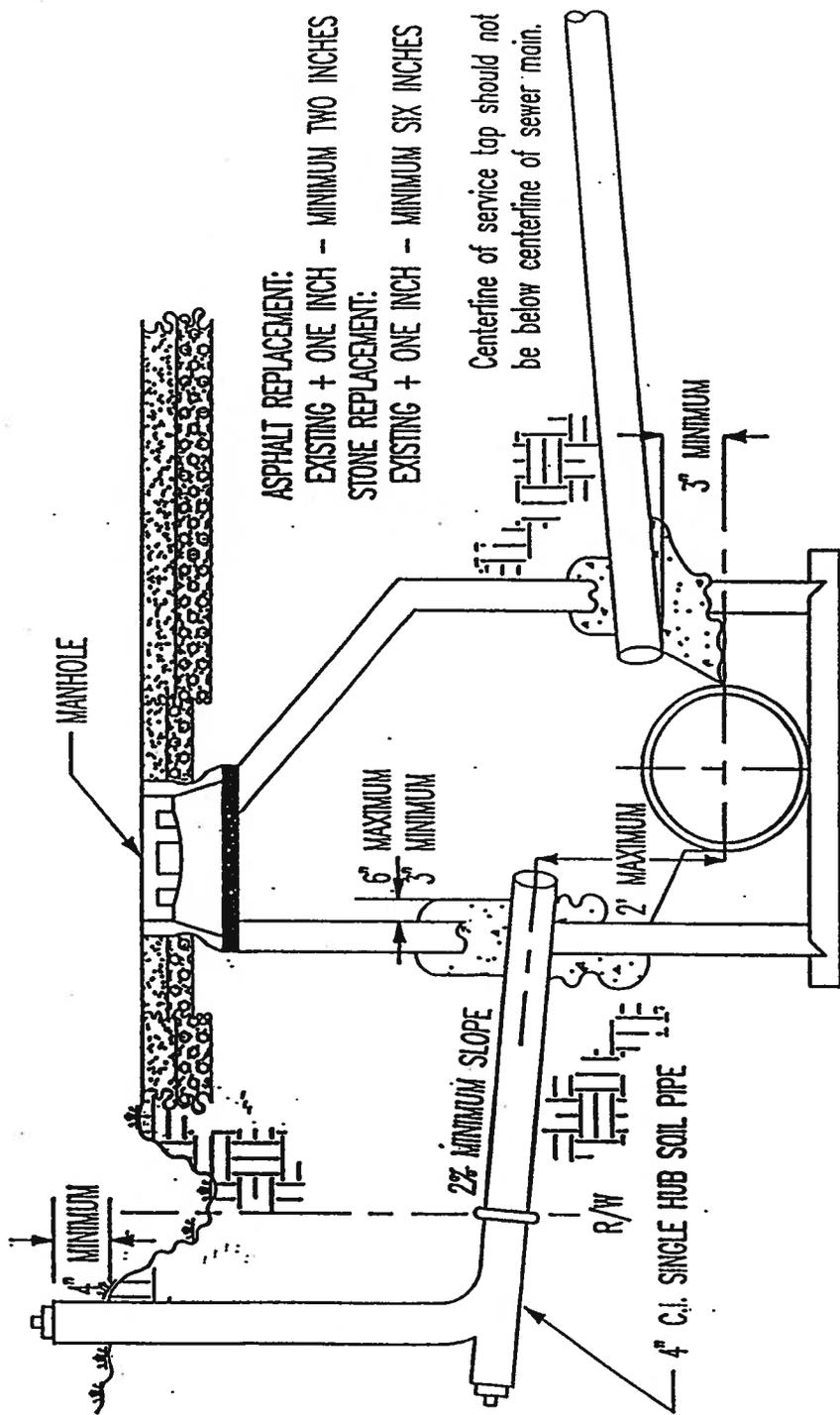
All proposed gravity sewer lines shall be submitted to the City of Sanford for review and approval. All plans shall include plan and profile views and the signature of a registered P.E. Four (4) sets of plans shall be submitted to the City of Sanford. A check for the appropriate application fee made payable to NRCD shall be provided to the City for submittal with plans and applications to NRCD.

All proposed gravity sewer lines shall have a maximum reach of four hundred (400) linear feet between manholes. All gravity sewer lines shall have a slope of not less than 0.55 percent (0.55%) and not greater than 10.0 percent (10.0%). All manholes shall have a minimum drop between inverts of 0.20 feet. Manholes with an invert drop greater than 2'6" or 30" shall be required to have either an

outside drop or a 4' diameter manhole or an inside drop within a 5' diameter manhole.

**E. BASIS OF PAYMENT**

Payment will be made for all items based on the unit and lump sum prices stated in the proposal and measured as previously described. Any costs for cleanup and seeding shall be included in the price per linear foot for installation of the sewerline. Construction of the sewerline shall be considered as ninety percent (90%) complete until such time as the clean up for that section of line is completed to the satisfaction of the City. Therefore, payment shall only be ninety percent (90%) of the price per linear foot until the cleanup, seeding, etc., for that section of line is completed to the City's satisfaction. The prices stated in the proposal shall cover all work required to properly install the sewer mains, complete with all necessary appurtenances, in accordance with the plans and specifications.



NOTE: Clean-out must be installed by property owner prior to service connection.

Scale: NTS

Date: 9/18/91

CADD By: LLA

City of Sanford

SEWER TAP INTO MANHOLE

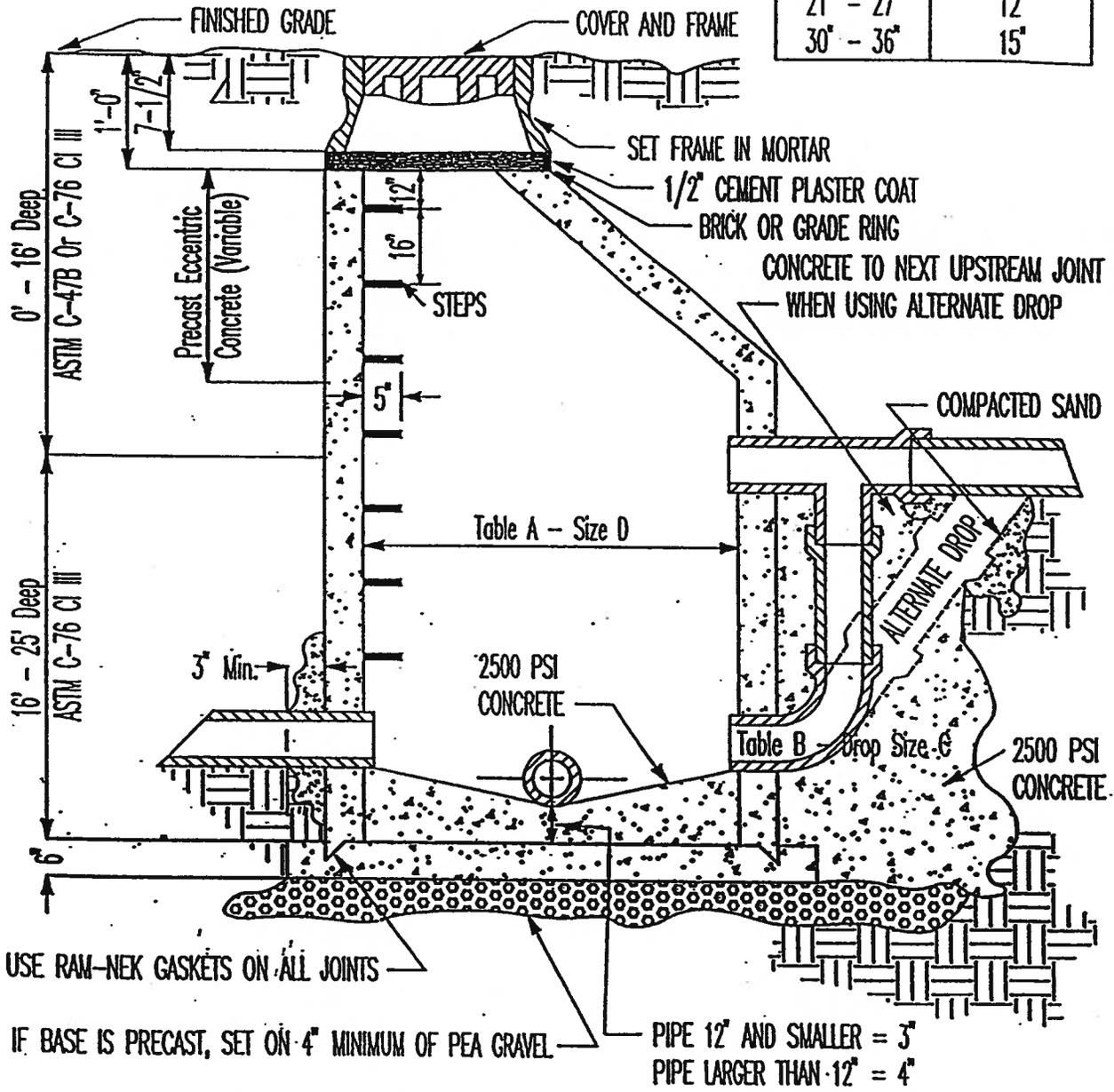
TABLE A

PIPE SIZE	SIZE D
8" - 24"	4'-0"
27" - 33"	5'-0"
36" - 42"	6'-0"

NOTE: Use drop connection detail for invert drops over 2'-6".

TABLE B

PIPE SIZE (INCOMING)	DROP SIZE C
8" - 12"	8"
15" - 18"	10"
21" - 27"	12"
30" - 36"	15"



USE RAM-NEK GASKETS ON ALL JOINTS

IF BASE IS PRECAST, SET ON 4" MINIMUM OF PEA GRAVEL

PIPE 12" AND SMALLER = 3"  
 PIPE LARGER THAN 12" = 4"

Scale: NTS

Date: 9/18/91

CADD By: LLA

City of Sanford

STANDARD SEWER MANHOLE

(4) 1" DIA. HOLES

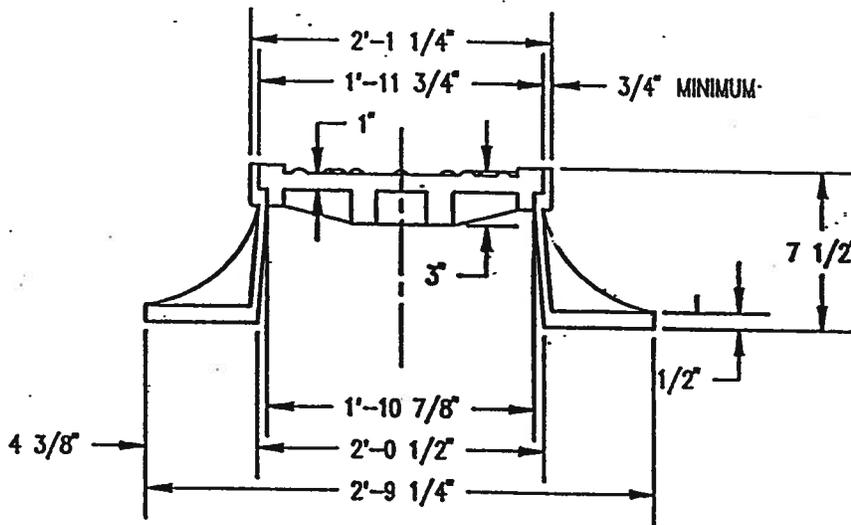
1/2" MINIMUM

TOP OF COVER

BOTTOM OF COVER

1/2" MINIMUM

NOTE:  
MANHOLE RING AND COVER  
DEWEY BROS. 2001 OR EQUIVALENT



Scale: NTS

DATE: 11/18/91

CADD By: LLA

City of Sanford

MANHOLE RING AND COVER