

FORCE MAIN INSTALLATION AND TESTING

FORCE MAIN SANITARY SEWER

Construct force main sewers in conformance with NCDENR Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains.

INSTALLATION GENERAL

Install lines with 36" to 42" of cover to finished grade unless otherwise directed or approved. Install lines with great distances to accommodate utility controls, to make tie-ins to existing facilities, to eliminate high points in the pipeline or to provide clearance from existing or proposed utilities, drainage, other obstacles or actual field conditions.

PRESSURE TESTING

- A HYDROSTATIC PRESSURE TEST SHALL BE PERFORMED ON EACH SEGMENT OF INSTALLED FORCE MAIN.
- THE TEST SHALL BE PERFORMED AFTER THE FORCE MAIN HAS BEEN BACKFILLED AND AT LEAST SEVEN DAYS FOLLOWING THE POURING OF THE LAST THRUST BLOCK.
- THE FOLLOWING PROCEDURES SHALL BE FOLLOWED IN PERFORMING HYDROSTATIC PRESSURE TESTS ON FORCE MAINS:
 - THE FORCE MAIN SEGMENT SHALL BE CAREFULLY FILLED WITH WATER AT A VELOCITY OF APPROXIMATELY ONE FOOT PER SECOND. WATER MAY BE INTRODUCED FROM EITHER THE PUMP STATION OR A TEMPORARY CONNECTION MADE IN THE FORCE MAIN. APPROPRIATE MEASURES NECESSARY TO ELIMINATE ALL AIR FROM THE FORCE MAIN SHALL BE TAKEN DURING THIS PROCESS.
 - ONCE FULL OF WATER, THE FORCE MAIN SEGMENT SHALL BE PRESSURIZED AND ALLOWED TO STABILIZE AT A MINIMUM TEST PRESSURE OF 1.5 TIMES THE MAXIMUM DESIGN PRESSURE OF THE FORCE MAIN PIPE MATERIAL.
 - THIS PRESSURE SHALL BE MAINTAINED FOR AT LEAST TWO CONSECUTIVE HOURS.
 - IF THE STATED PRESSURE CANNOT BE MAINTAINED, THE APPLICANT IS RESPONSIBLE FOR ASSURING THAT THE CAUSE OF TEST FAILURE IS DETERMINED, ALL NECESSARY REPAIRS ARE MADE, AND REPEATING THE HYDROSTATIC PRESSURE TEST UNTIL THE FORCE MAIN SEGMENT PASSES.
- THE PRESSURE TEST MAY BE PERFORMED CONCURRENTLY OR SEPARATELY WITH THE LEAKAGE TEST AS NOTED BELOW.

LEAKAGE TESTING

- A LEAKAGE TEST SHALL BE PERFORMED ON EACH SEGMENT OF INSTALLED FORCE MAIN AT THE HYDROSTATIC PRESSURE TEST STIPULATED ABOVE.
- LEAKAGE SHALL BE DEFINED AS THE QUANTITY OF WATER REQUIRED TO MAINTAIN A PRESSURE WITHIN FIVE POUNDS PER SQUARE INCH OF THE SPECIFIED TEST PRESSURE AFTER THE PIPE HAS BEEN FILLED WITH WATER AND ALL AIR HAS BEEN EXPELLLED.
- LEAKAGE SHALL BE MEASURED WITH A CALIBRATED TEST METER AND SHALL NOT EXCEED THE AMOUNT GIVEN BY THE FOLLOWING FORMULA:

$$L = \frac{SD\sqrt{P}}{133,200}$$

S = LENGTH OF PIPE (FEET)
 D = NOMINAL DIAMETER OF PIPE SEGMENT TESTED (INCHES)
 P = TEST PRESSURE (POUNDS PER SQUARE INCH)

ALL VISIBLE LEAKS SHALL BE REPAIRED REGARDLESS OF THE AMOUNT OF LEAKAGE. IF LEAKAGE EXCEEDS THIS RATE, THE APPLICANT IS RESPONSIBLE FOR ASSURING THAT THE CAUSE OF TEST FAILURE IS DETERMINED, ALL NECESSARY REPAIRS ARE MADE, AND REPEATING THE TEST UNTIL THE FORCE MAIN SEGMENT PASSES.

NCDOT POLICY ON DIRECTIONAL DRILLING OF UTILITIES

Directional drilling methods have not been given statewide approval for use on NCDOT right of way. The following conditions shall apply. Under no condition shall the jetting along (wet boring with water) of utility pipelines be allowed. Directional boring utilizing jetting with a Bentonite (or equivalent material) slurry is approved at a minimum depth of ten (10') feet below the pavement surface on non-controlled access routes, a minimum depth of fifteen (15') feet below the pavement surface on controlled access routes, and a minimum of five (5') feet below any ditch line. Any parallel installation utilizing the directional boring method shall be made at a minimum depth of three (3') feet below the ground surface, except where the parallel installation crosses a paved roadway. The tip of the drill string shall have a cutter head. Any changes shall be submitted to the District Engineer for approval prior to construction. An overbore shall not be more than two (2') inches greater than the diameter of the pipe or encasement. An overbore exceeding two (2') inches greater than the diameter of the pipe or encasement will be considered if the encroachment agreement includes a statement signed and sealed by a North Carolina Registered Professional Engineer indicating that an overbore in excess of two (2') inches of the pipe or encasement will arch and no damage will be done to the pavement or subgrade.

2.0 WASTEWATER COLLECTION SYSTEM

2.1 Gravity Sewer Main Materials

Ductile iron pipe shall be designed as per ANSI A21.50 and ANSI A21.51 for a working pressure of 150 psi; laying condition B. Pipe shall be manufactured as per AWWA C141 in 18 ft. minimum lengths.

Pipe joints shall be of the push-on type as per AWWA C151. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with AWWA C104.

Polyvinyl Chloride (PVC) pipe shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in Specifications D1784. PVC pipe shall have integral wall bell and spigot joints for the conveyance of domestic sewage. Fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13364-B as defined in Specifications D1784. Fittings must be manufactured by pipe supplier or approved equal, and have bell and/or spigot configurations compatible with that of the pipe. Composites with superior properties are also acceptable.

Pipe shall have a maximum Standard Dimension Ratio (SDR) of 35. Where laying conditions so warrant, and in accordance with manufacturer's recommendations, lower SDR values (stronger pipe) may be required.

Installation shall consist of either Class I or Class II bedding material (as defined hereinafter), placed 6" below the pipe barrel and continuing to a minimum of 6" above the pipe, as per ASTM D2321. In addition, the installation of PVC pipe shall satisfy the flexible pipe requirements as outlined hereinafter. No Clay or VCP Pipe will be accepted.

Additional Requirements for PVC Pipe

A. Installation of PVC pipe shall follow the recommendations of ASTM-D-2321 "Underground Installation of Flexible Thermoplastic Sewer Pipe". For flexible pipe bedding and embedment material shall be either Class I or Class II. In any area where the pipe will be installed below existing or future ground water levels and where the trench could be subject to inundations, in any area material shall be used for bedding and embedment.

B. The manufacturer's specifications or otherwise approved method shall be used in determining the stiffness class of the pipe to be installed so as to obtain the required deflection control. The class of the pipe must be approved by the Engineer prior to installation.

C. The maximum allowable deflection after installation shall be LESS THAN 5% of the pipe diameter. The mandrel (polypropylene) deflection test must be performed on each line prior to acceptance, and no less than 30 days after installation. The Contractor shall supply the mandrel used for this performance test. The mandrel device shall be cylindrical in shape and have 8 possible contact points with the pipe. The mandrel's length and diameter (D of proving ring) shall equal the dimensions in the following table, and shall be subject to the Engineer's approval.

For flexible PVC pipes, the following shall apply:

Nominal Diameter	Length	Proving Ring Dia/Mandrel
8"	8"	7.40"

D. For flexible PVC pipe, the pipe shall be produced with bell and construction. Joining will be accomplished by rubber gasket in accordance with manufacturer's recommendation, unless otherwise directed or approved Engineer. Flexible watertight elastomeric seals in accordance D3212-81, may also be used. Each pipe length shall be clearly marked information including pipe size, profile number, and class number.

E. A minimum trench width shall be one pipe diameter plus 9" on each side of the pipe.

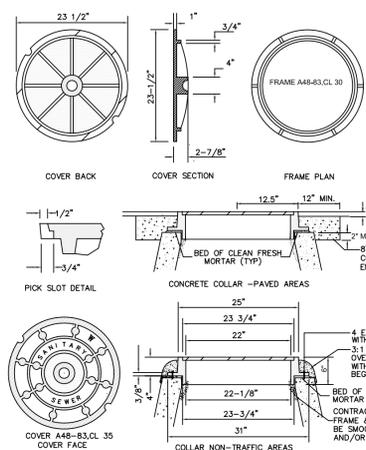
F. The bedding (6" minimum) and embedment materials shall be per ASTM D2321. The embedment materials shall be installed from trench wall to trench wall and from the invert to a minimum of 6" above the crown of the pipe.

G. The bedding and embedment materials shall be compacted to a minimum of 90% Standard Proctor density for Class I and II materials. Bedding and embedment materials classifications shall be defined as follows:

Class I
Angular (1/4" to 1-1/2") graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed gravel and crushed shells.

Class II
Coarse sands and gravels with maximum particle size of 1-1/2", including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW & SP are included in this class.

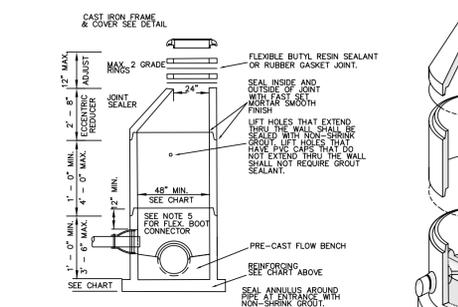
H. The minimum design slope for gravity sewer mains shall be 0.6%, and no gravity lines will be accepted with less than 0.5% slope "Installed".



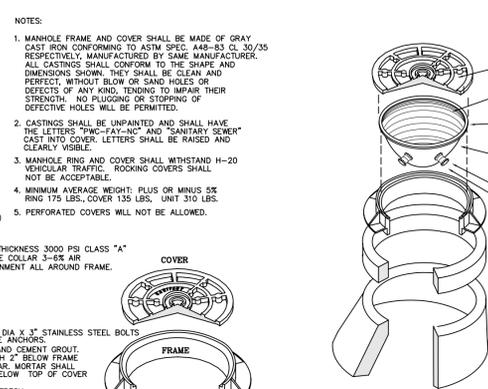
TYPICAL MANHOLE FRAME & COVER
SCALE: NONE

PIPE SIZE	MANHOLE SIZE	MIN. WALL THICKNESS	MIN. REINF. STEEL	MIN. BASE THICKNESS
24" & LESS	48" DIAMETER	6"	ASTM A-185 0.12 SQ./IN.	6"
24" - 36"	60" DIAMETER	6"	ASTM A-185 0.15 SQ./IN.	6"
42"	72" DIAMETER	6"	ASTM A-185 0.15 SQ./IN.	6"

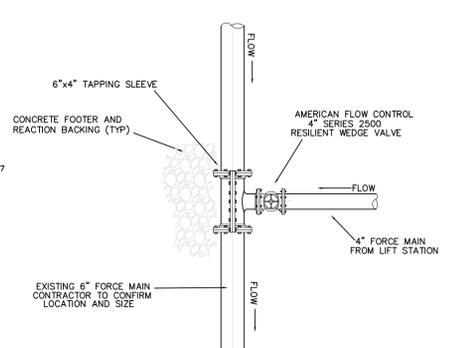
MANHOLE DIAMETER SIZES MAY BE ADJUSTED ON THE PLANS TO REFLECT THE CONCRETE MANHOLE SIZES ARE NOT ACCEPTABLE ON MANHOLES LESS THAN OR EQUAL TO 6' DIAMETER.



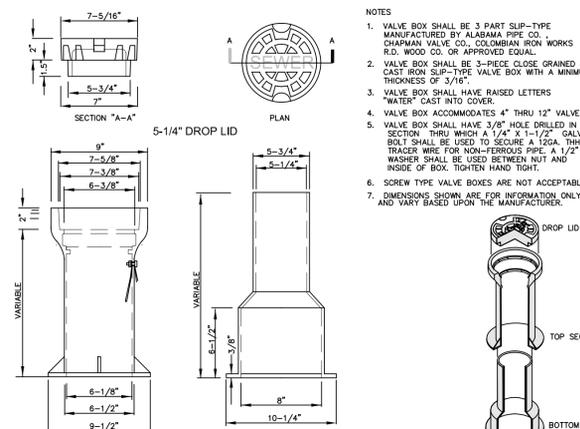
TYPICAL MANHOLE
SCALE: NONE



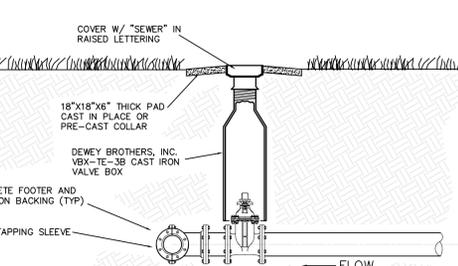
TYPICAL MANHOLE INSERT
SCALE: NONE



FORCE MAIN CONNECTION DETAIL - PLAN
SCALE: NONE

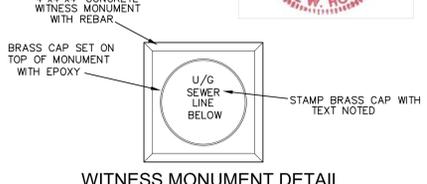


VALVE BOX DETAIL - SEWER
NOT TO SCALE

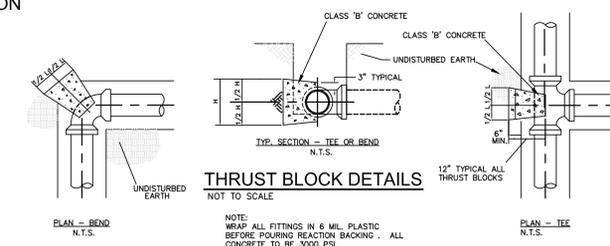


FORCE MAIN CONNECTION DETAIL - PROFILE
SCALE: NONE

KDH COMMISSIONERS REVIEW PLAN NOT RELEASED FOR CONSTRUCTION



WITNESS MONUMENT DETAIL
SCALE: NONE



THRUST BLOCK DETAILS
NOT TO SCALE

CONCRETE THRUST BLOCK SCHEDULE

PIPE SIZE INCHES	TEE AND DEAD END		BEND				DESIGN PRESSURE PSI						
	H	L	90°	45°	22 1/2°	11 1/4°	H	L					
4" & 2	1.5'	2.0'	0.11	1.5'	2.0'	0.11	1.5	2.0	0.11	150			
6"	2.5'	2.5'	0.23	2.5'	2.5'	0.23	1.5	2.0	0.11	150			
8"	2.5'	2.5'	0.23	3.0	3.0	0.33	2.5'	2.5'	0.23	1.5	2.0	0.11	150

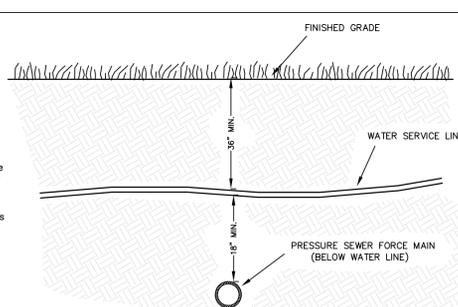
Relation of Water Mains to Sewers

(a) Lateral Separation of Sewers and Water Mains. Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation--in which case:

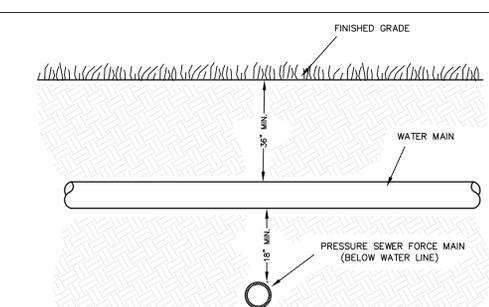
- The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or
- The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

(b) Crossing a Water Main Over a 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 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18 inch vertical separation--in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

(c) Crossing a Water Main Under a Sewer. Whenever it is necessary for a water main to cross under a sewer, both the water main and sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

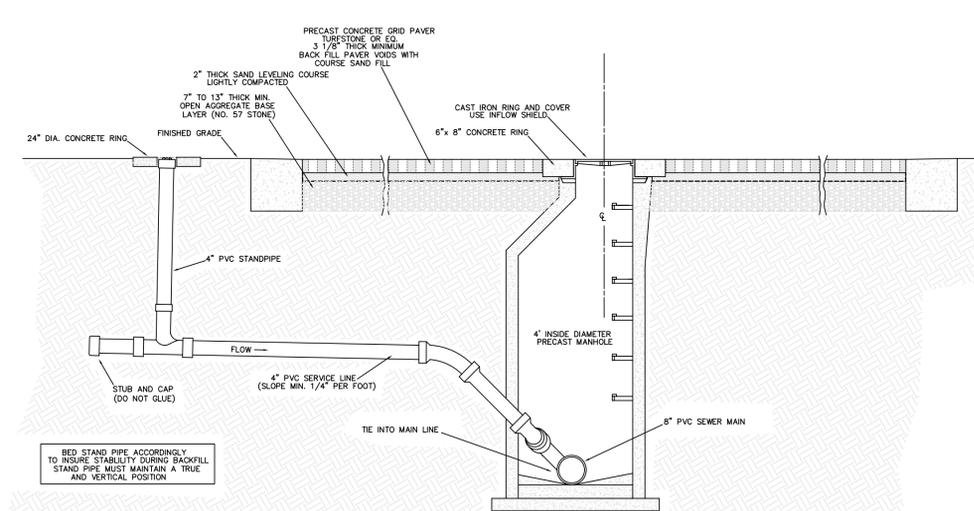


WATER SERVICE / SEWER FORCE MAIN CROSSING DETAIL
NOT TO SCALE



WATER MAIN / SEWER FORCE MAIN CROSSING DETAIL
NOT TO SCALE

North Carolina ONE-CALL CENTER
Call Before You Dig 1-800-632-4949
www.nccoc.org



TYPICAL SEWER SERVICE DETAIL
NOT TO SCALE

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WASTEWATER PLAN

REVISIONS

NO.	DATE	DESCRIPTION	BY	CHKD.
1	07-27-22	REV FOR PHL COMPLETION REVIEW	MWR	

PROJECT: OCEAN BREEZE TOWNHOMES
NORTH CAROLINA
DARE COUNTY
KILL DEVIL HILLS

902 SOUTH VIRGINIA DARE TRAIL

DATE: 01-31-22 SCALE: 1"=20'
DESIGNED: MWR DRAWN: MWR
SHEET: 9 OF 10
CAD FILE: ocean view cottages-kdh-base.dwg
PROJECT NO: 051121