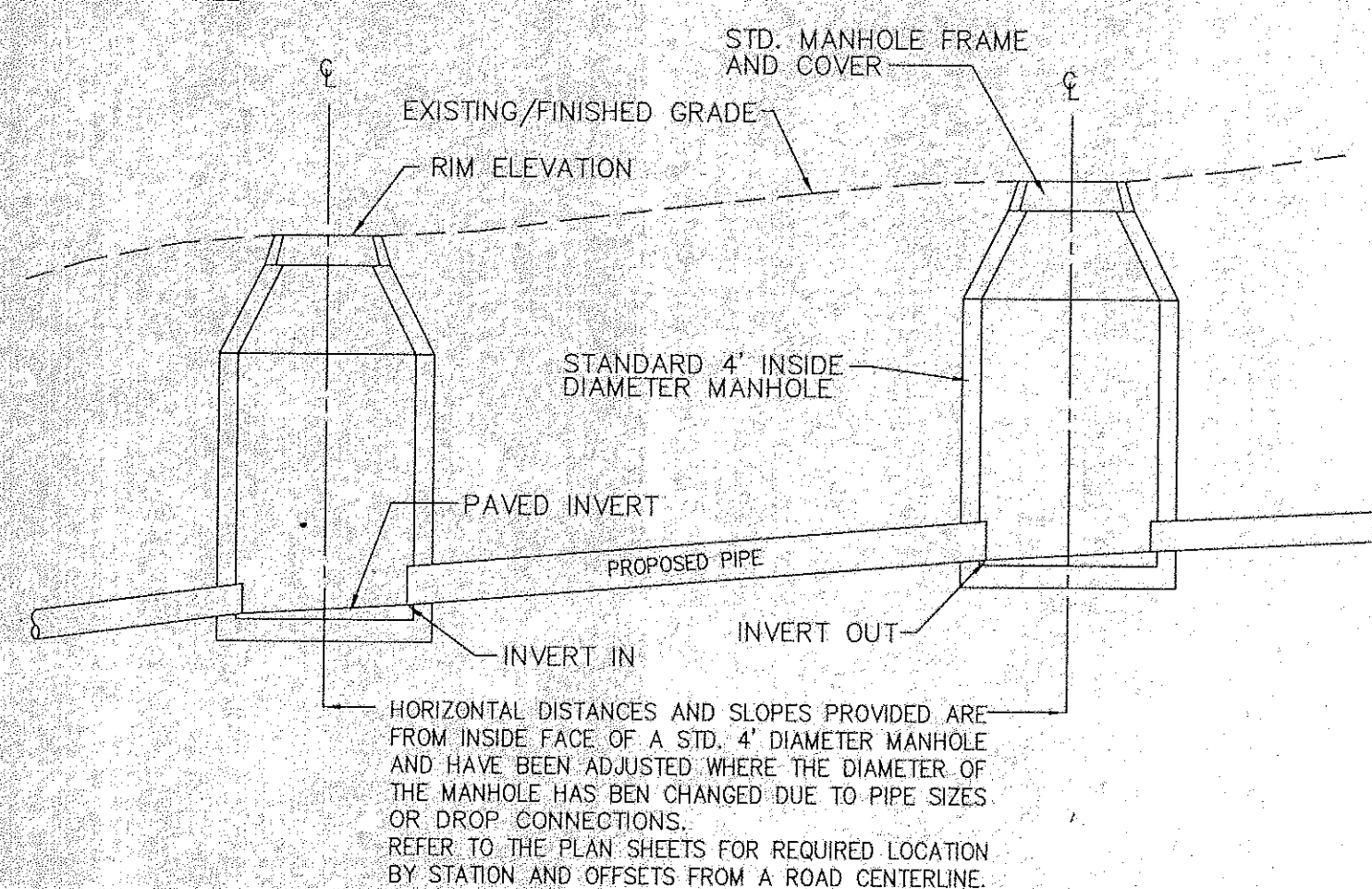


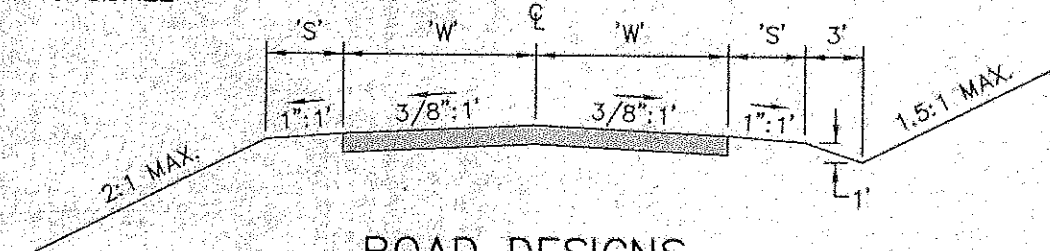
MANHOLE CONSTRUCTION INFORMATION

NO SCALE



TYPICAL ROADWAY SECTIONS

NO SCALE



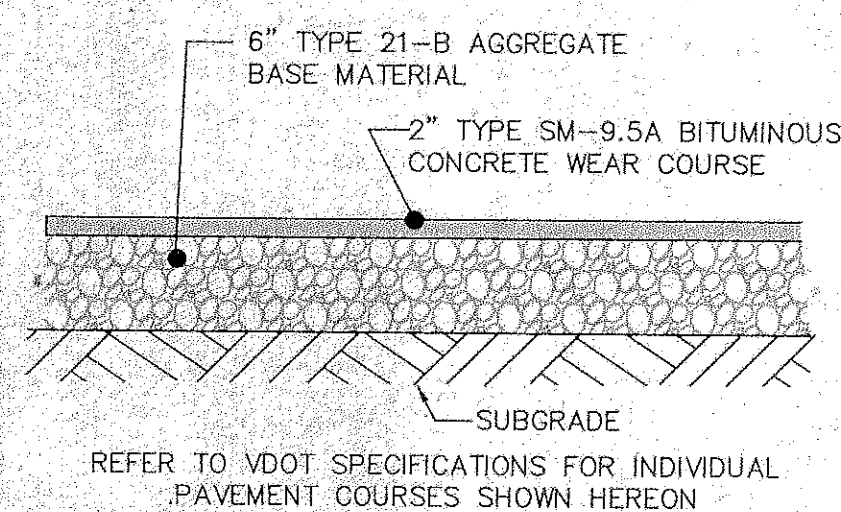
ROAD DESIGNS

ROAD	PAVEMENT WIDTH	SHOULDER WIDTH
'A'		
STA. 10+00 to 14+56	10'	4'
STA. 14+56 to END	7'	2'
'B'	8'	3'
'C'	7'	2'
'D'	7'	2'

* NOTE THAT MINIMUM SHOULDER WIDTH SHALL BE AS INDICATED UNLESS PROPOSED WATERLINE CONSTRUCTION IS LOCATED IN THE SHOULDER. THEN SAID SHOULDER AREA SHALL BE MINIMUM 10' PAST THE CENTERLINE OF THE INSTALLED WATERLINE.

PAVEMENT DESIGN

NO SCALE

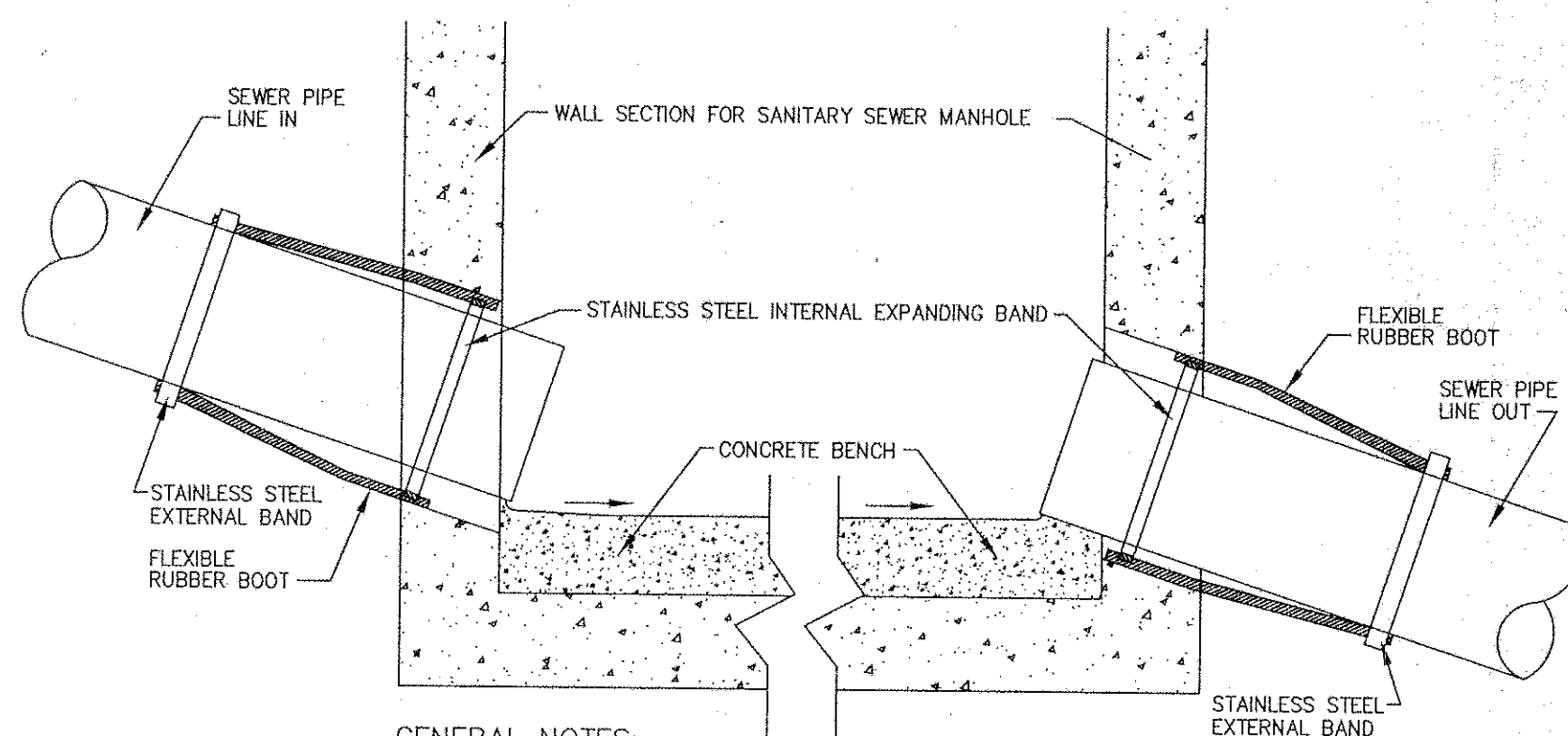


QUANTITY & COST ESTIMATE

ITEM	QUANTITY	x	UNIT COST	TOTAL
Roadway Excavation	11,200	CY	x \$2.50	CY \$28,000.00
Cat I Pavement	2875	SY	x \$10.00	SY \$28,750.00
Grate Inlets	5	EA	x \$1,000.00	EA \$5,000.00
15" Conc. Pipe	528	LF	x \$19.50	LF \$10,296.00
48" Conc. Pipe	120	LF	x \$72.00	LF \$8,640.00
48" End Sections	2	EA	x \$450.00	EA \$900.00
Conc. Ditch	155	LF	x \$15.00	LF \$2,325.00
Rip-Rap	17	CY	x \$75.00	CY \$1,275.00
SWM Riser			Lump Sum	\$4,000.00
Emergency Spillway			Lump Sum	\$2,000.00
SWM Embankment	7100	CY	x \$2.50	CY \$17,750.00
8" S.S. Pipe	2178	LF	x \$20.00	LF \$43,560.00
Std. S.S. Manholes	15	EA	x \$1,200.00	EA \$18,000.00
4" Laterals/Cleanouts	18	EA	x \$300.00	EA \$5,400.00
8" Waterline	860	LF	x \$22.50	LF \$19,350.00
8" Gate Valves	1	EA	x \$500.00	EA \$500.00
8" Blow-offs	1	EA	x \$700.00	EA \$700.00
8" Fittings	4	EA	x \$200.00	EA \$800.00
Fire Hydrant Assembly	2	EA	x \$1,500.00	EA \$3,000.00
Double Meter Setters	8	EA	x \$350.00	EA \$2,800.00
Single Meter Setters	2	EA	x \$300.00	EA \$600.00
Air Release Valves	1	EA	x \$1,500.00	EA \$1,500.00
Permanent Blow-off	2	EA	x \$500.00	EA \$1,000.00
As-built Plans			Lump Sum	\$2500.00
			Sub-Total	\$208,646.00
			10% Contingency	\$20,864.60
			ESTIMATED TOTAL	\$229,510.60

SEVERE GRADE MANHOLE CONSTRUCTION

NO SCALE



GENERAL NOTES:

1. CIRCULAR OPENING IN THE MANHOLE SHALL BE OF DIAMETER TO FIT THE REQUIRED BOOT SIZE AND SHALL BE DRILLED OR CAST AT THE PIPE GRADE INDICATED BY THE PROFILES.
2. KOR-N-SEAL FLEXIBLE RUBBER BOOT, AS MANUFACTURED BY NATIONAL POLLUTION CONTROL SYSTEMS, INC. (OR APPROVED EQUAL) SHALL BE USED FOR A WATERTIGHT CONNECTION.
3. SHAPE AND SLOPE NEW INVERT CHANNEL FOR SMOOTH FLOW FROM INVERT IN TO INVERT OUT.

WATER NOTES

A minimum cover of three (3) feet is required over proposed lines.

Contractor shall be responsible for locating and uncovering valve vaults after paving and adjustment to final grade if necessary.

All existing utilities may not be shown or may not be shown in the exact location. The contractor shall comply with the State Water Works Regulations, Section 12.05.03, where lines cross.

All trenches in existing or future highway right-of-ways shall be compacted according to V.D.O.T. standards.

Lines shall be staked prior to construction.

Water main shall be minimum Class 52 Ductile Iron in accordance to AWWA C151 or DR-14 PVC in accordance with AWWA C-900.

The construction of the proposed public water main and all residential services shall be in compliance with the Roanoke County Water and Sewer Regulations, 3rd Edition. Refer to these regulations for complete details and installation methods.

Availability number 02-194

SEPARATION OF WATER LINES AND SANITARY SEWER LINES

PARALLEL INSTALLATION

- A. Normal Conditions - water lines shall be laid at least ten feet (10') horizontally from a sewer line whenever possible, the distance shall be measured edge-to-edge unless determined by the Utility Director to be an unusual condition.
- B. Unusual Conditions - when local conditions prevent a horizontal separation described above, the following construction shall be used:
 1. The bottom (invert) of the water main shall be at least eighteen inches (18") above the top (crown) of the sewer.
 2. Whenever this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling. Pressure test shall be 30 psi.
 3. The sewer manhole shall be installed using 100% water-tight construction and tested in place by filling with water to top of manhole cover frame.

CROSSINGS

- A. Normal conditions - water lines crossing over sewers shall be laid to provide separation of at least eighteen inches (18") between the bottom of the water line and the top of the sewer whenever possible.
- B. Unusual conditions - when local conditions prevent a vertical separation as described above, the following construction shall be used:
 1. Sewers passing over or under waterlines shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfill. Pressure test shall be 30 psi.
 2. Water lines passing under sewers shall, in addition, be protected by providing:
 - a. A vertical separation of at least eighteen inches (18") between the bottom of the sewer and the top of the waterline. Sewer line shall be encased along its length where it is within ten feet (10') of the waterline.
 - b. Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the waterline.
 - c. The length of the waterline to be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

SEWER NOTES

A minimum cover of three (3) feet is required over proposed lines.

Contractor shall be responsible for locating and uncovering all manholes after paving. Manhole tops shall be adjusted to grade if necessary.

All existing utilities may not be shown or may not be shown in the exact location. The contractor shall comply with State Water Works Regulations, Section 12.05.03, where lines cross.

House connections are to be made with 4" pipe installed at a minimum grade of 1/4 inch to 1 foot in R/W.

Laterals from manholes shall be PVC or Ductile Iron of sufficient length to provide two (2) feet of bearing on natural ground. The transition from ductile iron to asbestos cement or concrete pipe shall be made with an adapter coupling in R/W.

All trenches in existing or future rights-of-way shall be compacted according to V.D.O.T. standards.

Lines shall be staked prior to construction.

The construction of the proposed public water main and all residential services shall be in compliance with the Roanoke County Water and Sewer Regulations, 3rd Edition. Refer to these regulations for complete details and installation methods.

Availability number 02-194

Due to the steep topography, the existing ground along the proposed sanitary sewer main shall be benched and stabilized. Upon completion of the installation of the main, the bench shall remain to provide access for maintenance purposes between MH's 102 & 204.

SANITARY SEWER MANHOLE AND CLEANOUT INFORMATION

LINE	BEARING	DISTANCE
exist. to #101	N. 43°48'08" W.	214.97'
#101 to #102	S. 81°58'01" W.	87.55'
#102 to #103	S. 81°58'01" W.	103.61'
#103 to #104	S. 81°58'01" W.	155.50'
#104 to #105	N. 62°21'14" W.	114.24'
#105 to #106	N. 39°51'14" W.	204.42'
#106 to #107	N. 78°48'21" W.	71.44'
#107 to #108	N. 46°37'34" W.	74.99'
#102 to #201	N. 28°21'59" W.	54.01'
#201 to #202	N. 28°21'59" W.	301.78'
#202 to #203	N. 26°17'47" W.	353.53'
#203 to #204	N. 30°43'17" W.	250.65'
#204 to #205	N. 30°43'17" W.	75.26'
#205 to #206	N. 49°38'13" E.	64.10'
#206 to #207	N. 32°38'58" W.	173.98'

HOME	MH - STA./OS	C.O. Inv.	MIN. FLOOR ELEV.
1	'103' - 1+00.1 / 17.0' Rt.	1195.2	1197.2
2	'103' - 1+22.1 / 17.0' Rt.	1196.7	1198.7
3	'105' - 0+79.1 / 26.0' Lt.	1205.0	1207.0
4	'105' - 1+49.1 / 26.0' Lt.	1209.1	1211.1
5	'108' - 7.75' Lt. of MH.	1213.5	1215.5
6	'108' - 21.5' Rt. of MH.	1213.8	1215.8
7	'107' - 0+11.7 / 20.1' Rt.	1213.2	1215.2
8	'105' - 1+81.9 / 7.0' Rt.	1210.7	1212.7
9	'105' - 1+19.0 / 7.0' Rt.	1206.7	1208.7
10	'105' - 0+49.5 / 7.0' Rt.	1202.8	1204.8
11	'201' - 2+60.6 / 9.5' Lt.	1167.2	1169.2
12	'201' - 2+65.2 / 9.5' Lt.	1167.3	1169.3
13	'202' - 1+00.9 / 9.5' Lt.	1168.0	1170.0
14	'202' - 1+05.4 / 9.5' Lt.	1168.1	1170.1
15	'203' - 2+18.7 / 9.5' Lt.	1170.5	1172.5
16	'203' - 2+22.7 / 9.5' Lt.	1170.5	1172.5
17	'205' - 0+26.0 / 12.0' Lt.	1176.5	1178.5
18	'205' - 0+30.0 / 12.0' Lt.	1176.5	1178.5

STATIONS AND OFFSETS ARE MEASURED ALONG A BASELINE FROM CENTER OF MANHOLE TO CENTER OF MANHOLE WITH 0+00.0 BEING THE BEGINNING AT THE LOWER MANHOLE.

CLEANOUT ELEVATIONS ARE BASED ON A MINIMUM SLOPE OF 2.08% WITHIN THE RIGHT-OF-WAY OR EASEMENTS AND MAY BE INCREASED AS DICTATED BY THE SURROUNDING TOPOGRAPHY.

THE MIN. FLOOR ELEVATION IS BASED ON SEC. 200.02-5-A-8 OF THE ROANOKE CO. WATER & SEWER REGULATIONS. LOT OWNERS REQUESTING A LOWER SERVICE ELEVATION WILL REQUIRE THE USE OF A PRIVATE SEWAGE PUMP FACILITY, INSTALLED AND MAINTAINED BY THE HOMEOWNER.

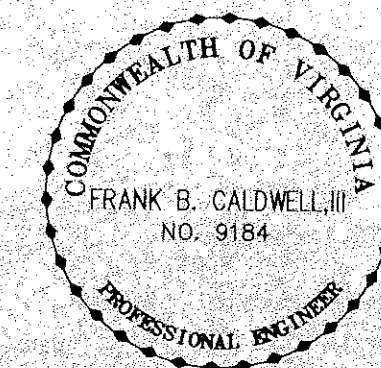
CONSTRUCTION DETAILS AND NOTES

SPEEDWELL

PROPOSED CLUSTER HOME SUBDIVISION

DEVELOPMENT OF TAX PARCELS #87.17-6-11.3, #87.17-6-12 & #97.05-1-27
situate between Merriman Road and Crystal Creek Drive
CAVE SPRING MAGISTERIAL DISTRICT
ROANOKE COUNTY, VIRGINIA

Designed: J.V. Judy
Drawn: J.V. Judy
Checked: F.B. Caldwell
Date: Mar. 29, 2003
Scale: 1"=40'
Tax Parcel: See Title
Field Book: JW #16



REVISED: 4/7/04 per COUNTY OF ROANOKE 3rd REVIEW
REVISED: 3/3/04 per COUNTY OF ROANOKE 2nd REVIEW

CWA
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ENGINEERS / SURVEYORS / PLANNERS
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ROANOKE, VIRGINIA 24017
Telephone: (840) 366-3400 • Fax: (840) 366-8702
EMAIL: CWA@ROANOKEVA.COM AOL.COM