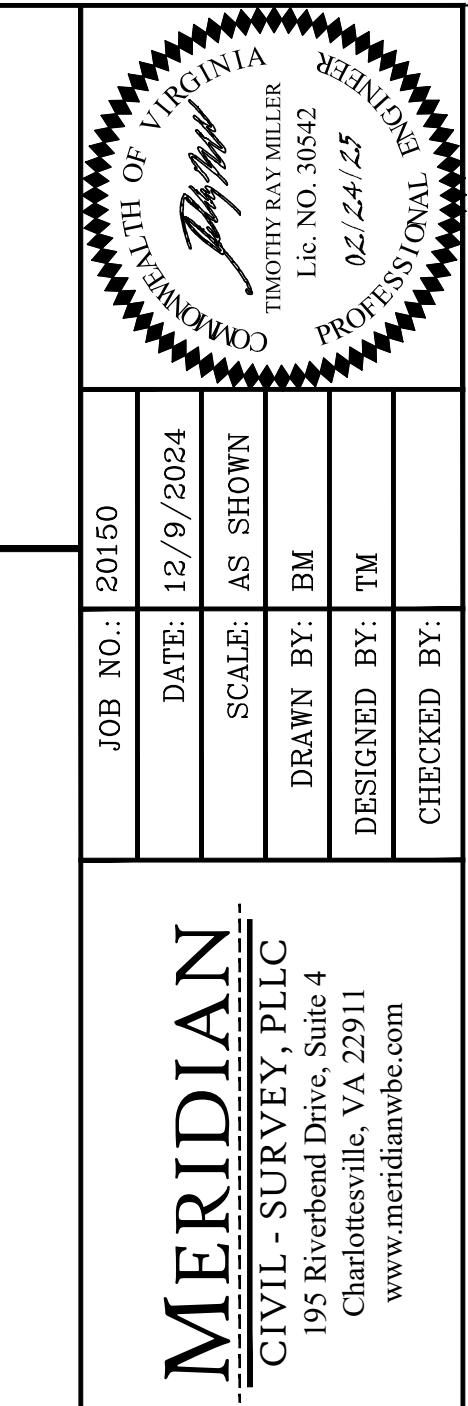


APPLICATION PLAN FOR CENTRAL SEWERAGE SYSTEM REQUEST  
CSW-2025-00002 & SDP 202300067  
OLD DOMINION VILLAGE

TMP 05600-00-00-067B0 & TMP 05600-00-00-074AO  
WHITE HALL DISTRICT, ALBEMARLE COUNTY, VIRGINIA



**PARCEL DATA FOR TMP 05600-00-00-067B0**

LEGAL\_REFERENCE: TMP 05600-00-00-067B0  
MAGISTERIAL\_DISTRICT: WHITE HALL  
OWNER: MARTIN SCHULMAN  
5220 HAVENWOOD LANE  
SCHUYLER, VA 22969  
SITE\_PLAN\_NUMBER: NONE  
PRELIMINARY\_SUBDIVISION: SUB202300003  
SPECAIL\_USE\_PERMIT: SP 1989: VETERINARY HOSPITAL WITH INDOOR KENNELS.  
ZONING\_MAP\_AMENDMENT: ZMA 2020-00005  
CURRENT\_ZONING\_DISTRICT: NMD - NEIGHBORHOOD MODEL  
CURRENT\_USE: OLD DOMINION ANIMAL HOSPITAL CROZET  
RECORDED\_DEEDS: DB 690-599, DB 794-381, DB 1028-358, DB 1086-583,  
DB 3626-623, DB 4341-677  
PARCEL\_ADDRESS: 1263 PARKVIEW DRIVE  
PARCEL\_AREA: 9.306 ACRES  
SOURCE\_OF\_BOUNDARY: BOUNDARY SURVEY PERFORMED BY MERIDIAN CIVIL-SURVEY, PLLC.  
SOURCE\_OF\_TOPOGRAPHY: AERIAL SURVEY PERFORMED BY MCKENZIE SNYDER, INC. ON MARCH 14, 2021.  
FLOODPLAIN: PORTION OF PARCEL IS IN ZONE A AS SHOWN ON FEMA MAP NO. 51003C0, EFFECTIVE DATE FEBRUARY 4, 2005, AND MAP REVISION DATED FEBRUARY 6, 2017.

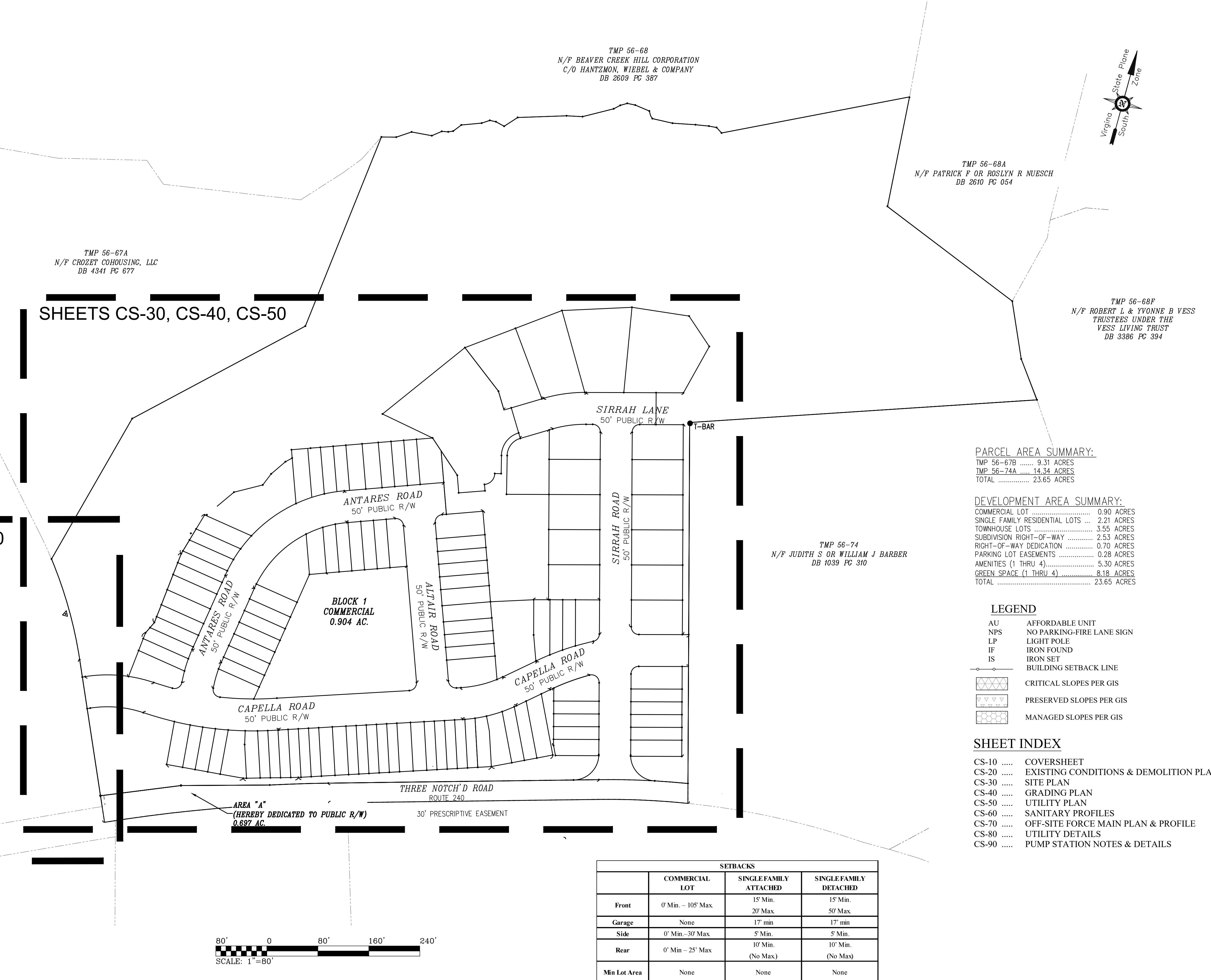
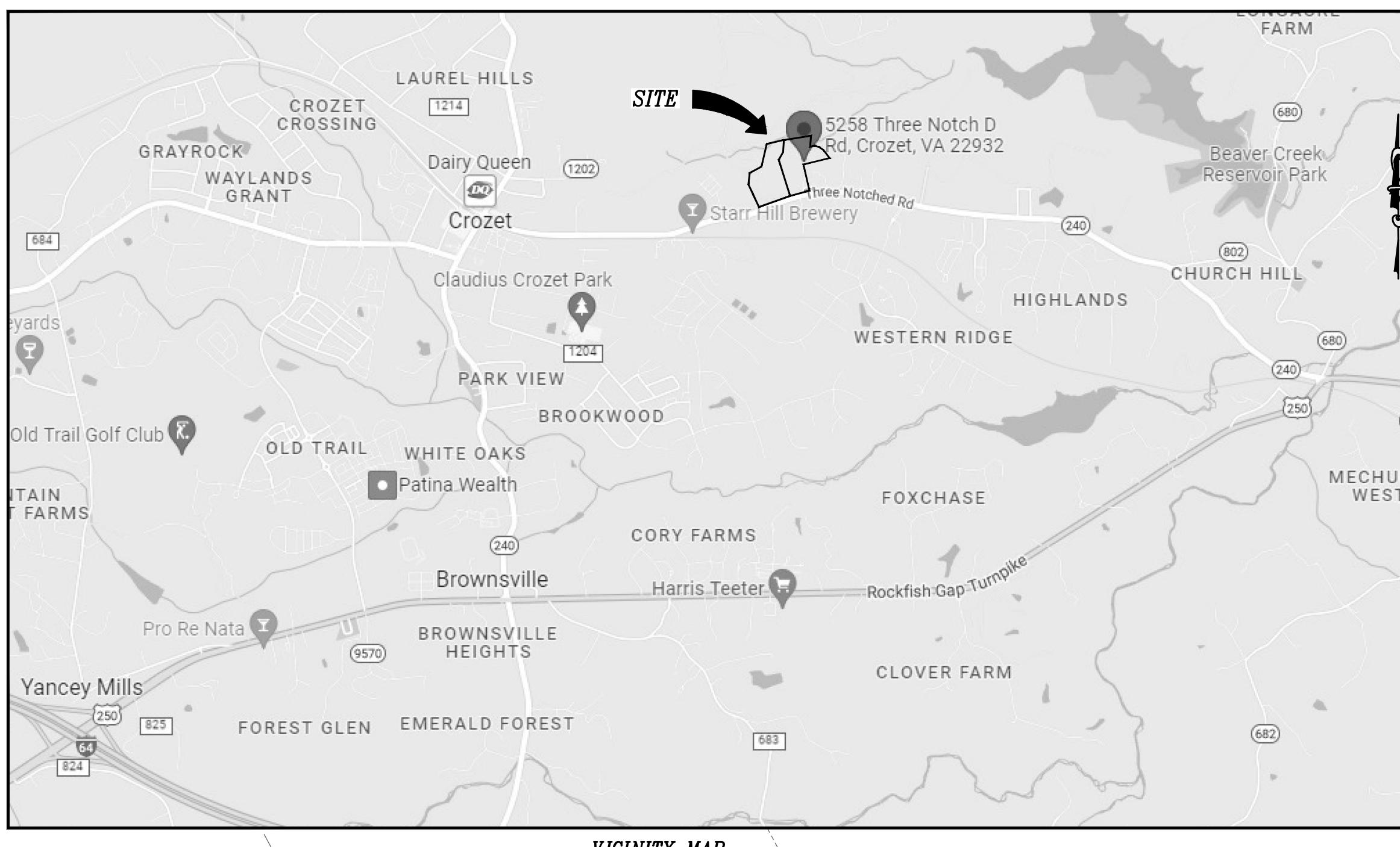
**PARCEL DATA FOR TMP 05600-00-00-074A0**


LEGAL\_REFERENCE: TMP 05600-00-00-074A0  
MAGISTERIAL\_DISTRICT: WHITE HALL  
OWNER: EMERALD LAND, LLC  
325 BARRACKS HILLS  
CHARLOTTESVILLE, VA 22901  
SITE\_PLAN\_NUMBER: NONE  
PRELIMINARY\_SUBDIVISION: SUB202300003  
SPECAIL\_USE\_PERMIT: NONE  
ZONING\_MAP\_AMENDMENT: ZMA 2020-00005  
CURRENT\_ZONING\_DISTRICT: NMD - NEIGHBORHOOD MODEL  
CURRENT\_USE: RESIDENTIAL  
RECORDED\_DEEDS: INST #202300001569  
PARCEL\_ADDRESS: 5258 THREE NOTCH'D ROAD  
PARCEL\_AREA: 14.331 ACRES  
SOURCE\_OF\_BOUNDARY: BOUNDARY SURVEY PERFORMED BY MERIDIAN PLANNING GROUP, LLC.  
SOURCE\_OF\_TOPOGRAPHY: AERIAL SURVEY PERFORMED BY MCKENZIE SNYDER, INC. ON MARCH 14, 2021.  
FLOODPLAIN: PORTION OF PARCEL IS IN ZONE A AS SHOWN ON FEMA MAP NO. 51003C0, EFFECTIVE DATE FEBRUARY 4, 2005, AND MAP REVISION DATED FEBRUARY 6, 2017.


**SITE DATA**

PROPOSED SINGLE\_FAMILY: 16 LOTS  
PROPOSED\_TOWNSHOUSE: 94 LOTS  
PROPOSED\_PARKING: SINGLE FAMILY LOTS: DRIVEWAY AND GARAGE,  
TOWNSHOUSE LOTS: DRIVEWAY AND GARAGE  
TOWNSHOUSE\_GUESTS: 1 SPACE PER 4 TOWNSHOUSES  
PARKING\_SPACES\_REQUIRED: 94 / 4 = 23.5 SPACES  
PARKING\_SPACES PROVIDED: 24 SPACES  
WATER\_& SEWER\_SERVICE: PUBLIC WATER AND PRIVATE SEWER  
AFFORDABLE\_UNITS: REQUIRED: 22  
PROVIDED: 22 (LOTS 32 to 53)

**MERIDIAN**  
CIVIL SURVEY, PLLC  
195 Riverbend Drive, Suite 4  
Charlottesville, VA 22911  
www.meridianvabe.com



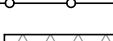




**FIRE PREVENTION STEPS FOR DEMOLITION AND CONSTRUCTION**

1. As found in the Virginia Statewide Fire Prevention Code, establish a written Fire Prevention Plan and identify someone to serve as the Fire Prevention Superintendent to ensure site compliance with the plan.
2. Smoking shall be prohibited in areas where smoking is a hazard, and these areas shall be designated with no smoking signs per Virginia Statewide Fire Prevention Code.
3. Areas where smoking can occur, shall have appropriate receptacles for discarded smoking materials per Virginia Statewide Fire Prevention Code.
4. Contractor shall ensure the street names and building numbers are always plainly visible from the frontage street during construction per the Virginia Statewide Fire Code.
5. Per the Virginia Statewide Fire Prevention Code, safe and efficient vehicular access for firefighting and emergency operations shall be provided and maintained at all construction and demolition sites. This includes provision of the required unobstructed access widths, a surface capable of supporting emergency apparatus of up to 85,000 lbs. in all weather conditions, free of overhead obstructions from 13 ft. 6 inches and below, provide access to fire department connections within 100 feet of water supply/hydrants and must provide for aerial access no closer than 15 ft. and no more than 30 ft. from the access road to buildings over 30 feet tall. This access may be via permanent or temporary road as long as the conditions listed, and they are properly identified/marketed.
6. An approved water supply for firefighting operations shall be in place with unobstructed accessibility as soon as combustible materials arrive on site.
7. Waste and combustible debris shall be removed from the building at the end of each day and disposed of in accordance with the Virginia Statewide Fire Code.
8. Fire extinguishers shall be provided, with not less than one approved fire extinguisher at each stairwell, on all floor levels where combustible materials have accumulated, in every storage and construction shed and in areas of special hazards, such as where flammable and combustible liquids are stored or used, in accordance with the Virginia Statewide Fire Code.
9. Operations involving the use of cutting and welding shall comply with the Virginia Statewide Fire Prevention Code and shall require a permit from the Albemarle County Fire Marshal's Office.

A scale bar diagram for a map. It features a horizontal line with tick marks. The first tick mark is labeled '30'' above the line. The second tick mark is labeled '0' above the line. The third tick mark is labeled '30'' above the line. The fourth tick mark is labeled '60'' above the line. Below the line, the text 'SCALE: 1"=30'' is written.

<u>LEGEND</u>	
AU	AFFORDABLE UNIT
NPS	NO PARKING-FIRE LANE SIGN
LP	LIGHT POLE
IF	IRON FOUND
IS	IRON SET
—○—	BUILDING SETBACK LINE
	CRITICAL SLOPES PER GIS
	PRESERVED SLOPES PER GIS
	MANAGED SLOPES PER GIS

*GREEN SPACE #1  
HEREBY DEDICATED TO ALBEMARLE COUNTY*

JOB NO.:	20150
DATE:	12/9/2024
SCALE:	AS SHOWN
DRAWN BY:	BM
DESIGNED BY:	TM
CHECKED BY:	

**MERIDIAN**  
CIVIL - SURVEY, PLLC  
195 Riverbend Drive, Suite 4  
Charlottesville, VA 22911  
[www.meridianwbe.com](http://www.meridianwbe.com)

# MERIDIAN


CIVIL - SURVEY, PLLC  
195 Riverbend Drive, Suite 4  
Charlottesville, VA 22921

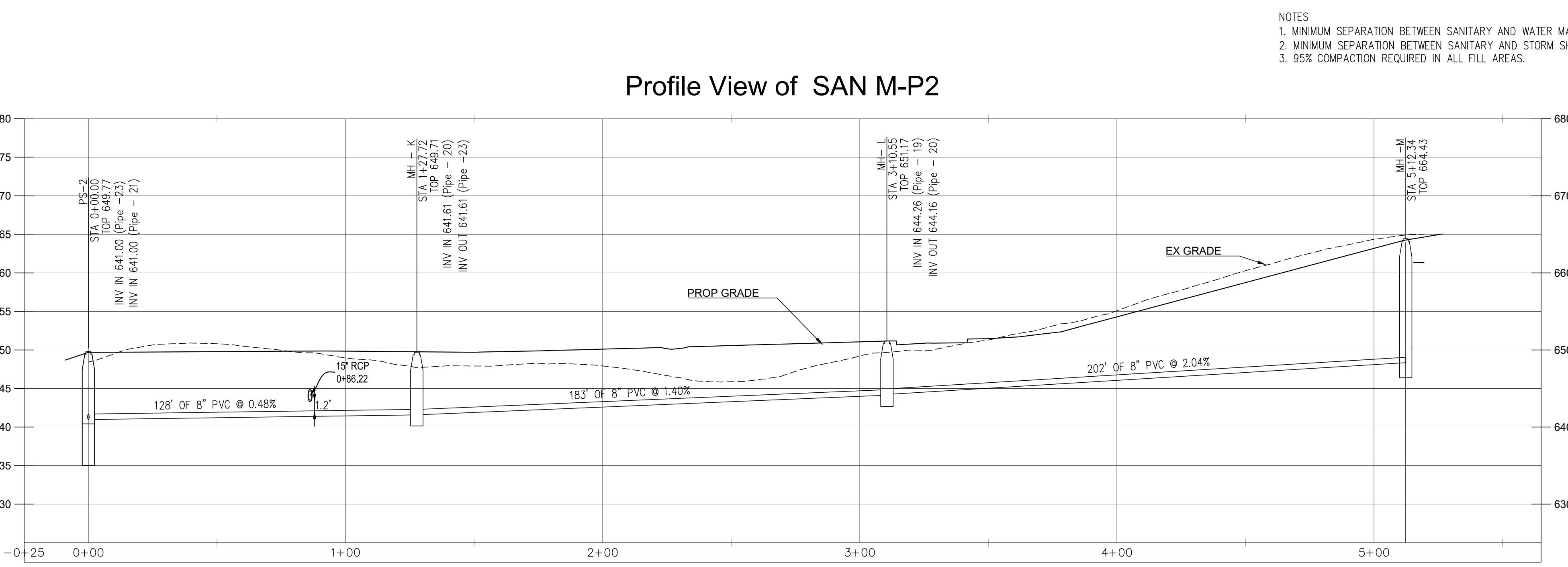
# GRADING PLAN WATER SUPPLY SYSTEM COMINION VILLAGE

PROJECT TITLE:	APPLI CENTRAL OLD D	SHEET TITLE:
SHEET NO.		CS - 40

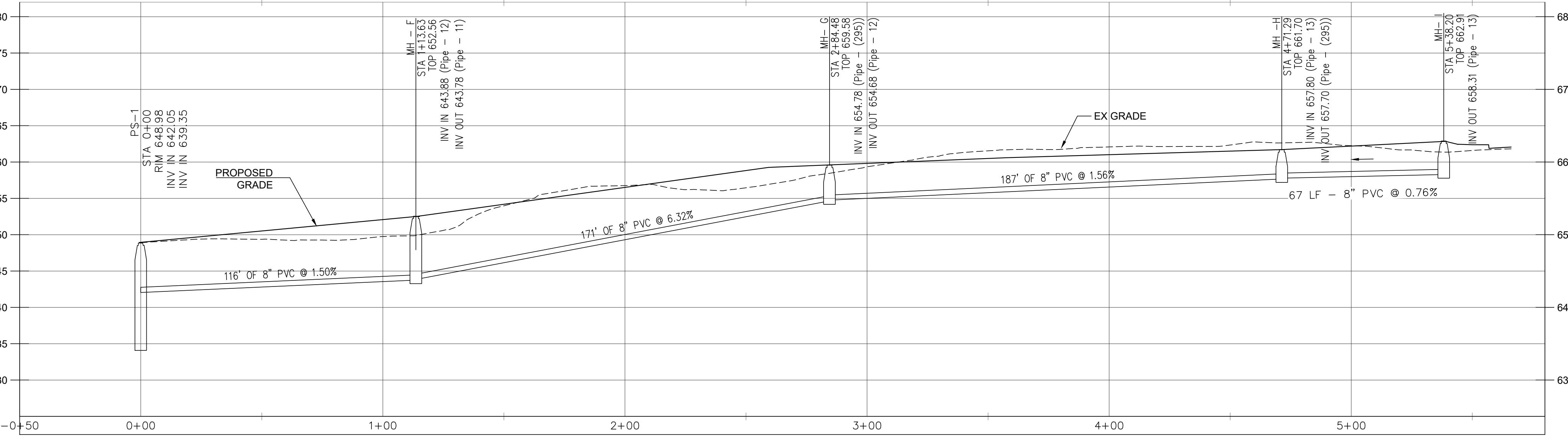
SHEET NO.  
CS-40

SHEET 4 of 9

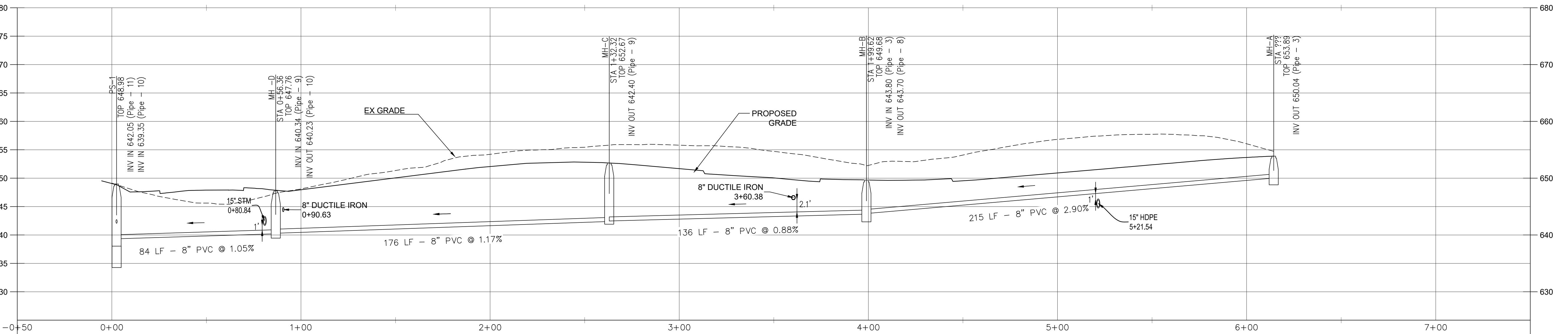




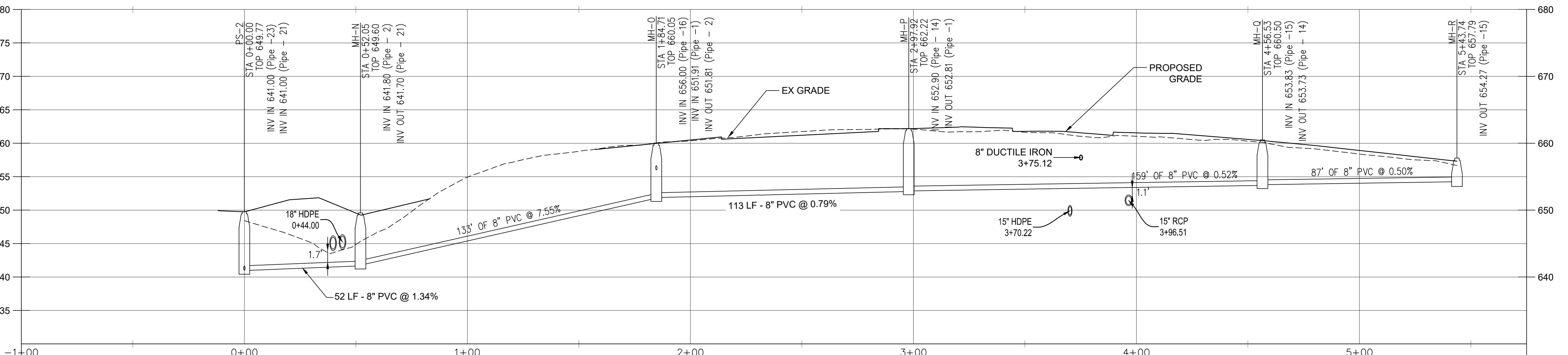
# Profile View of PS-1 TO I



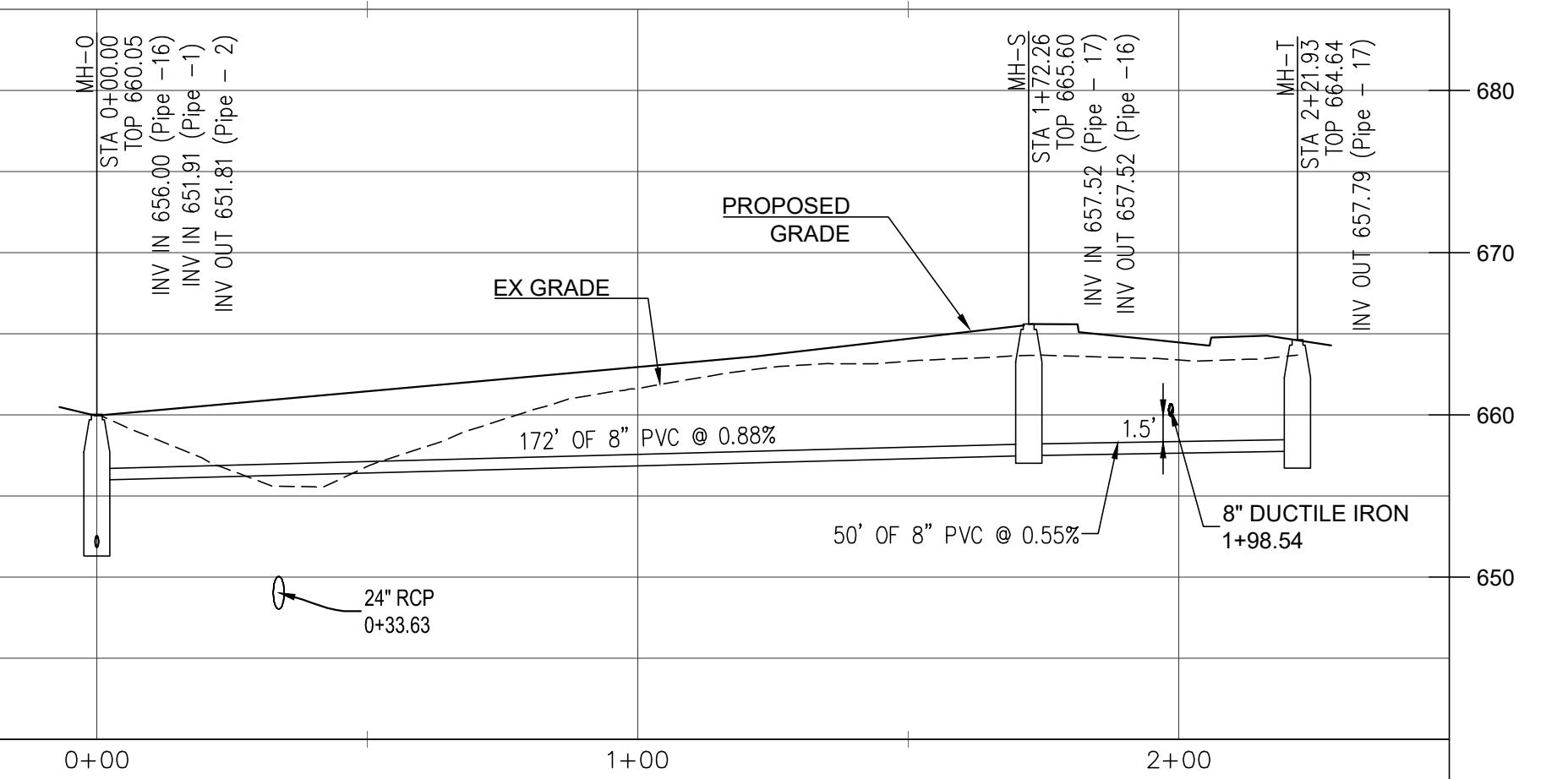
# Profile View of STR A-PS-1



# Profile View of SAN R-P2



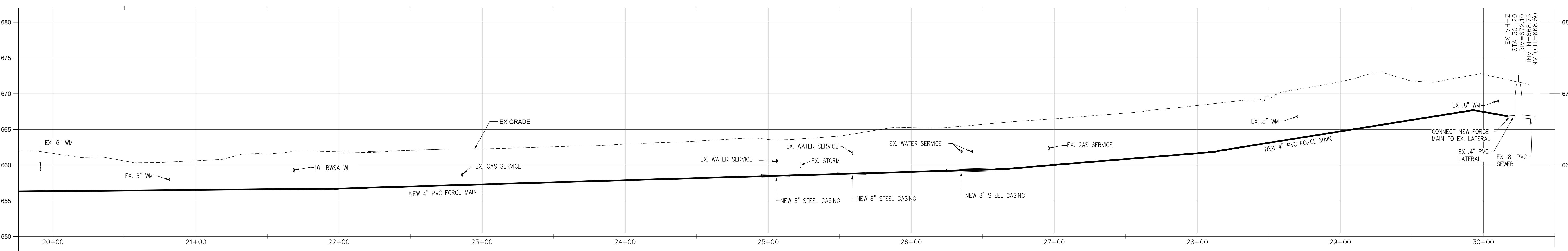
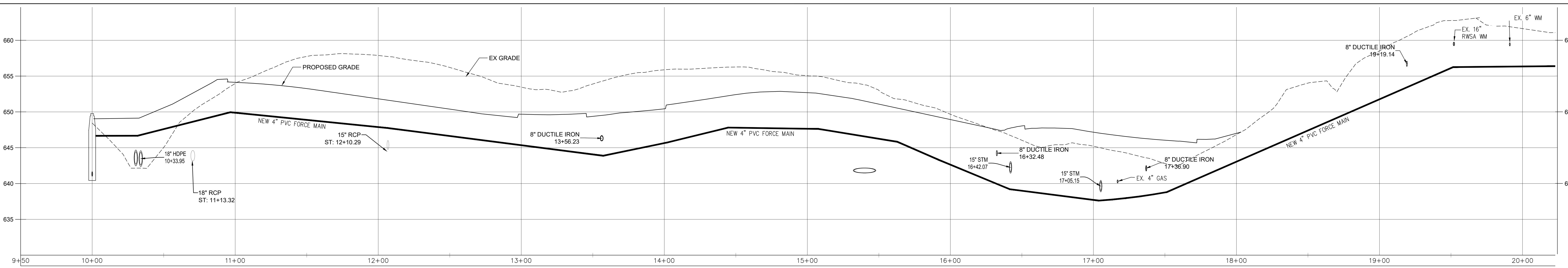
# Profile View of STR T-O



JOB NO.:	20150
DATE:	12/9/2024
SCALE:	AS SHOWN
DRAWN BY:	BM
DESIGNED BY:	TM
CHECKED BY:	

**MERIDIAN**

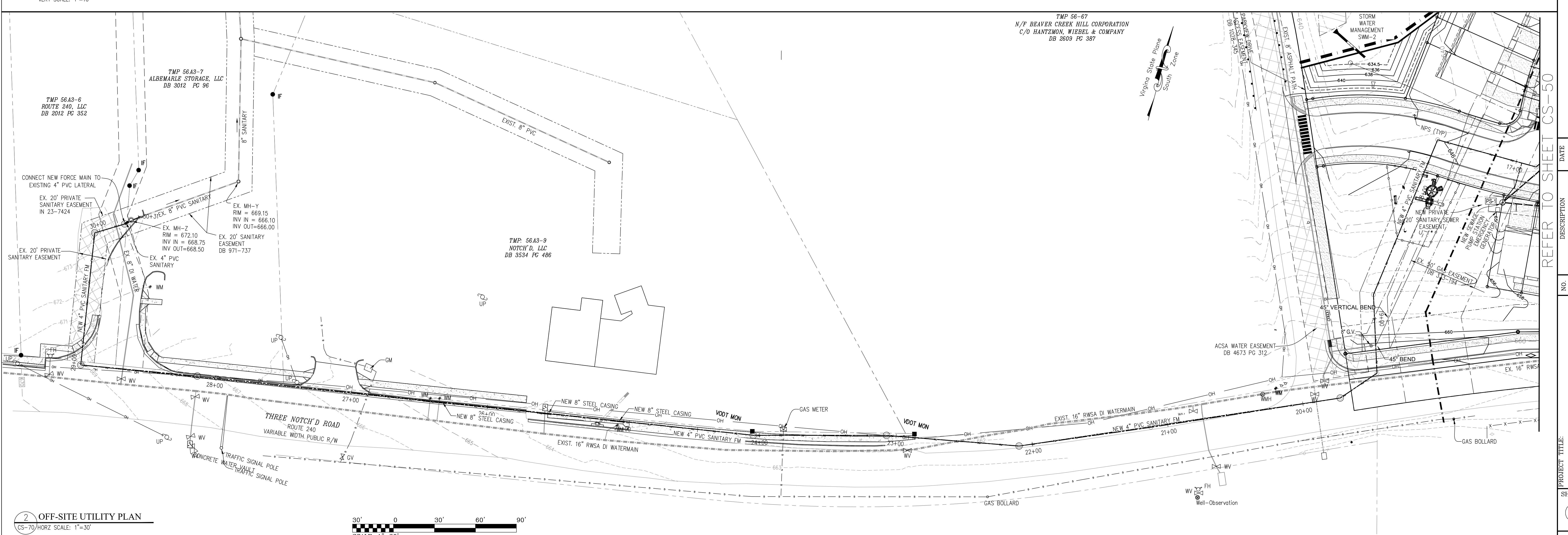
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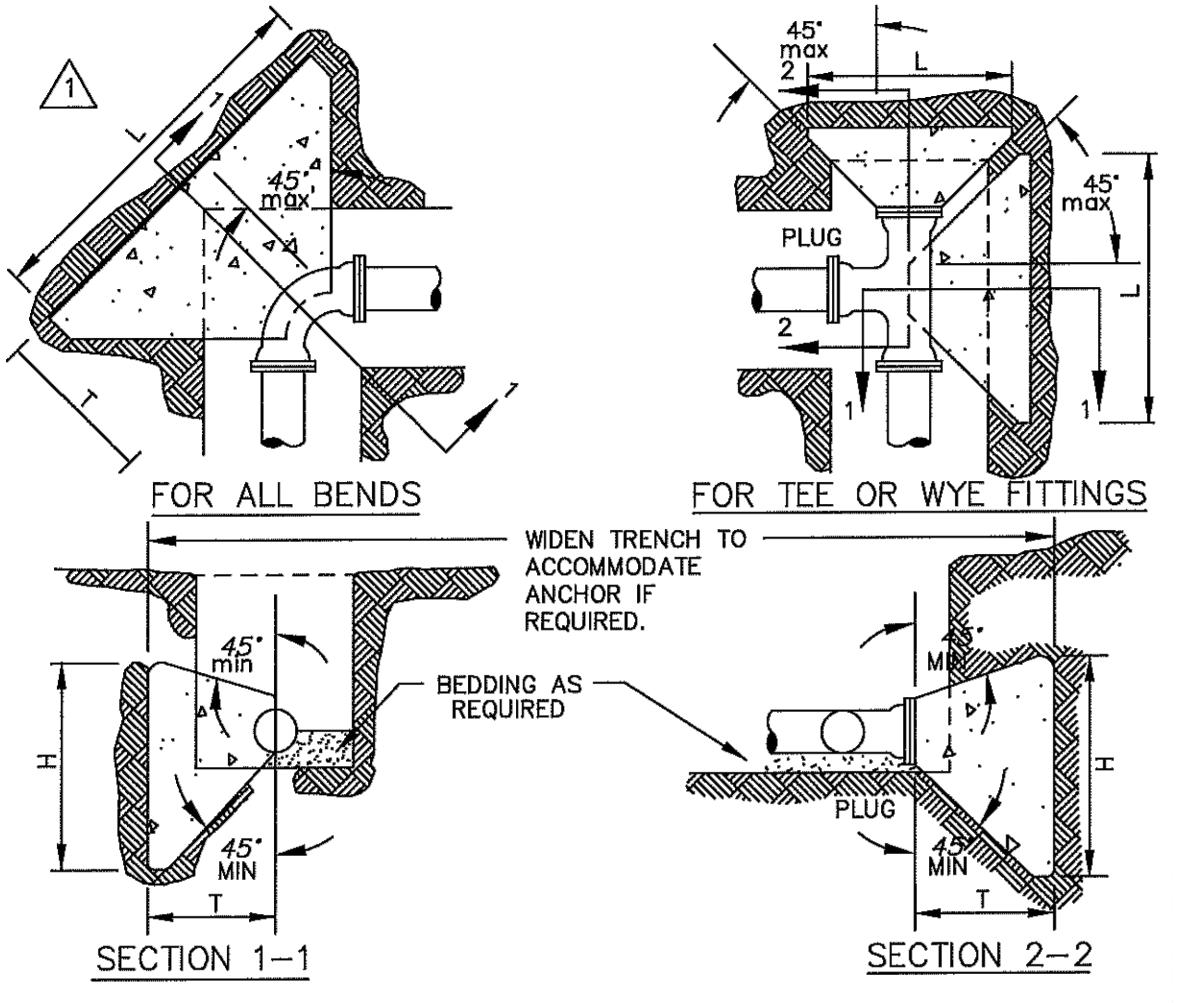
NOTES

1. MINIMUM SEPARATION BETWEEN SANITARY AND WATER MAINS SHALL BE 18".
2. MINIMUM SEPARATION BETWEEN SANITARY AND STORM SHALL BE 12".
3. 95% COMPACTION REQUIRED IN ALL FILL AREAS.
4. DEPTH OF EXISTING UTILITIES AT CROSSINGS SHALL BE VERIFIED BY CONTRACTOR PRIOR TO INSTALLING FORCE MAIN.

# 1 SANITARY FORCEMAIN PROFILE



COUNTY COMMENTS	02/24/25

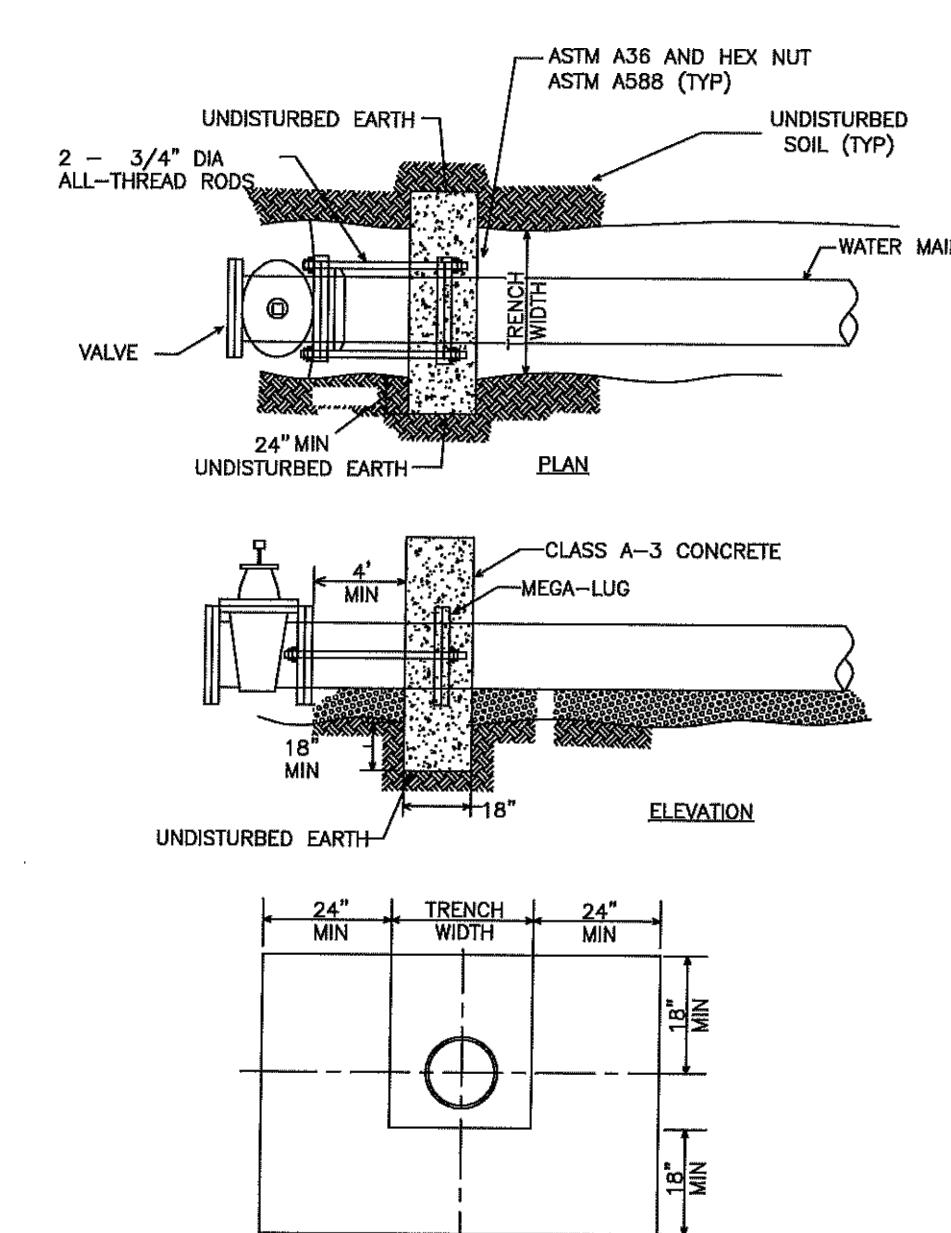


PIPE SIZE	DEGREE OF BEND	BEND DIMENSIONS (FEET)	VOL. CU.YD.	TEE AND PLUGS (FEET)	VOL. CU.YD.
4"	45°	2.50	2.50	3.01	0.24
4"	45°	2.00	2.25	2.60	0.15
4"	22 1/2°	1.50	2.00	2.50	0.10
8"	45°	3.66	3.16	3.21	0.28
8"	45°	2.66	2.66	2.77	0.26
8"	22 1/2°	1.66	2.15	2.67	0.13
10" & 12"	45°	4.83	3.83	3.42	0.83
10" & 12"	22 1/2°	3.33	3.58	2.95	0.43
10" & 12"	11 1/4°	2.33	2.58	2.88	0.24
10" & 12"	11 1/4°	1.63	2.33	2.84	0.18

1. THRUST BLOCKS ARE REQUIRED WHENEVER THE PIPELINE CHANGES DIRECTION, CHANGES SIZE OR DIRECTION, OR CHANGES VALVES.  
 2. USE 2500 P.S.I. CONCRETE.  
 3. NO CONCRETE SHALL BE POURED ON ANY PART OF THE JOINT.  
 4. THE CONSULTANT ENGINEER SHALL BE RESPONSIBLE TO VERIFY THE TYPE & SIZE OF ALL THRUST BLOCKS.

#### CONCRETE THRUST BLOCKS

NTS  
FIG. W-3

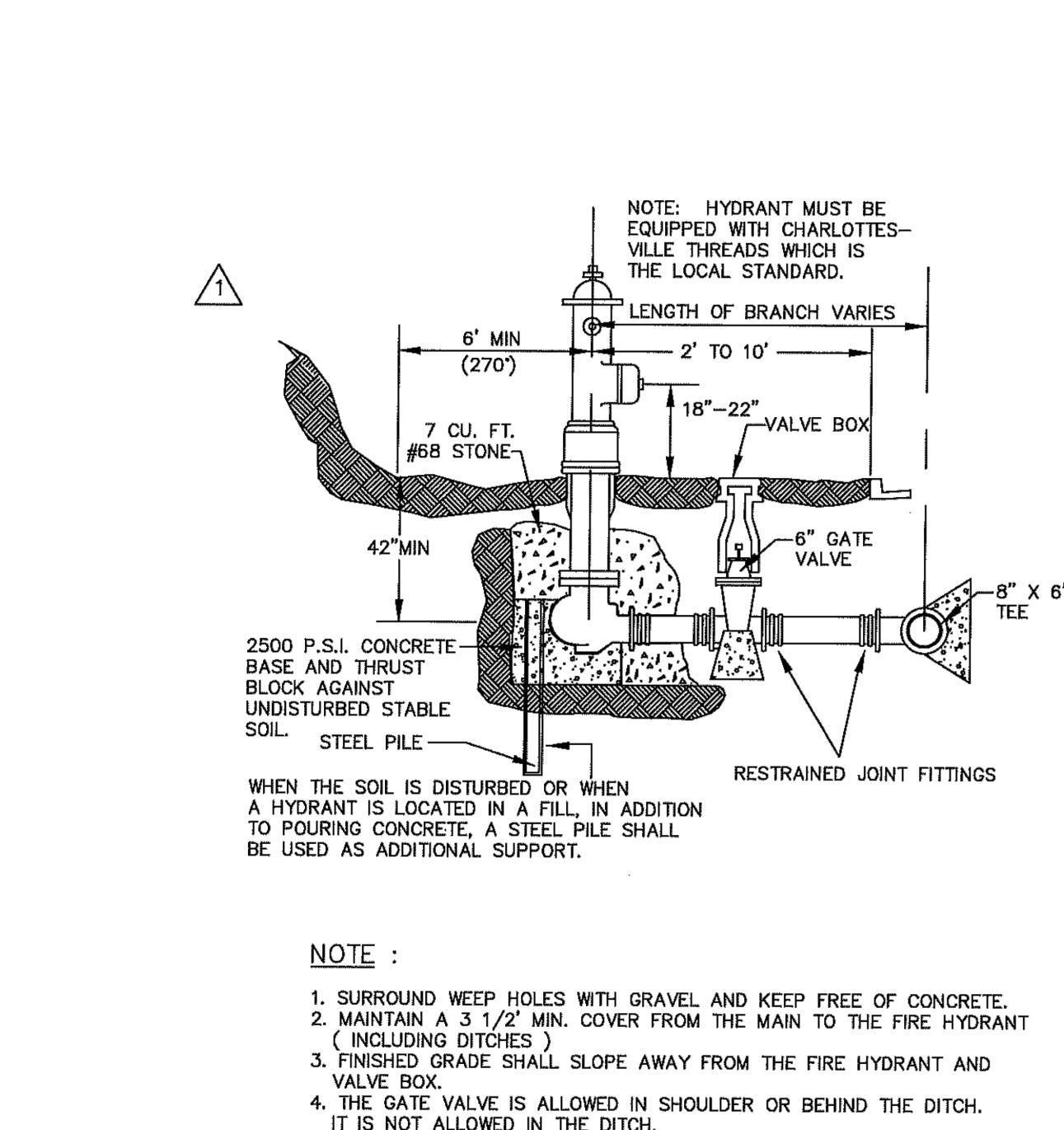


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8"	45°	1.66	2.15	2.67	0.13
10" & 12"	45°	3.33	3.58	2.95	0.43
10" & 12"	45°	2.33	2.58	2.88	0.24
10" & 12"	11 1/4°	1.63	2.33	2.84	0.18

1. ALL RODS AND FASTENERS SHALL BE GIVEN TWO COATS OF ASPHALTIC PAINT AFTER ASSEMBLY.  
 2. CONTRACTOR SHALL ENSURE THAT THE COLLAR BEARS AGAINST UNDISTURBED SOIL FOR THE MINIMUM CONTRACTION SHOWN.  
 3. DIMENSIONS SHOWN BEYOND THE TRENCH WIDTH ARE ABSOLUTE MINIMUM. IF THE TRENCH WIDTH IS LARGER DURING CONSTRUCTION, THE COLLAR DIMENSIONS SHALL INCREASE ACCORDINGLY.

#### CROSS ANCHOR RESTRAINTS FOR VALVES

NTS  
FIG. W-3C

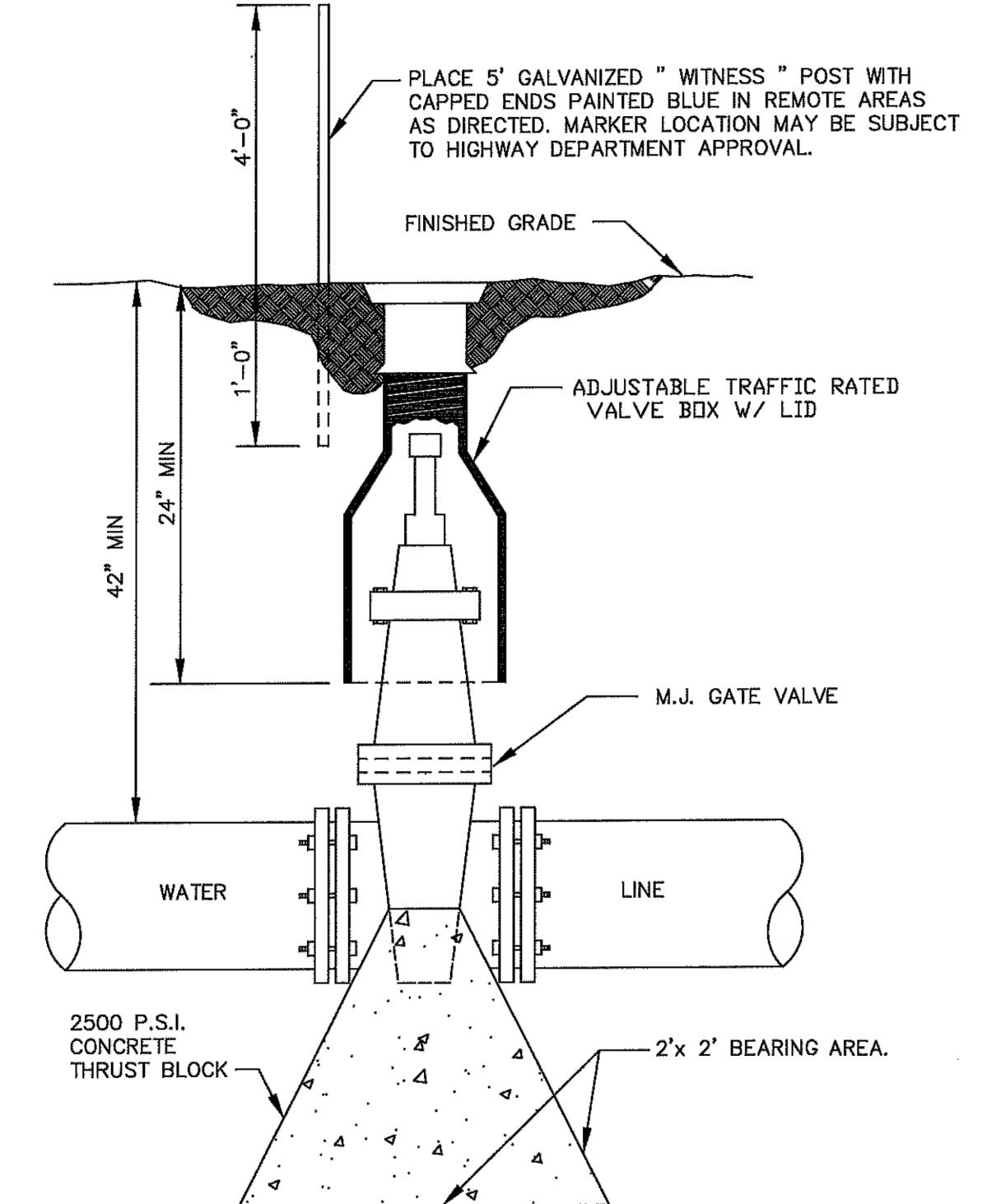


PIPE SIZE	DEGREE OF BEND	BEND DIMENSIONS (FEET)	VOL. CU.YD.	TEE AND PLUGS (FEET)	VOL. CU.YD.
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10" & 12"	22 1/2°	2.33	2.58	2.88	0.24
10" & 12"	11 1/4°	1.63	2.33	2.84	0.18

1. SURROUND WEEP HOLES WITH GRAVEL AND KEEP FREE OF CONCRETE. (INCLUDING DITCHES)  
 2. FINISHED GRADE SHALL SLOPE AWAY FROM THE FIRE HYDRANT AND VALVE BOX.  
 3. THE GATE VALVE IS ALLOWED IN SHOULDER OR BEHIND THE DITCH.  
 4. THE GATE VALVE IS ALLOWED IN SHOULDER OR BEHIND THE DITCH.  
 5. PUMPED WATER IS ALLOWED IN TRENCHES LOCATED WHERE WEEP HOLES ARE ABOVE THE PREVAILING GROUNDWATER ELEVATION. IF REQUIRED TO BE IN WET AREAS, THE WEEP HOLES SHALL BE PLUGGED AND THE HYDRANT SHALL BE PUMPED DRY.

NOTE: IN REMOTE AREAS, VALVE BOXES SHALL EXTEND SIX (6) INCHES ABOVE GRADE.

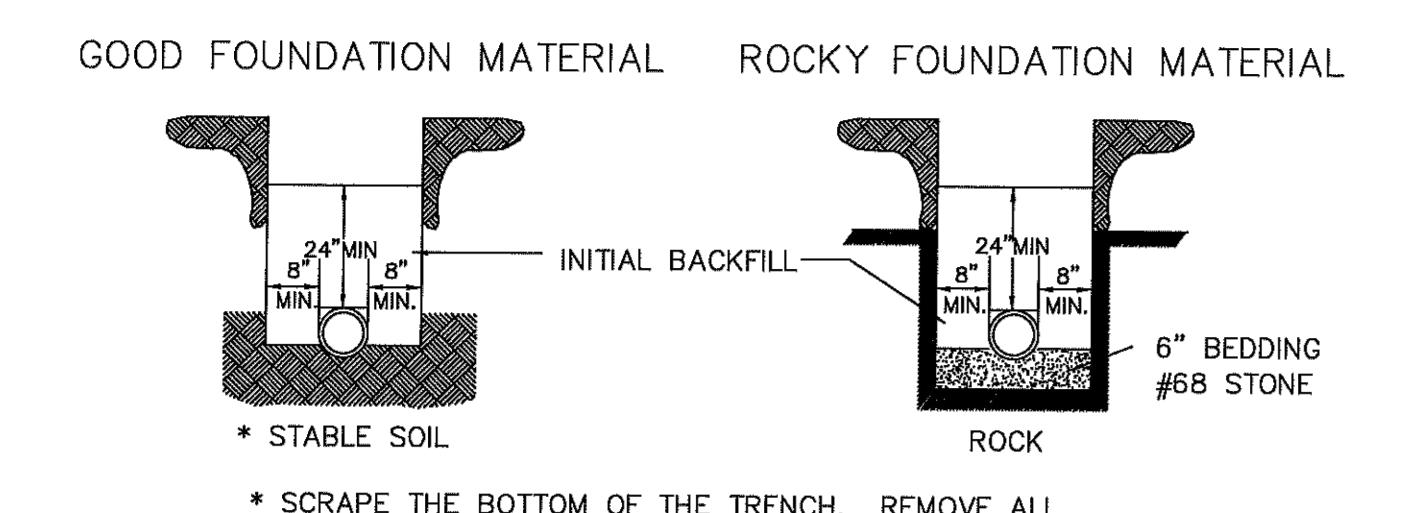
NTS  
FIG. W-4



PIPE SIZE	DEGREE OF BEND	BEND DIMENSIONS (FEET)	VOL. CU.YD.	TEE AND PLUGS (FEET)	VOL. CU.YD.
4"	45°	2.50	2.50	3.01	0.24
4"	45°	2.00	2.25	2.60	0.15
4"	22 1/2°	1.50	2.00	2.50	0.10
8"	45°	3.66	3.16	3.21	0.28
8"	45°	2.66	2.66	2.77	0.26
8"	22 1/2°	1.66	2.15	2.67	0.13
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 2. FINISHED GRADE SHALL SLOPE AWAY FROM THE FIRE HYDRANT AND VALVE BOX.  
 3. THE GATE VALVE IS ALLOWED IN SHOULDER OR BEHIND THE DITCH.  
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 5. PUMPED WATER IS ALLOWED IN TRENCHES LOCATED WHERE WEEP HOLES ARE ABOVE THE PREVAILING GROUNDWATER ELEVATION. IF REQUIRED TO BE IN WET AREAS, THE WEEP HOLES SHALL BE PLUGGED AND THE HYDRANT SHALL BE PUMPED DRY.

NTS  
FIG. W-5



PIPE SIZE	DEGREE OF BEND	BEND DIMENSIONS (FEET)	VOL. CU.YD.	TEE AND PLUGS (FEET)	VOL. CU.YD.
4"	45°	2.50	2.50	3.01	0.24
4"	45°	2.00	2.25	2.60	0.15
4"	22 1/2°	1.50	2.00	2.50	0.10
8"	45°	3.66	3.16	3.21	0.28
8"	45°	2.66	2.66	2.77	0.26
8"	22 1/2°	1.66	2.15	2.67	0.13
10" & 12"	45°	4.83	3.83	3.42	0.83
10" & 12"	45°	3.33	3.58	2.95	0.43
10" & 12"	22 1/2°	2.33	2.58	2.88	0.24
10" & 12"	11 1/4°	1.63	2.33	2.84	0.18

1. SCRAPE THE BOTTOM OF THE TRENCH. REMOVE ALL STONES TO INSURE THE PIPE DOESN'T REST ON ROCK AND THEN COMPACT THE SOIL OR PROVIDE A 4" BEDDING OF #68 STONE.

2. STABILIZE THE SOIL.

3. SCRAPE THE BOTTOM OF THE TRENCH. REMOVE ALL STONES TO INSURE THE PIPE DOESN'T REST ON ROCK AND THEN COMPACT THE SOIL OR PROVIDE A 4" BEDDING OF #68 STONE.

4. SCRABBLE THE BOTTOM OF THE TRENCH. REMOVE ALL STONES TO INSURE THE PIPE DOESN'T REST ON ROCK AND THEN COMPACT THE SOIL OR PROVIDE A 4" BEDDING OF #68 STONE.

5. BELL HOLES SHALL BE DUG OUT IN ALL CASES.

6. NO ROCKS SHALL BE ALLOWED WITHIN 24" OF THE WATER LINES.

7. NO ROCKS LARGER THAN 6" IN ANY DIMENSION SHALL BE ALLOWED ABOVE THE INITIAL BACKFILL.

8. THE INITIAL BACKFILL SHALL BE PLACED AND COMPAKTED IN 6" LIFTS.

9. NO ORGANIC OR FROZEN MATERIAL OR DEBRIS SHALL BE ALLOWED IN THE TRENCH.

10. BELL HOLES SHALL BE DUG OUT IN ALL CASES.

11. NO ROCKS SHALL BE ALLOWED WITHIN 24" OF THE WATER LINES.

12. NO ROCKS LARGER THAN 6" IN ANY DIMENSION SHALL BE ALLOWED ABOVE THE INITIAL BACKFILL.

13. THE INITIAL BACKFILL SHALL BE PLACED AND COMPAKTED IN 6" LIFTS.

14. NO ORGANIC OR FROZEN MATERIAL OR DEBRIS SHALL BE ALLOWED IN THE TRENCH.

15. BELL HOLES SHALL BE DUG OUT IN ALL CASES.

16. NO ROCKS SHALL BE ALLOWED WITHIN 24" OF THE WATER LINES.

17. NO ROCKS LARGER THAN 6" IN ANY DIMENSION SHALL BE ALLOWED ABOVE THE INITIAL BACKFILL.

18. THE INITIAL BACKFILL SHALL BE PLACED AND COMPAKTED IN 6" LIFTS.

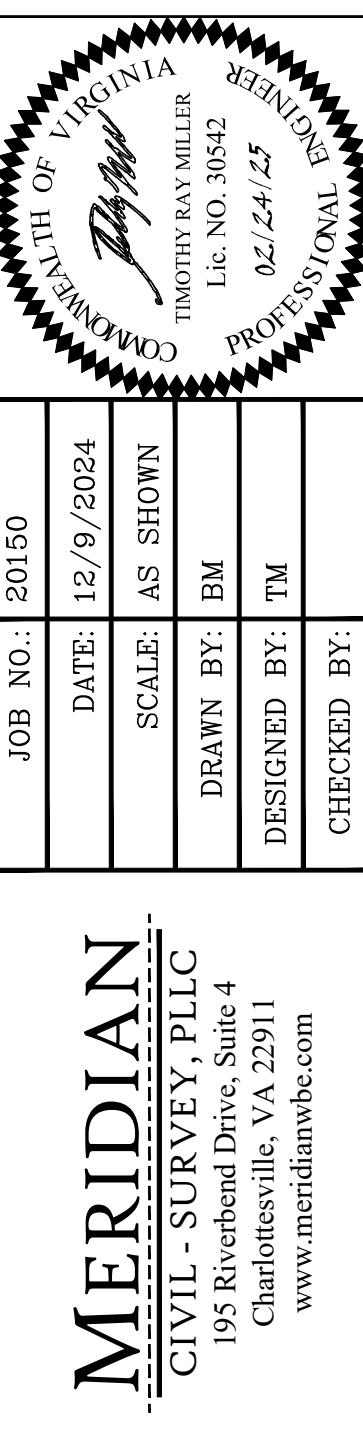
19. NO ORGANIC OR FROZEN MATERIAL OR DEBRIS SHALL BE ALLOWED IN THE TRENCH.

20. BELL HOLES SHALL BE DUG OUT IN ALL CASES.

21. NO ROCKS SHALL BE ALLOWED WITHIN 24" OF THE WATER LINES.

22. NO ROCKS LARGER THAN 6" IN ANY DIMENSION SHALL BE ALLOWED ABOVE THE INITIAL BACKFILL.

23. THE INITIAL BACKFILL SHALL BE PLACED AND COMPAKTED IN 6" LIFTS



### OLD DOMINION PUMP STATION NO. 1 DESIGN

#### COMPUTATION OF FLOW GENERATION

##### RESIDENTIAL AREA

Townhomes = 66 Lots x 3.2 Persons/Dwelling x 100 gpd/Person = 21,120 gpd

##### COMMERCIAL AREA

Existing Veterinary Clinic = 1,180 gpd

Total flow would be 22,300 gpd for Pump Station No. 1

#### FORCE MAIN SIZING From Pump Station No. 1

Average flow: 22,300 gpd/1440 minutes/day = 16 gpm  
Peak Flow: 16 gpm x 3 peak factor = 48 gpm

A 4 inch force main would require a flow of minimum 80 gallons per minute to achieve the scour velocity of 2.0 feet per second. In this case the pump would have a capacity of almost 2 times the peak flow into the station.

#### STORAGE IN WET WELL AND PIPING IF BOTH PUMPS FAIL

Volume in Wet Well  $\pi r^2 h \times 7.48 \text{ gallons/cu. ft}$  Where  $\pi = 3.14$   
 $r = 3 \text{ ft}$   
 $h = 2 \text{ ft}$

Volume in Wet Well  $3.14(3)^2 \times 2 \times 7.48 = 422 \text{ gallons}$

Volume in Gravity Sewer Line  $\pi(r)^2 \times \text{length} \times 7.48 \text{ gallons/cu. ft}$  Where  $\pi = 3.14$   
 $r = 4/12 = 0.33 \text{ ft}$

Manholes PS 1 to MHF, MHF to MHD, MHD to MHC  
MHC to MHB length = 424 ft

Volume in Gravity Sewer  $3.14(0.33)^2 \times 424 \times 7.48 \text{ gallons/cu. ft.} = 1084 \text{ gallons}$

Volume in Manholes  $\pi(r)^2 h \times 7.48 \text{ gallons/cu. ft}$  Where  $\pi = 3.14$   
 $r = 2 \text{ ft}$   
 $h = 9 \text{ ft}$

Volume in Manholes  $3.14(2)^2 \times 9 \times 7.48 \text{ gallons/cu. ft} = 846 \text{ gallons}$

Total Storage = Wet Well + Gravity Sewer Line + Manholes

422 gallons + 1084 gallons + 846 gallons = 2,352 gallons

Time to React at Peak Flow = 2,352 gallons/48 gallons/minute = 49 minutes

Time to React at Average Flow = 2,352 gallons/16 gallons/minute = 147 minutes  
(2 Hours and 27 minutes)

#### GENERAL HORSEPOWER DETERMINATIONS

4 inch PVC C900 Force Main  
W<sub>hp</sub> = (q)(TDH)/3920 Where q = pump capacity 80 gpm  
TDH is 36.93 ft.

Pump efficiency is 40%  
Motor Efficiency is 55%

B<sub>hp</sub> = W<sub>hp</sub>/Pump Efficiency  
H<sub>hp</sub> = B<sub>hp</sub>/Motor Efficiency

H<sub>hp</sub> = 80 (36.93)/3920 x 0.40 x 0.55 = 3.42

Actual Conditions will be dictated by the pump curves and pump selection.

#### BUOYANCY FORCE

Upward Force  
Force =  $\pi r^2 \times \text{height} \times 7.49 \text{ gallons/ft}^3 \times 8.34 \text{ #/gallon}$  where  $\pi = 3.14$   
 $R = 3 \text{ ft}$

Height = 16.1 ft

Force Upward =  $3.14 \times 3^2 \times 17.1 \times 7.49 \times 8.34 = 30,186 \text{ pounds}$

Downward Force  
Manhole Weight

Outside Diameter - Inside Diameter = Area of Concrete in  $\text{ft}^3$   
 $(3.14 \times 3.5^2 \times 12.1 \text{ ft}) - (3.14 \times 3^2 \times 12.1 \text{ ft}) = (657 \text{ ft}^3) - (483 \text{ ft}^3) = 174 \text{ ft}^3$   
 $174 \text{ ft}^3 \times 36 \text{ yd}^3/27 = 6.4 \text{ yd}^3$  for manhole only

Bottom Slab Weight

$\pi r^2 \times \text{height}$  where  $r = 4.5 \text{ ft}$ ,  
Height = 0.5 ft

Force Upward =  $3.14 \times 3^2 \times 17.1 \times 7.49 \times 8.34 = 30,186 \text{ pounds}$

Downward Force  
Manhole Weight

Outside Diameter - Inside Diameter = Area of Concrete in  $\text{ft}^3$   
 $(3.14 \times 3.5^2 \times 17.1 \text{ ft}) - (3.14 \times 3^2 \times 17.1 \text{ ft}) = (1087 \text{ ft}^3) - (657 \text{ ft}^3) = 430 \text{ ft}^3$

Weight of dirt =  $62.4 \text{ #/ft}^3$  Concrete Weight =  $4,000 \text{ #/ft}^3$

Downward Force = Manhole Weight + Bottom Slab + Top Slab + Dirt Weight

=  $(6.4 \text{ yd}^3 + 1.71 \text{ yd}^3 + 0.52 \text{ yd}^3) \times 4,000 \text{ #/yd}^3 + (430 \text{ ft}^3 \times 62.4 \text{ #/ft}^3)$

=  $32,360 \text{ #} + 26,832 \text{ #} = 59,192 \text{ pounds}$

Downward Force is greater than the buoyancy force without adding in the footings.

52,192 pounds is greater than 30,186 pounds.

#### CYCLE TIME FOR PUMPING STATION

At Average Flow of 16 gpm: 422 gallons of volume between Pump On and Pump Off

422 gallons/(80 gpm - 16 gpm) = 6.6 minutes of pumping time.

Fill Time 422 gallons/16 gpm = 26.3 minutes to fill

Cycle time is 6.6 minutes + 26.3 minutes = 32.9 minutes

Pump Runs 6.6 minutes per 30 minutes at average flow.

At peak flow of 48 gpm:

422 gallons/(80 gpm - 48 gpm) = 13.2 minutes pumping time

Fill Time 422 gallons/48 gpm = 8.8 minutes to fill

Cycle time is 13.2 minutes + 8.8 minutes = 22 minutes

Pump Runs 13.2 minutes per 30 minutes at peak flow

### OLD DOMINION PUMP STATION NO. 2 DESIGN

#### COMPUTATION OF FLOW GENERATION

##### RESIDENTIAL AREA

Single-Family = 16 Lots x 6 Persons/Dwelling x 75 gpd/Person = 7,200 gpd

Townhomes = 28 Lots x 4 Persons/Dwelling x 75 gpd/Person = 8,400 gpd

Total residential flow would be 15,600 gpd for Pump Station No. 2

#### FORCE MAIN SIZING From Pump Station No. 2

Average flow: 15,600 gpd/1440 minutes/day = 11 gpm

Peak Flow: 11 gpm x 3 peak factor = 33 gpm

A 4 inch force main would require a flow of minimum 80 gallons per minute to achieve the scour velocity of 2.0 feet per second. In this case the pump would have a capacity of almost 3 times the peak flow into the station.

#### STORAGE IN WET WELL AND PIPING IF BOTH PUMPS FAIL

Volume in Wet Well  $\pi r^2 h \times 7.48 \text{ gallons/cu. ft}$  Where  $\pi = 3.14$   
 $r = 3 \text{ ft}$   
 $h = 2 \text{ ft}$

Volume in Wet Well  $3.14(3)^2 \times 2 \times 7.48 = 422 \text{ gallons}$

Volume in Gravity Sewer Line  $\pi(r)^2 \times \text{length} \times 7.48 \text{ gallons/cu. ft}$  Where  $\pi = 3.14$   
 $r = 4/12 = 0.33 \text{ ft}$

Manholes MUH to MHN & MHN to MHO length = 159 ft

Volume in Gravity Sewer  $3.14(0.33)^2 \times 159 \times 7.48 \text{ gallons/cu. ft.} = 407 \text{ gallons}$

Volume in Manholes  $\pi(r)^2 h \times 7.48 \text{ gallons/cu. ft}$  Where  $\pi = 3.14$   
 $r = 2 \text{ ft}$   
 $h = 7.0 \text{ ft}$

Manholes MUH, MHN

Volume in Manholes  $3.14(2)^2 \times 7.0 \times 7.48 \text{ gallons/cu. ft.} = 658 \text{ gallons}$

Total Storage = Wet Well + Gravity Sewer Line + Manholes

422 gallons + 407 gallons + 658 gallons = 1,487 gallons

Time to React at Peak Flow = 1,487 gallons/33 gallons/minute = 45 minutes

Time to React at Average Flow = 1,487 gallons/11 gallons/minute = 135 minutes  
(2 Hr. 15 Min)

#### GENERAL HORSEPOWER DETERMINATIONS

4 inch PVC C900 Force Main  
Where q = pump capacity 80 gpm  
TDH is 40.76 ft.

Pump efficiency is 40%  
Motor Efficiency is 55%

H<sub>hp</sub> = W<sub>hp</sub>/Pump Efficiency  
H<sub>hp</sub> = B<sub>hp</sub>/Motor Efficiency

H<sub>hp</sub> = 80 (40.76)/3920 x 0.40 x 0.55 = 3.78

Actual Conditions will be dictated by the pump curves and pump selection.

#### BUOYANCY FORCE

Upward Force  
Force =  $\pi r^2 \times \text{height} \times 7.49 \text{ gallons/ft}^3 \times 8.34 \text{ #/gallon}$  where  $\pi = 3.14$

R = 3 ft.

Height = 12.1 ft

Force Upward =  $3.14 \times 3^2 \times 12.1 \times 7.49 \times 8.34 = 21,360 \text{ pounds}$

Downward Force  
Manhole Weight

Outside Diameter - Inside Diameter = Area of Concrete in  $\text{ft}^3$   
 $(3.14 \times 3.5^2 \times 12.1 \text{ ft}) - (3.14 \times 3^2 \times 12.1 \text{ ft}) = (465 \text{ ft}^3) - (342 \text{ ft}^3) = 123 \text{ ft}^3$

$123 \text{ ft}^3 \times 36 \text{ yd}^3/27 = 4.55 \text{ yd}^3$  for manhole only

Bottom Slab Weight

$\pi r^2 \times \text{height}$  where  $r = 4.5 \text{ ft}$ ,  
Height = 0.5 ft

Force Upward =  $3.14 \times 4.5^2 \times 0.5 \text{ ft} \times 36 \text{ yd}^3/27 \text{ ft}^3 = 1.17 \text{ yd}^3$

Top Slab Weight

$\pi R^2 \times R \times \text{height} \times 36 \text{ yd}^3/27 \text{ ft}^3$  where  $R = 3 \text{ ft}$

$\pi = 3.14 \text{ ft}$

Height = 0.5 ft

3.14  $\times 4.5^2 \times 0.5 \text{ ft} \times 36 \text{ yd}^3/27 \text{ ft}^3 = 0.52 \text{ yd}^3$

Weight of dirt =  $62.4 \text{ #/ft}^3$  Concrete Weight =  $4,000 \text{ #/ft}^3$

Downward Force = Manhole Weight + Bottom Slab + Top Slab + Dirt Weight

=  $(4.55 \text{ yd}^3 + 1.17 \text{ yd}^3 + 0.52 \text{ yd}^3 \times 4,000 \text{ #/yd}^3 + (304 \text{ ft}^3 \times 62.4 \text{ #/ft}^3)$

=  $24,960 \text{ #} + 18,969 \text{ #} = 43,929 \text{ pounds}$

Downward Force is greater than twice the buoyancy force without adding in the footings.

43,929 pounds is greater than 21,360 pounds.

#### CYCLE TIME FOR PUMPING STATION

At Average Flow of 11 gpm: 211 gallons of volume between Pump On and Pump Off

211 gallons/(80 gpm - 11 gpm) = 3.0 minutes of pumping time.

Fill Time 211 gallons/11 gpm = 19 minutes to fill

Cycle time is 3.0 minutes + 19 minutes = 22 minutes

Pump Runs 9.0 minutes per 60 minutes at average flow.

At peak flow of 33 gpm:

211 gallons/(80 gpm - 33 gpm) = 4.5 minutes pumping time

Fill time 211 gallons/33 gpm = 6.4 minutes to fill

Cycle time is 4.5 minutes + 6.4 minutes = 10.9 minutes