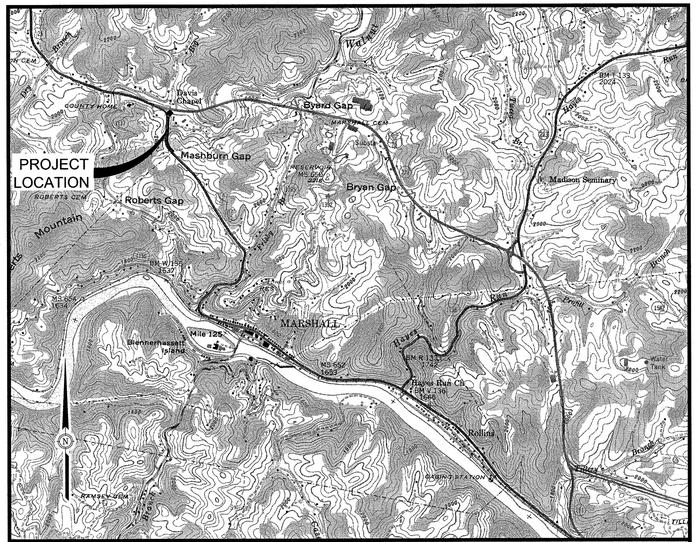
PROPOSED SANITARY SEWER IMPROVEMENTS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY

MADISON COUNTY, NORTH CAROLINA



PROJECT LOCATION MAP NOT TO SCALE

SCHEDULE OF DRAWINGS

McGill ASSOCIATES
ENGINEERING · PLANNING · FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22541 HARRY B. BUCKNER
10-22-2013

SEPTEMBER 2013

GENERAL CONSTRUCTION NOTES

REVISION DATE - JUNE 16, 2009

1. FINISH GRADE TOLERANCES SHALL BE AS NOTED IN THE SPECIFICATIONS. THE ENGINEER MAY MAKE GRADE CHANGES AS REQUIRED IN THE FIELD WITHOUT EFFECTING THE UNIT BID PRICE FOR UNCLASSIFIED EXCAVATION.
2. UNLESS OTHERWISE STATED, ALL FILL AREAS SHALL BE CONSTRUCTED IN LAYERS OF 8" MAXIMUM THICKNESS, WITH WATER ADDED OR SOIL CONDITIONED TO THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY THE ENGINEER AND COMPACTED WITH A SHEEP'S FOOT ROLLER TO A COMPACTION EQUAL TO OR GREATER THAN 95% (100% IN THE TOP 2' OF THE SUB GRADE BELOW ROADWAYS AND PARKING LOTS) OF THE DENSITY OBTAINED BY COMPACTING A SAMPLE OF THE MATERIAL IN ACCORDANCE WITH THE STANDARD PROCTOR METHOD OF MOISTURE-DENSITY RELATIONSHIP TEST, ASTM D698 OR AASHTO-99 UNLESS SPECIFIED IN OTHER SPECIFICATIONS.
3. ENTIRE AREA TO BE GRADED SHALL BE CLEARED AND GRUBBED. NO FILL SHALL BE PLACED ON ANY AREA NOT CLEARED AND GRUBBED.
4. ALL SOIL EROSION CONTROL MEASURES REQUIRED BY THE GRADING PLAN SHALL BE PERFORMED PRIOR TO GRADING, CLEARING OR GRUBBING. ALL EROSION CONTROL DEVICES SUCH AS SILT FENCES, ETC., SHALL BE MAINTAINED IN WORKABLE CONDITION FOR THE LIFE OF THE PROJECT AND SHALL BE REMOVED AT THE COMPLETION OF THE PROJECT ONLY ON THE ENGINEER'S APPROVAL. PAYMENT SHALL BE CONSIDERED INCIDENTAL TO CLEARING AND GRUBBING. IF DURING THE LIFE OF THE PROJECT, A STORM CAUSES SOIL EROSION WHICH CHANGES FINISH GRADES OR CREATES "GULLIES" AND "WASHED AREAS", THESE SHALL BE REPAIRED AT NO EXTRA COST, AND ALL SILT WASHED OFF OF THE PROJECT SITE ONTO ADJACENT PROPERTY SHALL BE REMOVED AS DIRECTED BY THE ENGINEER AT NO EXTRA COST. THE CONTRACTOR SHALL ADHERE TO ANY APPROVED EROSION CONTROL PLANS WHETHER INDICATED IN THE CONSTRUCTION PLANS OR UNDER SEPARATE COVER.
5. DISPOSABLE MATERIAL
   A. CLEARING AND GRUBBING WASTES SHALL BE REMOVED FROM THE SITE AND PROPERLY DISPOSED OF BY THE CONTRACTOR AT HIS EXPENSE, UNLESS SPECIFIED OTHERWISE.
   B. SOLID WASTES TO BE REMOVED, SUCH AS SIDEWALKS, CURBS, PAVEMENT, ETC., MAY BE PLACED IN SPECIFIC DISPOSAL AREAS DELINEATED ON THE PLANS OR REMOVED FROM THE SITE AS REQUIRED BY THE SPECIFICATIONS. THIS MATERIAL SHALL HAVE A MINIMUM COVER OF 2'. THE CONTRACTOR SHALL MAINTAIN SPECIFIED COMPACTION REQUIREMENTS IN THESE AREAS. WHEN DISPOSAL SITES ARE NOT PROVIDED, THE CONTRACTOR SHALL REMOVE THIS WASTE FROM THE SITE AND PROPERLY DISPOSE OF IT AT HIS EXPENSE.
   C. ABANDONED UTILITIES SUCH AS CULVERTS, WATER PIPE, HYDRANTS, CASTINGS, PIPE APPURTENANCES, UTILITY POLES, ETC., SHALL BE THE PROPERTY OF THE SPECIFIC UTILITY AGENCY, OR COMPANY HAVING JURISDICTION. BEFORE THE CONTRACTOR CAN REMOVE, DESTROY, SALVAGE, REUSE, SELL OR STORE FOR HIS OWN USE ANY ABANDONED UTILITY, HE MUST PRESENT TO THE OWNER WRITTEN PERMISSION FROM THE UTILITY INVOLVED.
   D. ON SITE BURNING IS AN ACCEPTABLE METHOD OF DISPOSING OF FLAMMABLE WASTES. WHEN BURNING IS ANTICIPATED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND MEETING GOVERNING CODES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OR HIS REPRESENTATIVE AS TO THE SPECIFIC LOCATION OF BURNING.

      AFTER BURNING IS COMPLETED, PURE ASH MAY BE DISPOSED OF BY MIXING WITH FILL DIRT. ALL MATERIAL NOT TOTALLY BURNED SHALL BE DISPOSED OF AS SPECIFIED IN "B" ABOVE. THE CONTRACTOR SHALL NOT HOLD UP WORK PROGRESS FOR THE PURPOSE OF WAITING FOR A "BURNING DAY".
6. IN THE EVENT EXCESSIVE GROUNDWATER OR SPRINGS ARE ENCOUNTERED WITHIN THE LIMITS OF CONSTRUCTION, THE CONTRACTOR SHALL INSTALL NECESSARY UNDER DRAINS AND STONE AS DIRECTED BY THE ENGINEER. ALL WORK SHALL BE PAID BASED UPON UNIT BIDS, UNLESS SPECIFIED OTHERWISE.
7. THE CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF ADJUSTMENT OF ALL UTILITY SURFACE ACCESSES WHETHER HE PERFORMS THE WORK OR A UTILITY COMPANY PERFORMS THE WORK.
8. THE CONTRACTOR SHALL CONTROL ALL "DUST" BY PERIODIC WATERING AND SHALL PROVIDE ACCESS AT ALL TIMES FOR PROPERTY OWNERS WITHIN THE PROJECT AREA AND FOR EMERGENCY VEHICLES. ALL OPEN DITCHES AND HAZARDOUS AREAS SHALL BE CLEARLY MARKED IN ACCORDANCE WITH THE SPECIFICATIONS.
9. ALL AREAS WHERE THERE IS EXPOSED DIRT SHALL BE SEEDED, FERTILIZED AND MULCHED ACCORDING TO THE SPECIFICATIONS. THE FINISHED SURFACE SHALL BE TO GRADE AND SMOOTH, FREE OF ALL ROCKS LARGER THAN 3", EQUIPMENT TRACKS, DIRT CLODS, BUMPS, RIDGES AND GOUGES PRIOR TO SEEDING; THE SURFACE SHALL BE LOOSENED TO A DEPTH OF ±4"-6" TO ACCEPT SEED. THE CONTRACTOR SHALL NOT PROCEED WITH SEEDING OPERATIONS WITHOUT FIRST OBTAINING THE ENGINEER'S APPROVAL OF THE GRADED SURFACE. ALL SEEDING SHALL BE PERFORMED BY A MECHANICAL "HYDRO-SEEDER". HAND SEEDING SHALL BE AUTHORIZED ON AN AREA BY AREA APPROVAL BY THE ENGINEER. DISTURBED AREAS SHOULD THEN BE MATTED WITH SHORT-TERM PHOTODEGRADABLE EROSION CONTROL MATTING.
10. WHERE SPECIFIED, STORM DRAIN PIPE SHALL BE CORRUGATED METAL PIPE (CMP) CONFORMING TO AASHTO M-36, WITH REROLLED ENDS TO ACCOMMODATE CORRUGATED COUPLING BANDS. 18" PIPE SHALL BE 16 GAUGE, 24" AND 30" PIPE SHALL BE 14 GAUGE AND 36" PIPE AND OVER SHALL BE 12 GAUGE AS SPECIFIED ON THE PLANS, PIPE AND COUPLING BANDS SHALL CONFORM TO NCDOT 1032-3 FOR PLAIN PIPE OR 1032-4 (A) FOR BITUMINOUS COATED AND PARTIALLY PAVED PIPE. DIMPLE BANDS SHALL NOT BE USED.

    WHERE SPECIFIED, STORM DRAIN PIPE SHALL BE REINFORCED CONCRETE PIPE (RCP) CONFORMING TO AASHTO M-170, AS CONTAINED IN NCDOT STANDARD SPECIFICATION 1032-9 FOR WALL "B" TYPE.

    WHERE SPECIFIED, ALL STORM DRAIN PIPE SHALL BE HIGH DENSITY POLYETHYLENE (HDPE). SMOOTH WALL INTERIOR, WITH WATER TIGHT JOINTS, BACKFILLED WITH # 57 WASHED STONE UP TO MIN. 6" OVER THE TOP OF THE PIPE. HDPE PIPE USED FOR STORM DRAINAGE DETENTION SYSTEMS SHALL BE ADS N12 WT OR APPROVED EQUAL.

    WHERE SPECIFIED, ALL CORRUGATED METAL STORM DRAIN PIPE (CMP) SHALL BE ALUMINIZED TYPE 2 CORRUGATED STEEL MANUFACTURED IN ACCORDANCE WITH THE REQUIREMENTS OF AASHTO M-36. THE PIPE SHALL BE MANUFACTURED FROM ALUMINIZED STEEL TYPE 2 MATERIAL CONFORMING TO THE REQUIREMENTS OF AASHTO M-274. ALL PIPE SHALL BE FURNISHED WITH REROLLED ENDS AND SHALL BE JOINED WITH HUGGER BANDS. THE USE OF DIMPLE BANDS WILL NOT BE ALLOWED. PIPE THROUGH 24" DIAMETER SHALL BE 16 GAUGE, PIPE THROUGH 42" DIAMETER SHALL BE 14 GAUGE, PIPE THROUGH 54" DIAMETER SHALL BE 12 GAUGE.
11. CONTRACTOR SHALL VERIFY ALL ELEVATIONS BEFORE INSTALLATION OF FACILITIES.
12. CATCH BASINS CAST-IN-PLACE SHALL CONFORM TO THE REQUIREMENTS OF NCDOT STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES (LATEST EDITION) ARTICLES 840-1 THROUGH 840-3. CURB INLET CATCH BASIN SHALL CONFORM TO NCDOT STANDARD DETAILS 840.02 THROUGH 840.04. DROP INLETS SHALL CONFORM TO STANDARD DETAIL 840.14. JUNCTION BOXES SHALL CONFORM TO STANDARD DETAIL 840.31.
13. CURB INLET FRAME, GRATE AND HOOD SHALL BE NEENAH R-3233D, PRODUCTS BY DEWEY BROS., U.S. FOUNDRY OR EQUAL. DROP INLET FRAME AND GRATE SHALL BE NEENAH R-3339A OR EQUAL. FIELD INLET COVER SHALL CONFORM TO NCDOT STANDARD DETAIL 840.04, OPENING FACING UPSTREAM.
14. CONCRETE AND MASONRY SHALL MEET THE REQUIREMENTS OF APPROPRIATE SECTION OF NCDOT STANDARD SPECIFICATIONS FOR ROAD AND STRUCTURES (LATEST EDITION). CONCRETE SHALL BE CLASS A OR B, 4000 PSI MINIMUM, MEETING THE REQUIREMENTS OF SECTION 1000, CONSTRUCTED IN ACCORDANCE WITH SECTION 825. MASONRY SHALL MEET THE REQUIREMENTS OF SECTION 1040, CONSTRUCTED IN ACCORDANCE WITH SECTION 830 AND/OR 834.
15. TOPS OF PROPOSED FRAMES AND GRATES SHALL BE FLUSH WITH FINISHED GRADE.
16. PRE CAST CONCRETE BOXES ARE ACCEPTABLE ALTERNATIVES FOR PROPOSED CATCH BASINS.

PROPOSED SEWER & WATER LEGEND

Symbol	Description
●	MANHOLE
CO ●	CLEANOUT
Ⓥ	AIR/VACUUM RELEASE VALVE
	FIRE HYDRANT, VALVE AND TEE
Ⓐ	AIR RELEASE VALVE
	VALVE
	BLOWOFF (DISCHARGE TO STREAM/DITCH)
Ⓑ	BLOWOFF (TRAFFIC BEARING)
WM ○	WATER METER
—— S ——	GRAVITY SEWER LINE
—— FM ——	SEWER FORCE MAIN
—— W ——	WATER LINE

NORTH CAROLINA LAND QUALITY SECTION
EROSION CONTROL NOTES

REVISION DATE - OCTOBER, 2012

GENERAL: ALL EROSION CONTROL MEASURES ARE TO BE PERFORMED IN STRICT ACCORDANCE WITH REQUIREMENTS OF THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, DIVISION OF LAND RESOURCES, LAND QUALITY SECTION. THE FOLLOWING CONSTRUCTION SEQUENCE SHALL BE COMPLIED WITH FOR ALL WORK.

1. – PRIOR TO BEGINNING WORK ON THE PROJECT THE CONTRACTOR SHALL OBTAIN FROM THE OWNER A COPY OF THE "EROSION AND SEDIMENT CONTROL APPROVAL" FROM THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, DIVISION OF LAND QUALITY, OR THE LOCAL AUTHORIZED PROGRAM. THE APPROVAL NOTICE MUST BE AVAILABLE ON-SITE DURING ALL GRADING AND CONSTRUCTION ACTIVITIES.

2. – INSTALL ALL EROSION CONTROL MEASURES AS REQUIRED BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, DIVISION OF LAND RESOURCES, LAND QUALITY SECTION.

   NOTE: ALL UTILITY INSTALLATION WITHIN 25' OF A RIVER OR STREAM BANK SHALL BE INSTALLED PER STREAM PROTECTION DURING EXCAVATION DETAIL. SEEDING AND MULCHING SHALL BE COMPLETED DAILY IN AREAS NOTED AS STREAM PROTECTION AREAS. SILT FENCE IN THESE AREAS SHALL NOT BE INSTALLED CLOSER THAN 5' FROM CREEK BANK UNLESS FIELD CONDITIONS PREVENT SUFFICIENT CLEARANCE. ALL SILT FENCES SHALL BE INSPECTED AND CLEANED AS NEEDED AFTER EACH RAIN.

3. – NO WORK SHALL BE PERFORMED IN STREAM FROM OCTOBER 15 TO APRIL 15 (TO ACCOMMODATE COE AND DWQ RECOMMENDATIONS CONCERNING WORK IN TROUT WATERS.)

4. – CONTRACTOR IS TO PLACE PERMANENT STAKES MARKING CLEARLY THE 25' BUFFER FOR STREAMS WHERE SHOWN ON THE PLANS AND THE MARKERS ARE TO BE VISIBLE AT ALL TIMES DURING CONSTRUCTION.

5. – OBTAIN CERTIFICATE OF COMPLIANCE THROUGH ON-SITE INSPECTION BY A REPRESENTATIVE OF THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, DIVISION OF LAND RESOURCES, LAND QUALITY SECTION.

6. – CONSTRUCTION SHALL BE LIMITED TO 2000' OF CONTIGUOUS ROAD CORRIDOR UNTIL ALL CUTS, FILLS, AND DITCHES ARE STABILIZED FOR THAT 2000' SECTION. UPON STABILIZATION OF THAT SECTION ANOTHER 2000' SECTION CAN BE CONSTRUCTED AND STABILIZED.

7. – ALL STREAM CROSSINGS AND PERENNIAL STREAMS WILL BE ALIGNED WITH THE NATURAL STREAM PATTERNS ABOVE AND BELOW THE PROPOSED ROAD. ARCH CULVERTS WILL BE USED AND FOOTERS WILL BE CONSTRUCTED IN UNDISTURBED BANKS AWAY FROM THE STREAM FLOW.

8. – PROCEED WITH GRADING, CLEARING AND GRUBBING. NOTE: NO OFF SITE DISPOSAL OF MATERIAL IS ALLOWED UNLESS THE DISPOSAL SITE HAS AN APPROVED EROSION CONTROL PLAN.

9. – SEED AND PLACE EROSION CONTROL MATTING ON ALL CUT AND FILL SLOPES THAT ARE NOT ROCK IMMEDIATELY UPON COMPLETION OF SLOPE STABILIZATION.

10. – ALL TEMPORARY STREAM AND CREEK CROSSINGS FOR EQUIPMENT DURING CONSTRUCTION SHALL BE MADE USING TEMPORARY BRIDGES. NO STREAM BANK OR STREAM BED DISTURBANCE SHALL BE ALLOWED FOR EQUIPMENT CROSSINGS.

11. – SEED AND MULCH DENUDED AREA WITHIN 15 DAYS AFTER FINISHED GRADE ARE ESTABLISHED. SEED AND SOIL AMENDMENTS SHALL BE PLACED ON A PREPARED SEEDBED AT THE FOLLOWING RATES PER ACRE. STRAW MULCH SHALL BE TACKED WITH TACKING AGENT APPLIED BY HYDROSEEDER.

LIME	4,000 LBS
FERTILIZER (10-10-10)	1,000 LBS
KY-31 FESCUE (POA PRATENSIS)	100 LBS
STRAW MULCH	60-80 BALES

FOR SUMMER SEEDING ADD TO THE ABOVE:

GERMAN MILLET (SETARIA ITALICA)	40 LBS
SMALL-STEMMED SUDAN GRASS (SORGHUM BICOLOR)	50 LBS

FOR WINTER SEEDING ADD TO THE ABOVE:

RYE GRAIN (SECASE CEREALE)	120 LBS

IF HYDROSEEDING, WOOD CELLULOSE MAY BE USED IN ADDITION TO STRAW MULCH AT THE RATE OF 1,000 LBS PER ACRE.

ALL SEEDING SHALL BE MAINTAINED, WATERED ETC.., UNTIL A PERMANENT VEGETATIVE GROUND COVER IS ESTABLISHED OVER ALL DISTURBED AREAS.

FOR ALL SLOPES 2:1 OR STEEPER ADD TO THE ABOVE:

PURE LIVE SEED SWITCHGRASS	4 LBS
SERICEA LESPEDEZA	2 LBS
BROWNTOP MILLET OR PEARL MILLET (PENNISETUM GLAUCUM)	8 LBS
GRAIN SORGHUM (SORGHUM BICOLOR (L.) MOENCH SSP. BICOLOR)	2 LBS

ALL SLOPES 2:1 OR STEEPER SHALL BE COVERED BY EROSION CONTROL MATTING.

NATIVE SEEDING:

THE CORRECT SEEDBED pH IS 5.5 TO 6.5.

APPLY ZERO NITROGEN AT PLANTING.

INCORPORATE SOIL AMENDMENTS INTO TOPSOIL/ROOT ZONE BEFORE SEEDING.

FIRM SEEDBED BEFORE SEEDING (TRAVEL WITH DOZER CLEATS).

SEEDING DEPTH FOR ALL NATIVE SSP. EXCEPT E.GAMAGRASS (TRIPSACUM DACTYBIDES) NEED TO BE 1/4" - 1/2". GREATER DEPTHS CAUSE HIGH SEED MORTALITY.

SPECIALIZED SEEDING IMPLEMENTS ARE REQUIRED. SEED MIXES AND RATES TO MATCH SEEDER USED. A NO-TILL, DROP SEEDER OR BROADCASTER WITH PRECISION METERING TO CONTROL SMALL SEED FLOW AND PICKER WHEEL AGITATORS TO HANDLE FLUFFY SEED ARE BEST SUITED FOR NATIVE SEED.

NATIVE PLANT SEEDING MIX FOR STREAM OR RIVERBANK STABILIZATION

SEEDING FOR STREAM OR RIVERBANK STABILIZATION SHALL BE A MIXTURE OF NATIVE GRASSES, PLANTS AND TREES. NATIVE PLANT MIX SHALL INCLUDE THE FOLLOWING:

GRASSES – BIG BLUESTEM (ANDROPOGAN GERARDII), INDIAN GRASS (SORGASTRUM NUTANS), LITTLE BLUESTEM (SCHIZACHYRIUM SCOPARIUM), SWITCHGRASS (PANICUM VIRGATUM). 15 LBS/ACRE EACH
AUGUST THRU MAY – GREENRYE (SECALE CEREALE) 25 LBS/ACRE EACH
MAY 1 THRU AUGUST – MILLET (PENNISETUM GLLAUCUM) 25 LBS/ACRE EACH

TREES – SILKY DOGWOOD (CORNUS AMONUM), SILKY WILLOW (SALIX SERICEA), HAZEL ALDER (ALMUS SERRULATA) AND ELDERBERRY (SAMBUEUS CANADENSIS)

NATIVE PLANT MIX VARIATIONS SHALL BE APPROVED BY ENGINEER.

NOTE: NO FERTILIZER SHALL BE USED WITHIN 10' OF TOP OF STREAM OR RIVER BANK.

NPDES PERMITS - NOTE -FOR PROJECTS REQUIRING NPDES PERMITS, THE FOLLOWING STABILIZATION SCHEDULE SHALL APPLY:

SITE AREA DESCRIPTION	STABILIZATION TIMEFRAME	STABILIZATION TIMEFRAME EXCEPTIONS
PERIMETER DIKES, SWALES DITCHES AND SLOPES	7 DAYS	NONE
HIGH QUALITY WATER (HQW) ZONES	7 DAYS	NONE
SLOPES STEEPER THAN 3:1	7 DAYS	IF SLOPES ARE 10' OR LESS IN LENGTH AND ARE NOT STEEPER THAN 2:1, 14 DAYS ARE ALLOWED
SLOPES 3:1 OR FLATTER	14 DAYS	7-DAYS FOR SLOPES GREATER THAN 50 FEET IN LENGTH
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	14 DAYS	NONE (EXCEPT FOR PERIMETERS AND HQW ZONES)

12. – MAINTAIN SOIL EROSION CONTROL MEASURES UNTIL PERMANENT GROUND COVER IS ESTABLISHED.

13. – REMOVE SOIL EROSION CONTROL MEASURES AND STABILIZE THESE AREAS.

14. – REQUEST FINAL APPROVAL BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, DIVISION OF LAND RESOURCES, LAND QUALITY SECTION.

811 Know what's below. Call before you dig.
N.C. One-Call Center
Dial 811 or 1-800-632-4949

LEGEND–EXISTING CONDITIONS

Symbol	Description
TEL. PED.	TELEPHONE PEDESTAL
ELEC PED.	ELECTRIC PEDESTAL
SIGN	SIGN
CATV	UNDERGROUND CABLE TV SIGN
UG FOC	UNDERGROUND FIBER OPTIC CABLE SIGN
UG TEL	UNDERGROUND TELEPHONE CABLE SIGN
UG GAS	UNDERGROUND GAS LINE SIGN
UG ELEC	UNDERGROUND ELECTRIC SIGN
40	INTERSTATE HIGHWAY
66	U.S. HIGHWAY
⊠	CONCRETE MONUMENT
⊠ CM-R/W	RIGHT-OF-WAY MONUMENT
MB	MAILBOX OR PAPER BOX
PB	POSTAL DROP BOX
LP	STREET LIGHT
LP	LIGHT POLE
PP	UTILITY POLE
	GUY WIRE ANCHOR
MW	MONITORING WELL
PZ	PIEZOMETER
MH	MANHOLE
J.B.	JUNCTION BOX
C.O.	SEWER CLEAN-OUT
E.SS	ELECTRIC SERVICE STUB-OUT
G.SS	GAS SERVICE STUB-OUT
CB	CATCH BASIN
WM	WATER METER
FH	FIRE HYDRANT
WV	WATER VALVE
G/M	GAS METER
G/V	GAS VALVE
ICV	IRRIGATION CONTROL VALVE
PIV	POST INDICATOR VALVE
E.CAB	ELECTRIC CABINET
E.JUNC	ELECTRIC JUNCTION BOX OR OUTLET
E.TRANS	E.TRANS= ELECTRIC TRANSFORMER
⊙	IRON PIPE/PIN FOUND (PROPERTY CORNER)
PK NL	PK NAIL FOUND
△ CP/NL	CONTROL POINT/NAIL SET
	CULVERT
—X—	FENCE
	GUARD RAIL
—S—	APPROXIMATE LOCATION OF EXISTING SEWER LINES
—W—	APPROXIMATE LOCATION OF EXISTING WATER LINES
—G—	APPROXIMATE LOCATION OF EXISTING GAS LINES
	TOP & TOE LINES
—>—	DITCH LINES
—CTV—	APPROXIMATE LOCATION OF UNDERGROUND CABLE TV LINE
—CTV—	APPROXIMATE LOCATION OF OVERHEAD CABLE TV LINE
—FOC—	APPROXIMATE LOCATION OF UNDERGROUND FIBER OPTIC CABLE LINE
—E—	APPROXIMATE LOCATION OF UNDERGROUND ELECTRIC LINE
—E—	APPROXIMATE LOCATION OF OVERHEAD ELECTRIC LINE
	APPROXIMATE LOCATION OF UNGERGROUND TELEPHONE LINES
—T—	APPROXIMATE LOCATION OF OVERHEAD TELEPHONE LINES
— ROW —	RIGHT-OF-WAY
	TREES/SHRUBS
	TREELINE
E.I.P.	EXISTING IRON PIPE OR PIN
RBF	REBAR FOUND
OTIPF	OPEN TOP IRON PIN FOUND
CTIPF	CRIMPED TOP IRON PIN FOUND
IPS	IRON PIN SET
DIST.	DISTURBED
CMU	CONCRETE MASONRY UNIT
R/W	RIGHT OF WAY
℄	CENTERLINE
C	CURVE (SEE CURVE TABLE)
POB	POINT OF BEGINNING
CP	CALCULATED POINT
PB	PLAT BOOK
DB	DEED BOOK
L	LINE (SEE LINE TABLE)
BLDG	BUILDING
CIP	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CMU	CONCRETE MASONRY UNIT
CPP	CORRUGATED PLASTIC PIPE
DIP	DUCTILE IRON PIPE
E&T	ELECTRIC & TELEPHONE
FOC	FIBER OPTIC CABLE
GIP	GALVANIZED IRON PIPE
O/H	OVERHEAD
RCP	REINFORCED CONCRETE PIPE
U/G	UNDERGROUND
VCP	VITRIFIED CLAY PIPE
PVC	POLYVINYL CHLORIDE PIPE

NO.	DATE	BY	REVISION DESCRIPTION

McGill ASSOCIATES
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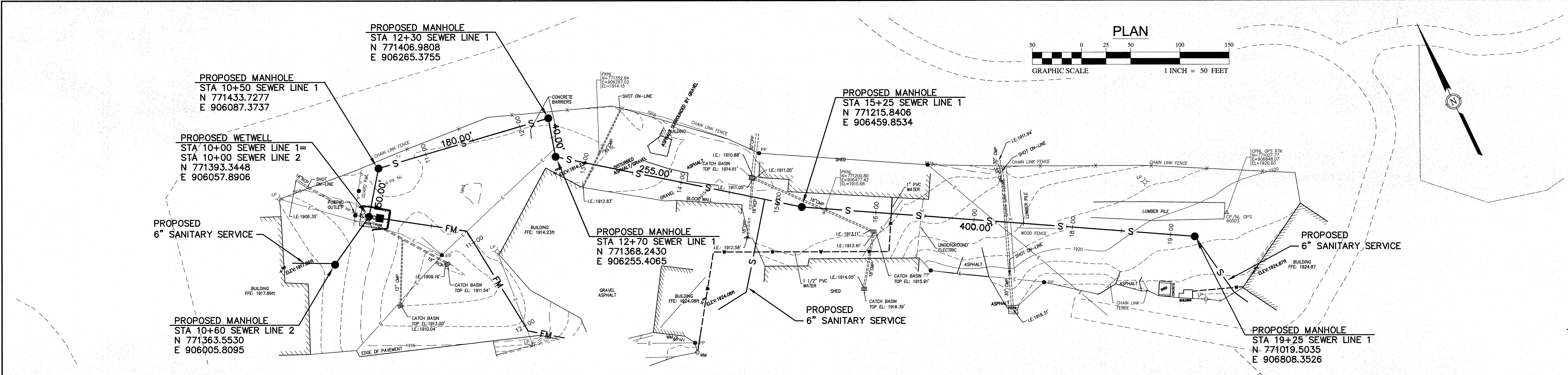
SEAL 22541 ENGINEER HARRY B. BUCKNER
10-22-2013

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

JOB NO.: 13.00377
DATE: SEPTEMBER 2013
DESIGNED BY: BGD
CADD BY: BW
DESIGN REVIEW:
CONST. REVIEW:
FILE NAME: 13.00377-G002.dwg

GENERAL NOTES AND LEGENDS

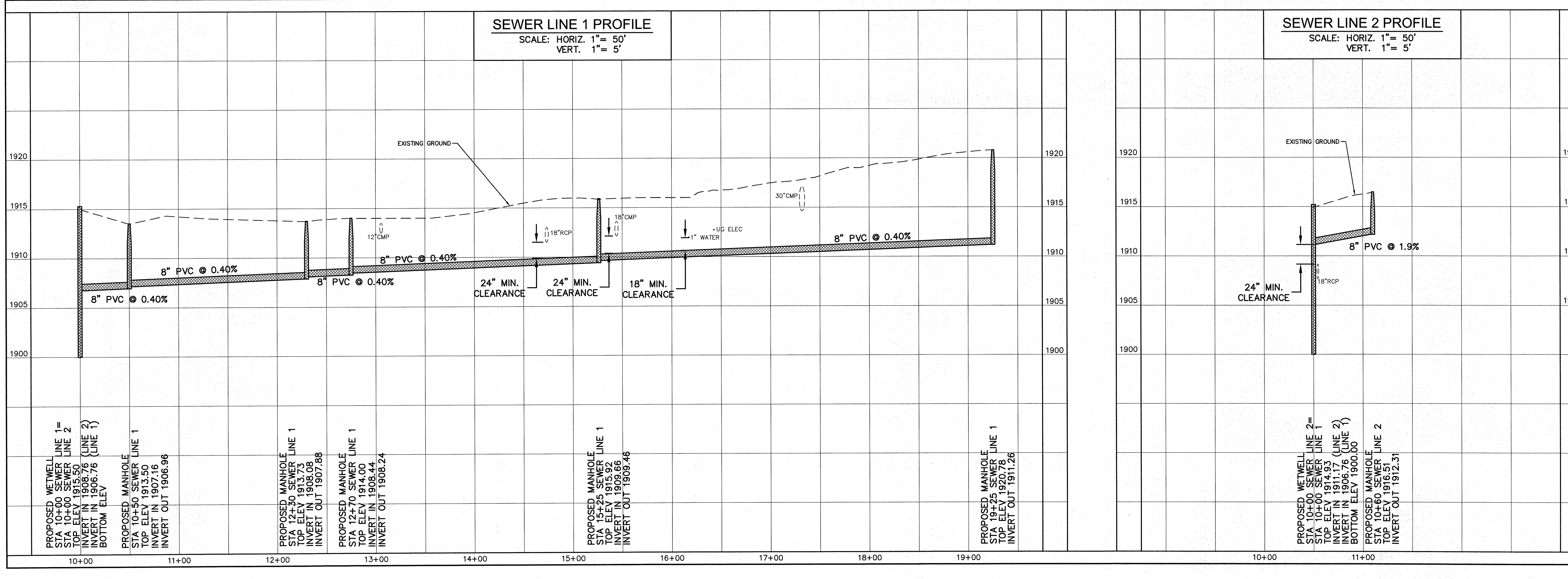
SHEET G-002



NOTES:

1. LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
2. CONTRACTOR SHALL REMOVE AND REPLACE ROADWAY SIGNS AND MAILBOXES AS NECESSARY TO INSTALL PROPOSED UTILITY LINE. CONTRACTOR SHALL COORDINATE SIGN REMOVAL AND REPLACEMENT WITH THE NCDOT.
3. CONTRACTOR SHALL COORDINATE WORK IN THE PROXIMITY OF UTILITY POLES WITH APPROPRIATE UTILITY COMPANIES.
4. CONTRACTOR SHALL PLACE A 2" LAYER OF SAND ON ALL ASPHALT OR CONCRETE SURFACES PRIOR TO PLACING EXCAVATED MATERIAL.
5. CONTRACTOR SHALL CONTACT ALL UTILITY PROVIDERS CONCERNING EXACT LOCATION OF EXISTING LINES PRIOR TO CONSTRUCTION. IF EXISTING UTILITY CABLES ARE ENCOUNTERED IN CONFLICT WITH PROPOSED UTILITY LINE, CONTRACTOR SHALL STRIP OUT EXISTING CABLES, INSTALL PROPOSED UTILITY LINE, & RE-INSTALL EXISTING UTILITY CABLES.
6. ALL RIGHT OF WAY INFORMATION PROVIDED BY THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION.
7. ALL UTILITY LINE INSTALLATIONS SHALL BE A MINIMUM OF 3' OFF THE EDGE OF PAVEMENT UNLESS SHORING MEASURES APPROVED BY NCDOT AND THE ENGINEER ARE UTILIZED.
8. FORCE MAIN SHALL BE INSTALLED AT A GRADUAL POSITIVE SLOPE TO HIGH POINT(S) AS SHOWN IN THE PROFILE. CONTRACTOR SHALL INSTALL FORCE MAIN SO AS NOT TO CREATE ANY INTERMEDIATE HIGH POINTS IN THE LINE. IN CASE OF CONFLICT IN GRADE BETWEEN FORCE MAIN AND OTHER UTILITIES, THE FORCE MAIN SHALL BE LOWERED DURING CONSTRUCTION. THE FORCE MAIN SHALL BE DEFLECTED AROUND STRUCTURES WITHOUT THE USE OF FITTINGS, WHERE POSSIBLE, AND WITHOUT EXCEEDING THE MANUFACTURER'S ALLOWABLE DEFLECTION.
9. CONTRACTOR SHALL CONNECT PROPOSED 6" SANITARY SERVICES TO EXISTING SANITARY LINES EXITING THE BUILDINGS AS SHOWN. CONTRACTOR SHALL FIELD VERIFY THE LOCATIONS OF EACH OF THE BUILDING SERVICES. LOCATIONS SHOWN ON PLANS ARE APPROXIMATE. CONTRACTOR SHALL BREAK UP TOP 3 FEET OF EXISTING SEPTIC TANKS TO BE ABANDONED AND FILL WITH ENGINEERED BACKFILL COMPACTED TO 98%. COST OF ABANDONING OF SEPTIC TANKS SHALL BE INCLUDED IN THE OTHER BID ITEMS. NO SEPARATE PAYMENT WILL BE MADE.
10. PAVEMENT REPLACEMENT THROUGH NCDOT FACILITY EXISTING PAVEMENT SHALL BE PER GRAVEL DRIVE REPLACEMENT DETAIL.

NO.	DATE	BY	REVISION DESCRIPTION



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JOB NO.: 13.00377
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SEWER LINES 1 AND 2
PLAN - PROFILE

SHEET
C-101

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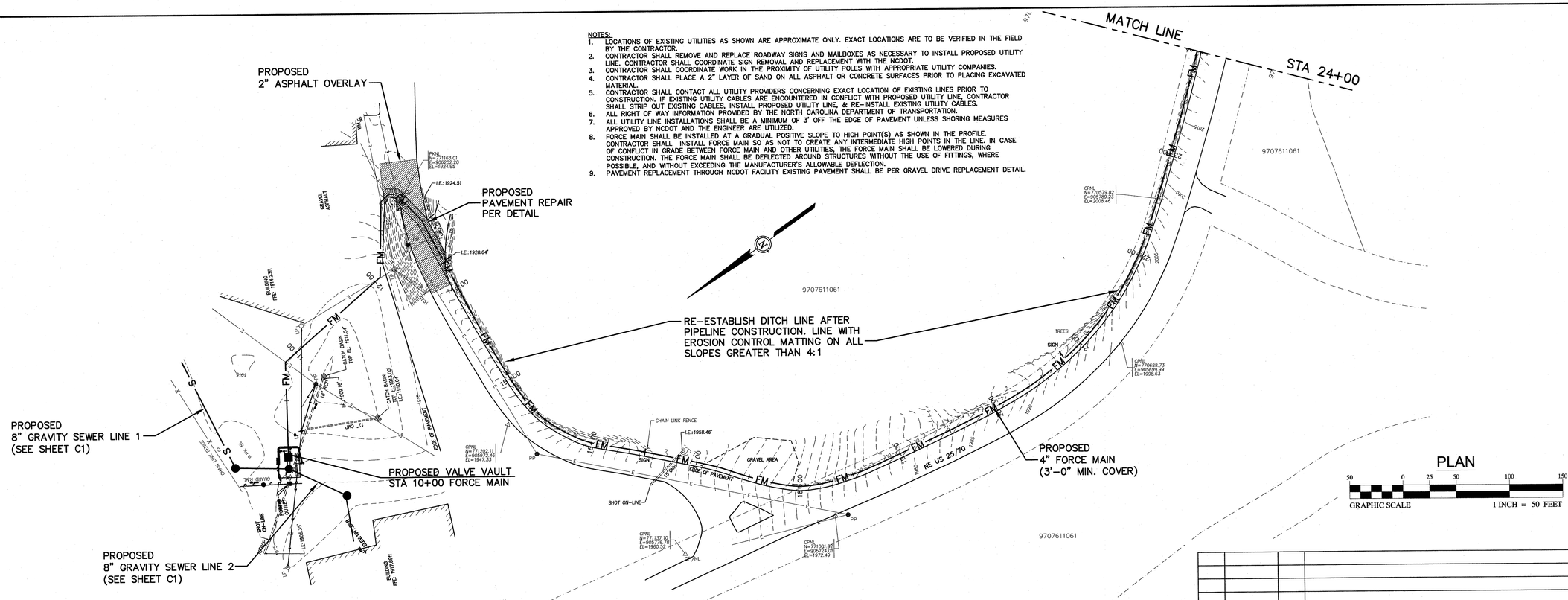
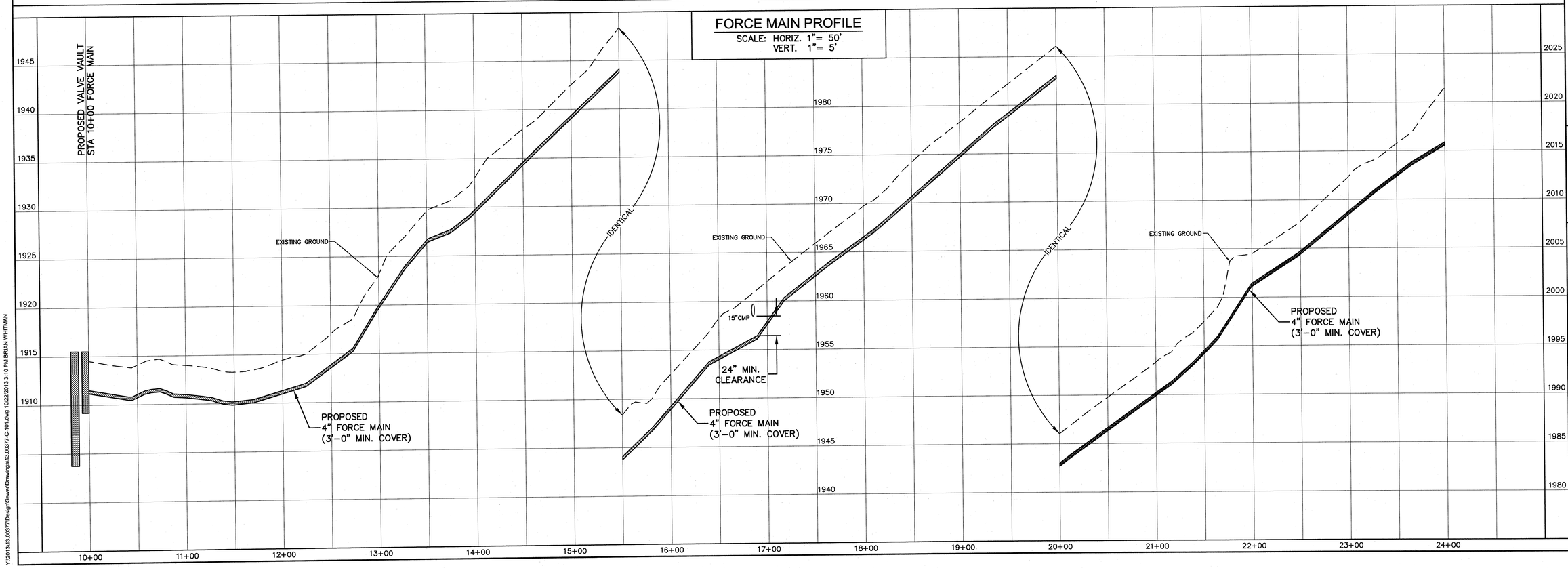
1. LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
2. CONTRACTOR SHALL REMOVE AND REPLACE ROADWAY SIGNS AND MAILBOXES AS NECESSARY TO INSTALL PROPOSED UTILITY LINE. CONTRACTOR SHALL COORDINATE SIGN REMOVAL AND REPLACEMENT WITH THE NCDOT.
3. CONTRACTOR SHALL COORDINATE WORK IN THE PROXIMITY OF UTILITY POLES WITH APPROPRIATE UTILITY COMPANIES.
4. CONTRACTOR SHALL PLACE A 2" LAYER OF SAND ON ALL ASPHALT OR CONCRETE SURFACES PRIOR TO PLACING EXCAVATED MATERIAL.
5. CONTRACTOR SHALL CONTACT ALL UTILITY PROVIDERS CONCERNING EXACT LOCATION OF EXISTING LINES PRIOR TO CONSTRUCTION. IF EXISTING UTILITY CABLES ARE ENCOUNTERED IN CONFLICT WITH PROPOSED UTILITY LINE, CONTRACTOR SHALL STRIP OUT EXISTING CABLES, INSTALL PROPOSED UTILITY LINE, & RE-INSTALL EXISTING UTILITY CABLES.
6. ALL RIGHT OF WAY INFORMATION PROVIDED BY THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION.
7. ALL UTILITY LINE INSTALLATIONS SHALL BE A MINIMUM OF 3' OFF THE EDGE OF PAVEMENT UNLESS SHORING MEASURES APPROVED BY NCDOT AND THE ENGINEER ARE UTILIZED.
8. FORCE MAIN SHALL BE INSTALLED AT A GRADUAL POSITIVE SLOPE TO HIGH POINT(S) AS SHOWN IN THE PROFILE. CONTRACTOR SHALL INSTALL FORCE MAIN SO AS NOT TO CREATE ANY INTERMEDIATE HIGH POINTS IN THE LINE. IN CASE OF CONFLICT IN GRADE BETWEEN FORCE MAIN AND OTHER UTILITIES, THE FORCE MAIN SHALL BE LOWERED DURING CONSTRUCTION. THE FORCE MAIN SHALL BE DEFLECTED AROUND STRUCTURES WITHOUT THE USE OF FITTINGS, WHERE POSSIBLE, AND WITHOUT EXCEEDING THE MANUFACTURER'S ALLOWABLE DEFLECTION.
9. PAVEMENT REPLACEMENT THROUGH NCDOT FACILITY EXISTING PAVEMENT SHALL BE PER GRAVEL DRIVE REPLACEMENT DETAIL.





NO.	DATE	BY	REVISION DESCRIPTION

McGill Associates
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22541 BRIAN D. WHITMAN
10-22-2013

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

JOB NO.: 13.00377
DATE: SEPTEMBER 2013
DESIGNED BY: BGD
CADD BY: BW
DESIGN REVIEW: BW
CONST. REVIEW: ____
FILE NAME: 13.00377-C-101.dwg

FORCE MAIN PLAN - PROFILE

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C-102

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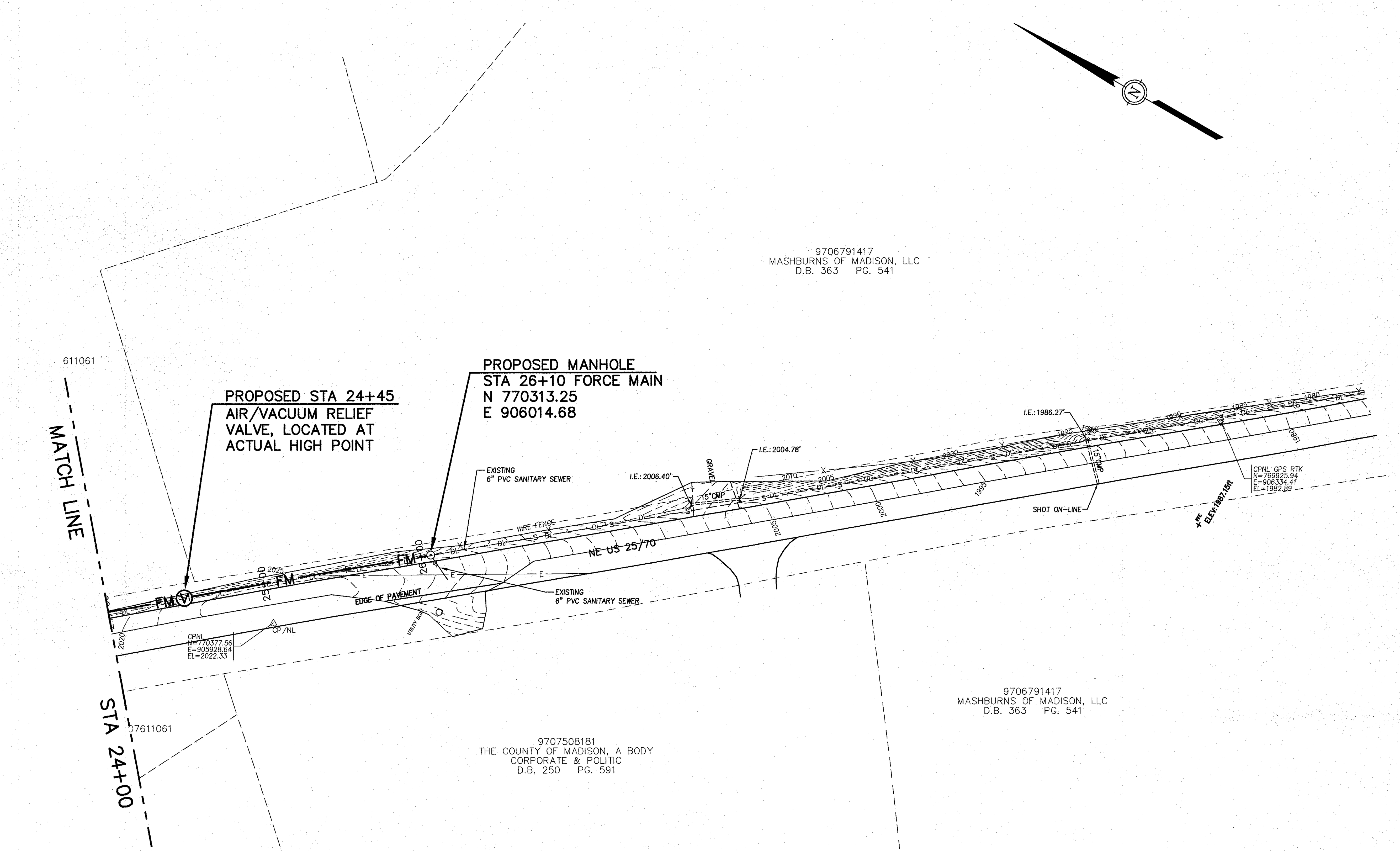
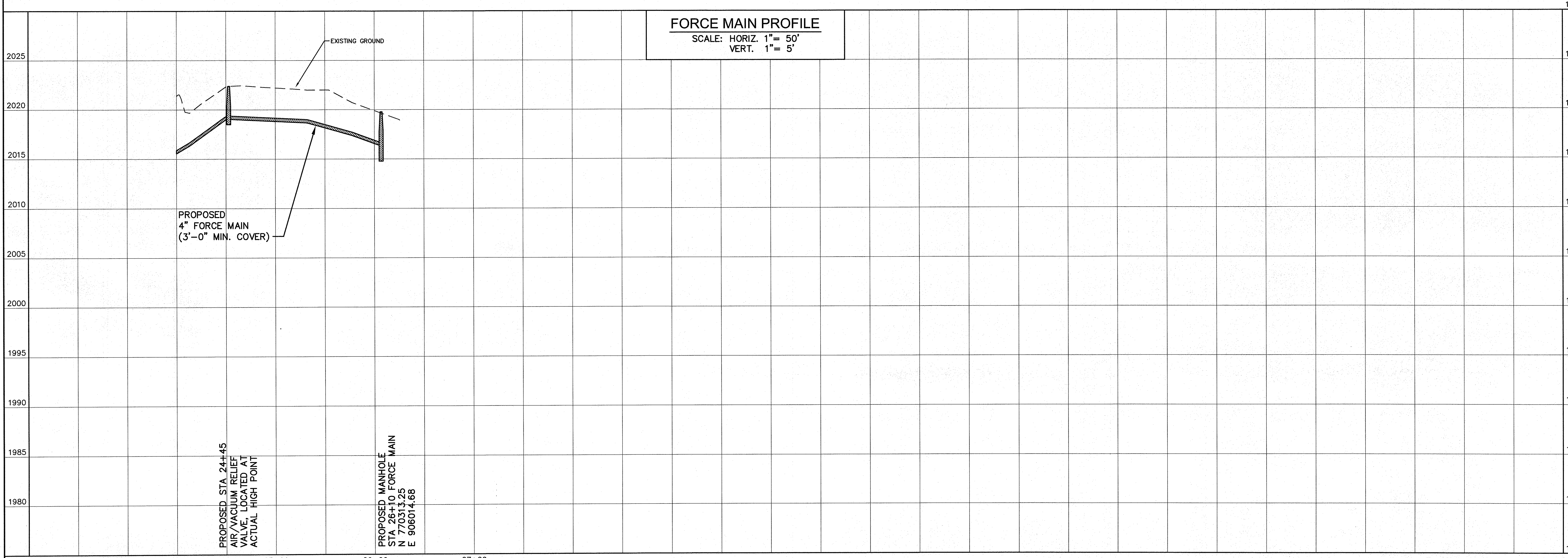


NOTES:
1. LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
2. CONTRACTOR SHALL REMOVE AND REPLACE ROADWAY SIGNS AND MAILBOXES AS NECESSARY TO INSTALL PROPOSED UTILITY LINE. CONTRACTOR SHALL COORDINATE SIGN REMOVAL AND REPLACEMENT WITH THE NCDOT.
3. CONTRACTOR SHALL COORDINATE WORK IN THE PROXIMITY OF UTILITY POLES WITH APPROPRIATE UTILITY COMPANIES.
4. CONTRACTOR SHALL PLACE A 2" LAYER OF SAND ON ALL ASPHALT OR CONCRETE SURFACES PRIOR TO PLACING EXCAVATED MATERIAL.
5. CONTRACTOR SHALL CONTACT ALL UTILITY PROVIDERS CONCERNING EXACT LOCATION OF EXISTING LINES PRIOR TO CONSTRUCTION. IF EXISTING UTILITY CABLES ARE ENCOUNTERED IN CONFLICT WITH PROPOSED UTILITY LINE, CONTRACTOR SHALL STRIP OUT EXISTING CABLES, INSTALL PROPOSED UTILITY LINE, & RE-INSTALL EXISTING UTILITY CABLES.
6. ALL RIGHT OF WAY INFORMATION PROVIDED BY THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION.
7. ALL UTILITY LINE INSTALLATIONS SHALL BE A MINIMUM OF 3' OFF THE EDGE OF PAVEMENT UNLESS SHORING MEASURES APPROVED BY NCDOT AND THE ENGINEER ARE UTILIZED.
8. FORCE MAIN SHALL BE INSTALLED AT A GRADUAL POSITIVE SLOPE TO HIGH POINT(S) AS SHOWN IN THE PROFILE. CONTRACTOR SHALL INSTALL FORCE MAIN SO AS NOT TO CREATE ANY INTERMEDIATE HIGH POINTS IN THE LINE. IN CASE OF CONFLICT IN GRADE BETWEEN FORCE MAIN AND OTHER UTILITIES, THE FORCE MAIN SHALL BE LOWERED DURING CONSTRUCTION. THE FORCE MAIN SHALL BE DEFLECTED AROUND STRUCTURES WITHOUT THE USE OF FITTINGS, WHERE POSSIBLE, AND WITHOUT EXCEEDING THE MANUFACTURER'S ALLOWABLE DEFLECTION.
9. CONTRACTOR SHALL FIELD LOCATE EXISTING 6" SANITARY SEWER AT CONNECTION POINT TO DETERMINE EXACT LOCATION OF PROPOSED MANHOLE PRIOR TO ORDERING MANHOLES FOR THE PROJECT. BOTTOM ELEVATION OF PROPOSED MANHOLE SHALL MATCH INVERT ELEVATION OF EXISTING 6" SANITARY SEWERS. FINAL LOCATION AND DEPTH SHALL BE APPROVED BY THE ENGINEER. FORCE MAIN CONNECTION SHALL BE MADE PER DETAIL.

PLAN

50 0 25 50 100 150
GRAPHIC SCALE 1 INCH = 50 FEET

NO.	DATE	BY	REVISION DESCRIPTION



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ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

SEAL 22541 HARRY B. BUCKNER ENGINEER

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

JOB NO.: 13.00377
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FORCE MAIN
PLAN - PROFILE

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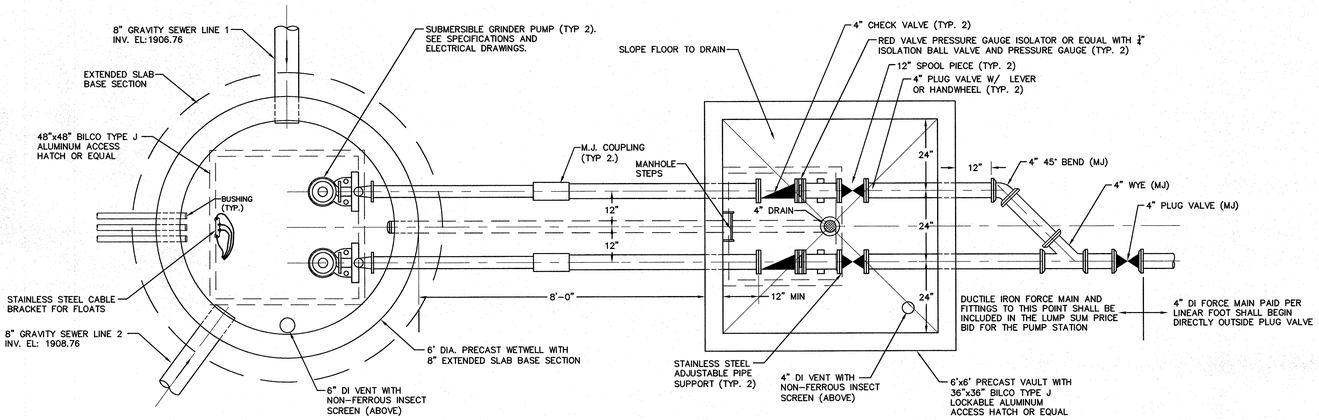


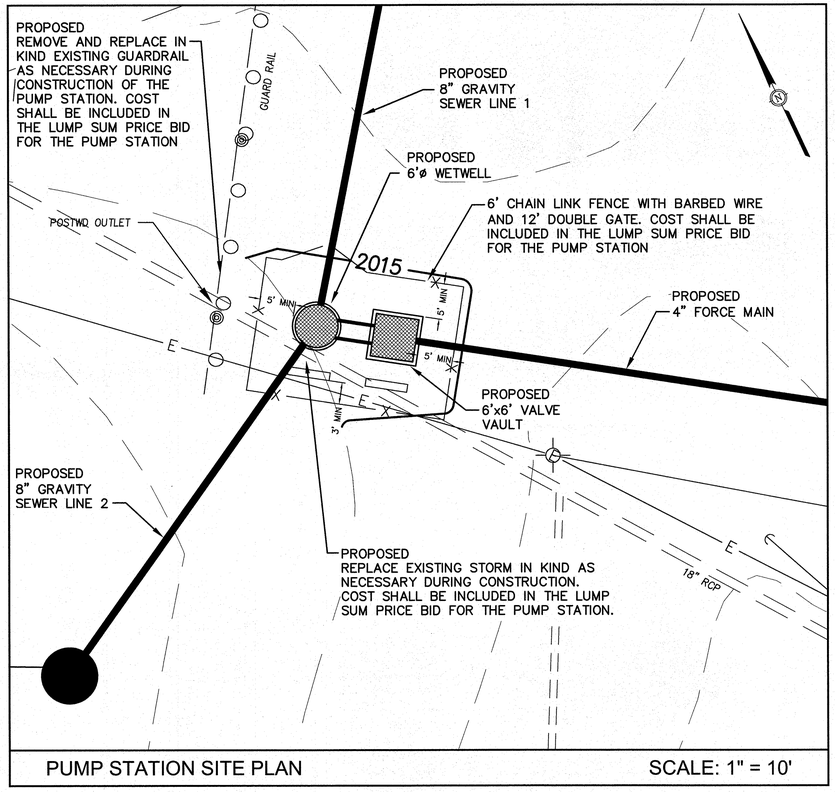
PUMP STATION PLAN VIEW

NOT TO SCALE

NOTES:
1. SUBMERSIBLE PUMPS SHALL BE REMOVABLE FROM TOP OF STATION THROUGH ACCESS DOORS. CONTRACTOR RESPONSIBLE FOR DIMENSION REVISIONS AS REQUIRED IF FINAL PUMP LAYOUT FROM PUMP SUPPLIER IS DIFFERENT FROM DRAWINGS.

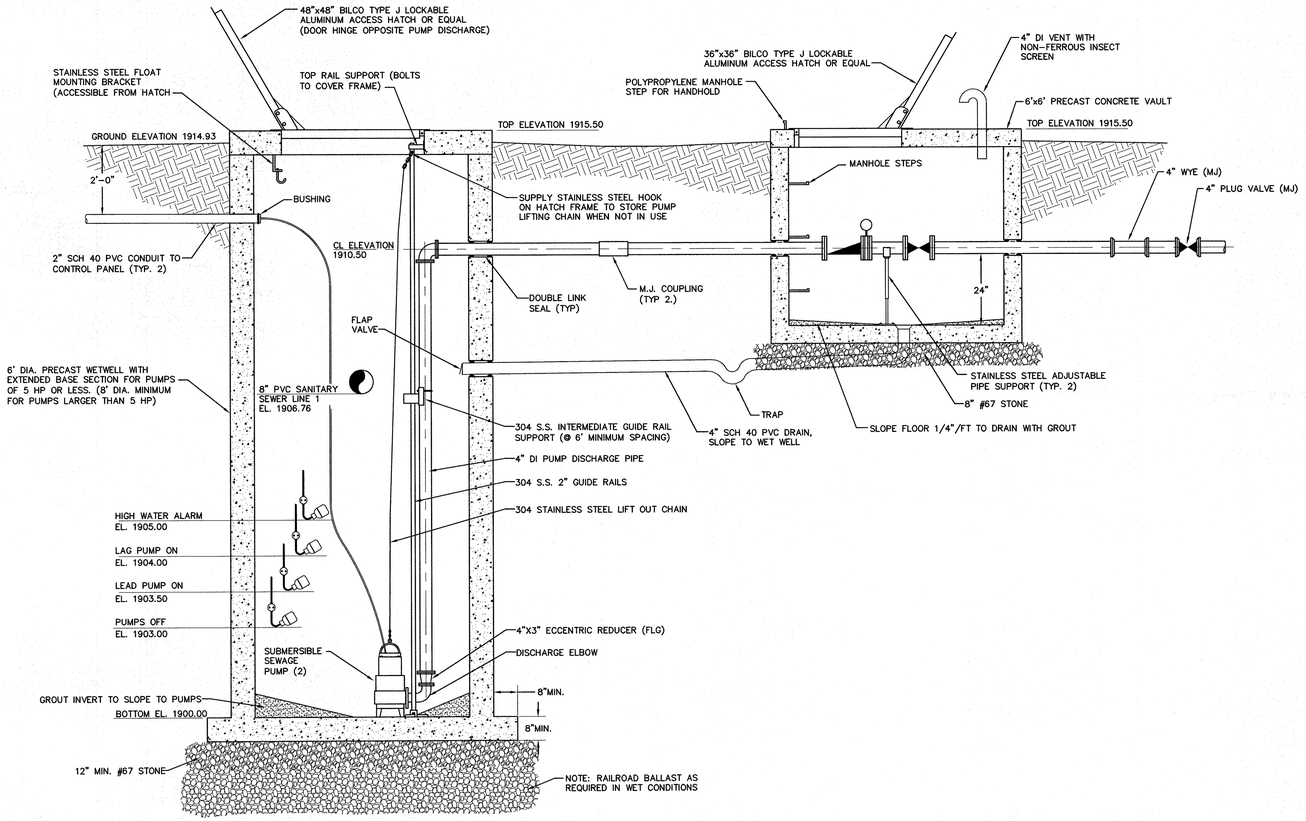
2. CONTRACTOR TO PROVIDE ALUMINUM LADDER OF SUFFICIENT HEIGHT FOR ACCESS INTO PUMP STATION DURING CONSTRUCTION AND INSPECTION.

3. MECHANICAL JOINT PIPE AND FITTINGS SHALL BE PROVIDED WITH RESTRAINED JOINTS MEGALUG OR APPROVED EQUAL. THRUST BLOCKING SHALL ALSO BE PROVIDED ACCORDING TO DETAILS



PUMP STATION SITE PLAN

SCALE: 1" = 10'



PUMP STATION SECTION VIEW

NOT TO SCALE

PUMP STATION GENERAL NOTES:

INSTALL ALL MATERIALS IN STRICT CONFORMANCE WITH THE MANUFACTURERS' RECOMMENDED INSTALLATION REQUIREMENTS.

PRIOR TO ACCEPTANCE OF THE PROJECT BY THE ENGINEER, THE MANUFACTURER OF THE PUMPS SHALL CERTIFY, IN WRITING TO THE ENGINEER, THAT THE CONTRACTOR HAS INSTALLED THE SUBMERSIBLE PUMPS AND ACCESSORIES IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

ALL ACCESS HATCHES SHALL BE LOCKABLE AND PADLOCKED. ALL PADLOCKS SHALL BE KEYED FOR THE SAME KEY AS PROVIDED BY THE OWNER.

THE FINAL SIZE AND LOCATION OF THE WET WELL ACCESS DOOR SHALL BE CLOSELY COORDINATED WITH THE PUMP MANUFACTURER SO AS TO ASSURE THAT THE PUMPS SUPPLIED WILL HAVE THE ABILITY TO BE EASILY PULLED FOR MAINTENANCE.

HATCHES SHALL BE LOCATED SO THAT ALL VALVES SHALL BE ACCESSIBLE VERTICALLY THROUGH THE HATCHES.

IT IS SOLELY THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE TO ENSURE THE SAFETY OF THE STRUCTURES AND ITS COMPONENTS DURING CONSTRUCTION. THIS INCLUDES, BUT IS NOT LIMITED TO, THE ADDITION OF WHATEVER SHEET PILING, TEMPORARY SHORING OR BRACING, GUYS OR TIE-DOWNS MAY BE NECESSARY.

THE CONTRACTOR SHALL NOTIFY THE ENGINEER AS SOON AS POSSIBLE OF ANY UNUSUAL SOIL CONDITIONS OR SOIL CONDITIONS IN VARIANCE WITH TEST BORINGS, SUCH AS UNEXPECTED SPRING OR SEEPAGE WATER, MATERIAL DIFFERING FROM TEST BORINGS, OR SOIL OF QUESTIONABLE BEARING CAPACITY.

BACKFILL MATERIAL FOR THE ENTIRE PUMP STATION AREA SHALL BE STRUCTURAL BACKFILL AS SPECIFIED. BACKFILL SHALL BE PLACED IN MAXIMUM 8-INCH LOOSE LIFTS. BACKFILL SHALL BE COMPACTED TO THE REQUIREMENTS OF THE SPECIFICATIONS. COMPACTION SHALL BE ACHIEVED THROUGH THE USE OF A MECHANICAL VIBRATORY ROLLER. COMPACTION TESTING OF THE BACKFILL SHALL BE PROVIDED, DIRECTED AND COORDINATED BY THE ENGINEER. INTERVALS OF TESTING SHALL BE AT THE TOTAL DISCRETION OF THE ENGINEER AND MAY BE CHANGED AT ANY TIME.

CARE SHALL BE TAKEN TO NOT DISTURB THE BOTTOM OF THE EXCAVATIONS. EXCAVATION TO FINAL GRADE SHALL NOT BE MADE UNTIL JUST PRIOR TO PLACING CONCRETE.

SETTLEMENT OR WASHING THAT OCCURS IN GRADED OR BACKFILLED AREAS PRIOR TO ACCEPTANCE OF THE WORK SHALL BE REPAIRED AND GRADES REESTABLISHED TO THE REQUIRED ELEVATIONS AND SLOPES.

THE VALVE VAULT SHALL BE PLACED ON EITHER UNDISTURBED SOIL OR ADEQUATELY COMPACTED BACKFILL, AS DETERMINED BY THE ENGINEER.

THE WET WELL SHALL BE UNDERCUT 3 FEET BELOW THE PROPOSED BOTTOM ELEVATION. EXCAVATED MATERIAL SHALL BE REPLACED WITH 24" NO. 1 OR 2 CRUSHED AGGREGATE FOLLOWED BY 12" OF #67 CRUSHED AGGREGATE.

ALL INTERNAL AND EXTERNAL MOUNTING HARDWARE ON THE WET WELL, VALVE VAULT, AND METER MANHOLE SHALL BE 316 STAINLESS STEEL.

SEWER INLET PIPE CONNECTIONS TO CONCRETE STRUCTURES SHALL BE MADE WITH ASTM C-923 FLEXIBLE GASKETS SUCH AS A-LOK, DURASEAL III, KOR-N-SEAL, OR APPROVED EQUIVALENT. OTHER PIPE PENETRATIONS WILL BE MADE BY THE USE OF CORING AND INSTALLATION OF A LINK SEAL.

MANHOLE STEPS SHALL BE M.A. INDUSTRIES PS-1-PF REINFORCED PLASTIC STEPS OR APPROVED EQUIVALENT.

CAST-IN-PLACE CONCRETE:

CAST-IN-PLACE CONCRETE WORK SHALL CONFORM TO THE LATEST AMERICAN CONCRETE INSTITUTE CODES AND STANDARDS, INCLUDING BUT NOT LIMITED TO, ACI 301, ACI 315, AND ACI 318.

CONCRETE SHALL HAVE 4000-PSI MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS WITH ENTRAINED AIR. THE AMOUNT OF ENTRAINED AIR SHALL BE 5% TO 7%.

THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR CONCRETE MIX DESIGN, CONCRETE TEST REPORTS, AND REINFORCING STEEL.

ALL REINFORCING STEEL SHALL BE NEW DOMESTIC DEFORMED BILLET STEEL CONFORMING TO ASTM A615, GRADE 60. PROVIDE EPOXY COATING FOR ALL REINFORCEMENTS PER ASTM A775. WELDING OF REINFORCING STEEL IS NOT PERMITTED.

CONTRACTOR SHALL REVIEW ALL DRAWINGS FOR SIZE AND LOCATION OF EMBEDDED ITEMS, SLEEVES, SLAB DEPRESSIONS, OPENINGS, AND ETC. REQUIRED BY OTHER TRADES PRIOR TO PROCEEDING WITH THE WORK.

CONTRACTOR SHALL PROVIDE SPACERS, CHAIRS, BOLSTERS, AND ETC. NECESSARY TO SUPPORT REINFORCING STEEL. SUPPORT ITEMS THAT BEAR ON EXPOSED CONCRETE SURFACES SHALL HAVE ENDS THAT ARE PLASTIC TIPPED OR STAINLESS STEEL.

CALCIUM CHLORIDE SHALL NOT BE PERMITTED NOR SHALL ANY ADMIXTURE CONTAINING CALCIUM CHLORIDE BE PERMITTED THAT RESULTS IN A TOTAL CONCRETE MIX IN WHICH THE PRESENCE OF CHLORIDE IONS EXCEED 0.15%, EXPRESSED AS A PERCENT WEIGHT OF CEMENT.

ALL CONCRETE SHALL CONTAIN A WATER-REDUCING ADMIXTURE CONFORMING TO ASTM C494, TYPE A, F OR G.

REINFORCING BARS REQUIRED FOR PROPER SUPPORT OF PRINCIPAL REINFORCING SHALL BE DETAILED AND SUPPLIED BY THE CONTRACTOR WHETHER OR NOT THEY ARE INDICATED ON THE DRAWINGS. THE MINIMUM BAR SIZE SHALL BE #4 AND MAXIMUM SPACING SHALL BE 36" O.C. FOR ALL BARS THAT NEED SUPPORT. WELDED WIRE FABRIC SHALL NOT BE USED FOR THE SUPPORT OF PRINCIPAL REINFORCING.

PRECAST CONCRETE:

PRECAST CONCRETE WORK SHALL CONFORM TO ASTM C478. ALL PRECAST SECTIONS SHALL BE CONSTRUCTED PLUMB.

ULTIMATE COMPRESSIVE STRENGTH OF CONCRETE IN 28 DAYS SHALL BE 4000 PSI WITH ENTRAINED AIR. THE AMOUNT OF ENTRAINED AIR SHALL BE 5% TO 7%. PRECAST CONCRETE SHALL BE CURED PER ACI 308.

ALL REBAR SHALL BE PER ASTM A615, GRADE 60.

JOINT SEAL BETWEEN PRECAST MANHOLE SECTIONS SHALL BE RESILIENT AND FLEXIBLE GASKET JOINTS PER THE LATEST EDITION OF ASTM C443. JOINT LOCATION SHALL BE DETERMINED BY THE PRECAST MANUFACTURER AFTER OBTAINING APPROVAL FROM THE ENGINEER.

THE PRECAST SUPPLIER SHALL BE RESPONSIBLE FOR THE STRUCTURAL DESIGN OF THE WET WELL AND VALVE VAULT. SHOP DRAWINGS SUBMITTED TO THE ENGINEER SHALL INCLUDE STRUCTURAL DESIGN CALCULATIONS SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF NORTH CAROLINA.

THE PRECAST SUPPLIER SHALL SUBMIT BOUYANCY CALCULATIONS TO VERIFY ANTI-FLOTATION OF THE WET WELL. THE CONTRACTOR SHALL MODIFY THE STRUCTURE AS REQUIRED TO ENSURE ANTI-FLOTATION WITH THE APPROVAL OF THE ENGINEER AND AT NO ADDITIONAL COST TO THE OWNER.

GRAVEL PAVEMENT

GRAVEL PAVEMENT SHALL BE INSTALLED TO THE ELEVATIONS SHOWN AND AREAS OUTSIDE PAVEMENT SHALL BE GRADED TO EXISTING GROUND. IN GENERAL, GRADES SHALL BE SUCH THAT POSITIVE DRAINAGE AWAY FROM THE PUMP STATION SITE IS MAINTAINED. GRAVEL PAVEMENT LOCATED IN THE PUMP STATION AREA SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE GRAVEL DRIVE DETAIL. COST OF GRAVEL PLACEMENT AND ALL NECESSARY GRADING SHALL BE INCLUDED IN THE PRICE BID FOR THE PUMP STATION

NO.	DATE	BY	REVISION DESCRIPTION

McGILL ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH: (828) 252-0575 FIRM LICENSE # C-0459

SEAL 22541 ENGINEER BRIAN K. WHITMAN NORTH CAROLINA
10-22-2013

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

JOB NO.: 13.00377
DATE: SEPTEMBER 2013
DESIGNED BY: BGD
CADD BY: BW
DESIGN REVIEW: BKW
CONST. REVIEW:
FILE NAME: 13.00377-C-101.dwg

PUMP STATION PLAN, SECTION AND DETAILS

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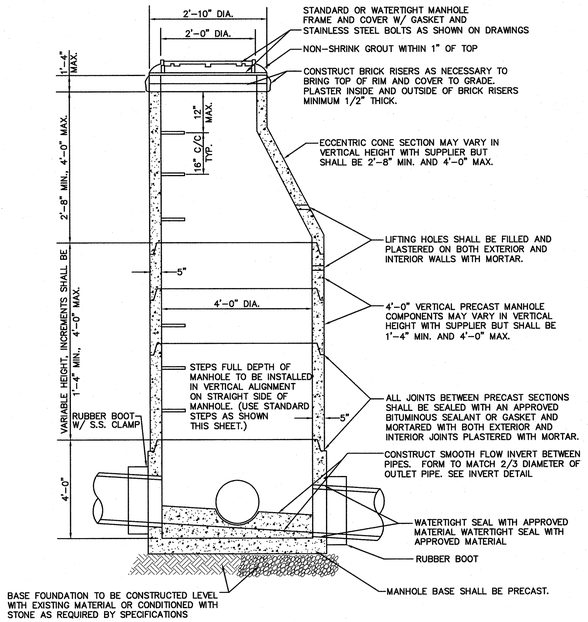


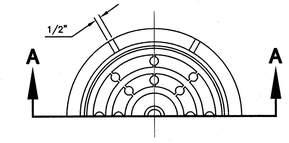
ELEVATION VIEW

PRECAST MANHOLE NOTES:

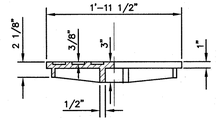
1. ALL PRECAST MANHOLE COMPONENTS SHALL MEET REQUIREMENTS OF ASTM C-478, LATEST REVISION.
2. ALL MANHOLES SHALL BE CONSTRUCTED PLUMB
3. ALL MANHOLE GRADES SHOWN ON THE PLANS ARE FOR THE INVERT OF THE MANHOLE CENTER.
4. IF MANHOLE IS SET IN LOCATION OF HIGH WATER TABLE OR UNDERGROUND WATER IS ENCOUNTERED, THE CONTRACTOR SHALL INSTALL UNDERDRAINS AND STONE AS DIRECTED IN THE FIELD BY THE ENGINEER.
5. STEPS SHALL BE INSTALLED ON STRAIGHT SIDE OF MANHOLE.

PRECAST CONCRETE MANHOLE

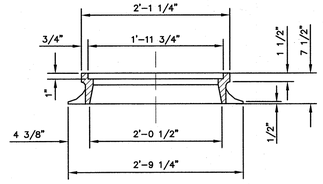
REVISION DATE - JANUARY 2, 2007



HALF PLAN OF MANHOLE RING & COVER



SECTION A-A MANHOLE COVER

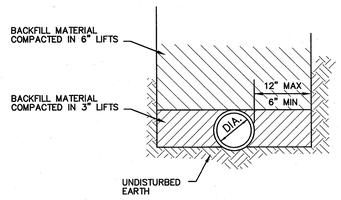


SECTION A-A MANHOLE RING

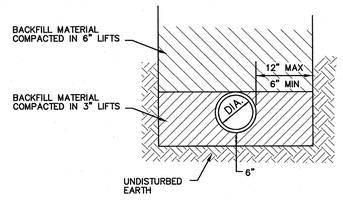
NOTE: TRAFFIC BEARING RING AND COVER. MINIMUM WEIGHT 315 POUNDS

MANHOLE RING & COVER

REVISION DATE - JANUARY 2, 2007

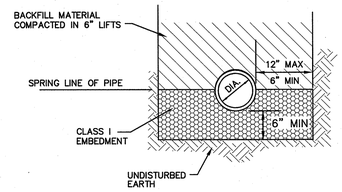


STANDARD EXCAVATION



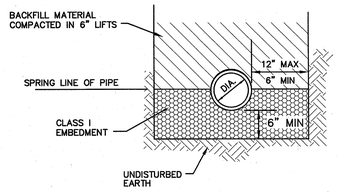
OVERCUT EXCAVATION

DUCTILE IRON SEWER

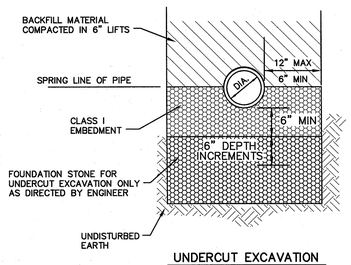


STANDARD EXCAVATION

PVC SEWER



STANDARD EXCAVATION IN WET CONDITIONS



UNDERCUT EXCAVATION IN UNSTABLE SOILS TYPES

PIPE IN WET OR UNSTABLE CONDITIONS
ALL PIPE TYPES
(AS DIRECTED BY ENGINEER)

NOTE: 1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.

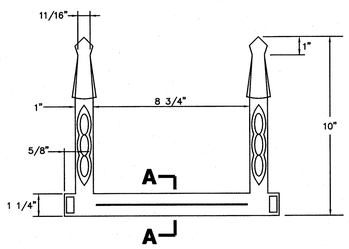
2. FOR UNIT PRICE CONTRACTS ONLY, PAYMENT FOR ROCK EXCAVATION AND SELECT BACKFILL IN TRENCH SHALL BE FOR ACTUAL QUANTITIES AND SHALL NOT EXCEED THE WIDTH OF TRENCH SHOWN ON THIS DETAIL.

3. FOR UNIT PRICE CONTRACTS ONLY, PAYMENT FOR FOUNDATION STONE UNDERCUT SHALL BE FOR THE LENGTH OF THE TRENCH REQUIRING UNDERCUT X 6" DEPTH INCREMENTS TO THE DEPTH REQUIRED.

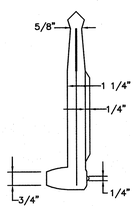
4. CLASS I EMBEDMENT SHALL BE NCDOT STANDARD # 67 STONE OR APPROVED EQUAL. FOUNDATION STONE SHALL BE NCDOT STANDARD # 57 OR # 67 STONE OR APPROVED EQUAL.

TYPICAL PIPELINE TRENCHING DETAILS

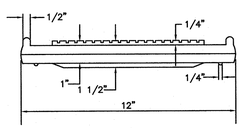
MODIFIED FOR THIS PROJECT



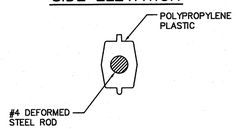
PLAN



SIDE ELEVATION



ELEVATION

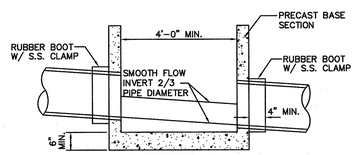


SECTION A-A

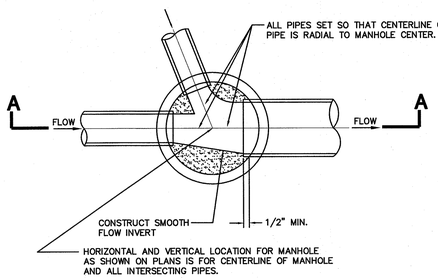
CONSTRUCTION NOTES 1. ALL STEPS SHALL PROTRUDE A MINIMUM OF 5" AND A MAXIMUM OF 7" FROM INSIDE FACE OF STRUCTURE WALL. 2. STEPS DIFFERING IN DIMENSIONS, CONFIGURATION, OR MATERIALS FROM THOSE SHOWN MAY ALSO BE USED PROVIDED THE CONTRACTOR HAS FURNISHED THE ENGINEER WITH DETAILS OF THE PROPOSED STEPS AND HAS RECEIVED PRIOR WRITTEN APPROVAL FROM THE ENGINEER FOR THE USE OF SAID STEPS.

MANHOLE STEPS

REVISION DATE - JANUARY 2, 2007



SECTION A-A



PLAN

NOTE: MANHOLES ON PLANS NOTED AS HIGH VELOCITY MANHOLES SHALL RECEIVE TWO COATS OF SIKAGARD 62, HIGH-BUILD, EPOXY RESIN COATING OR APPROVED EQUAL ON INVERT CHANNEL.

MANHOLE INVERTS

REVISION DATE - JANUARY 2, 2007

NO.	DATE	BY	REVISION DESCRIPTION

McGill Associates
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

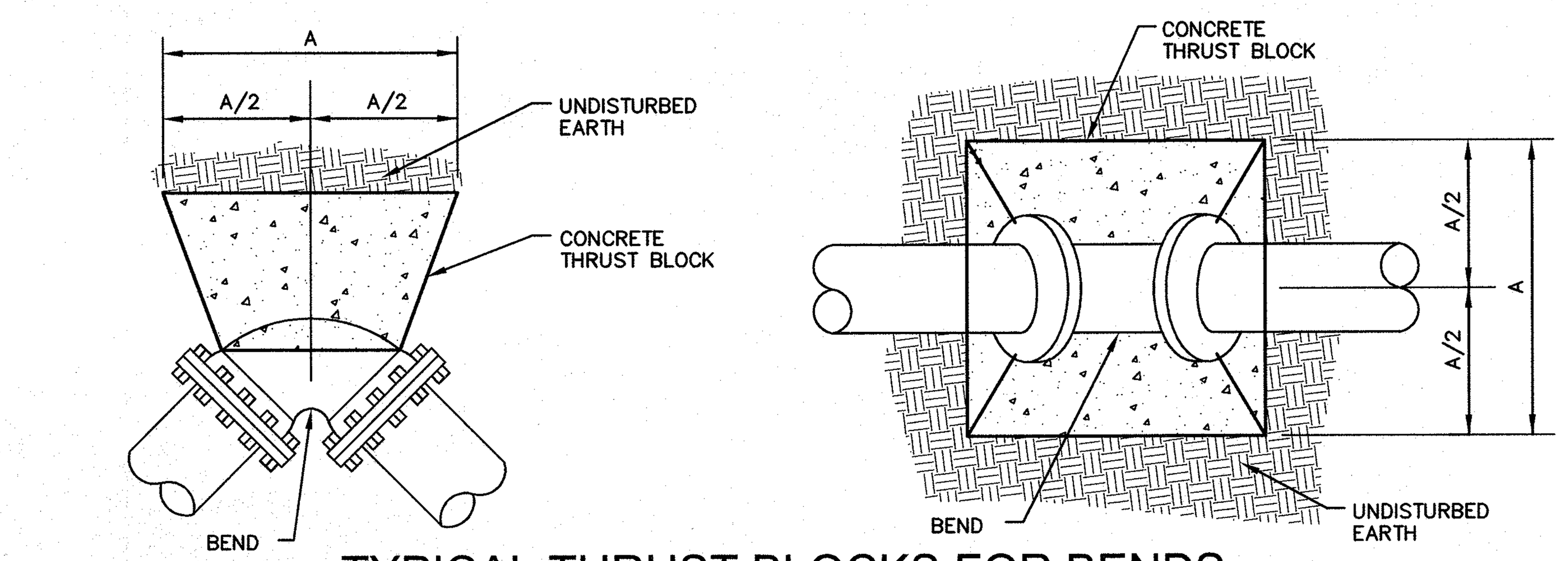
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22541 HARRY B. GILL JR. 10-22-2013

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

JOB NO.: 13.00377
DATE: SEPTEMBER 2013
DESIGNED BY: BGD
CADD BY: BW
DESIGN REVIEW: HBG
CONST. REVIEW:
FILE NAME: 13.00377-C-501.dwg

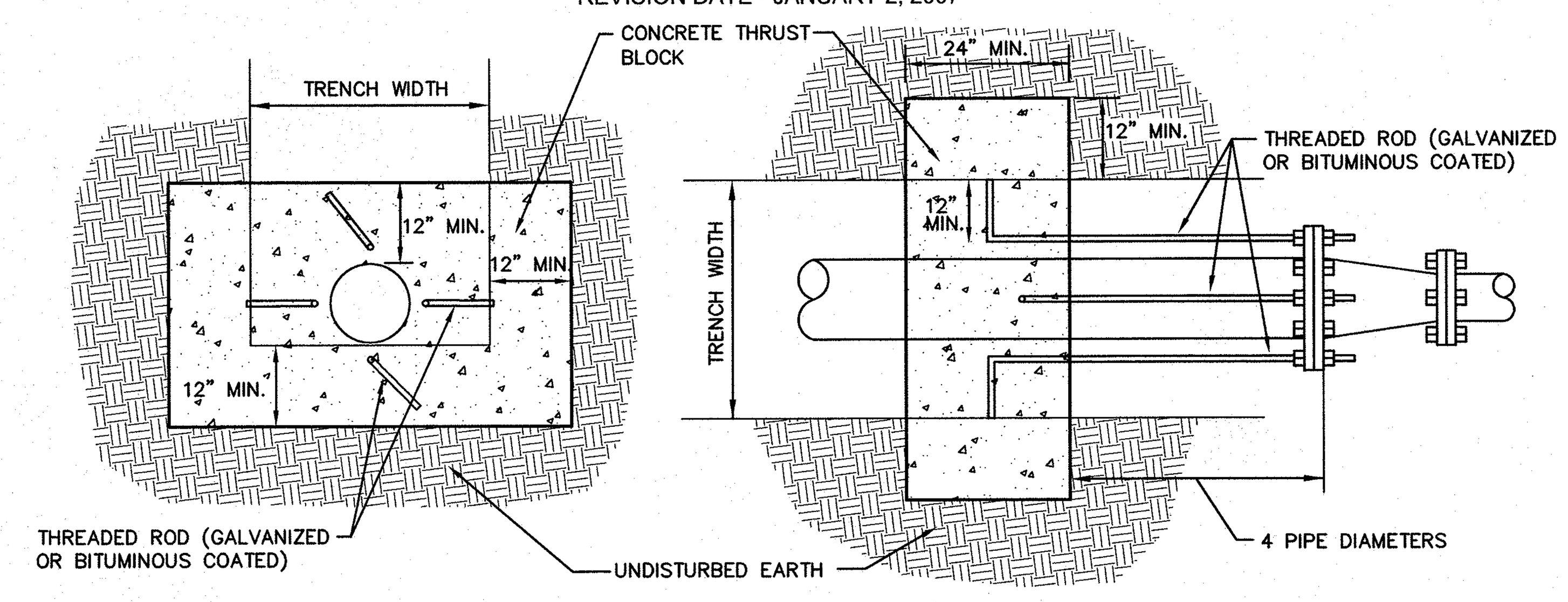
MISCELLANEOUS DETAILS

SHEET
C-501



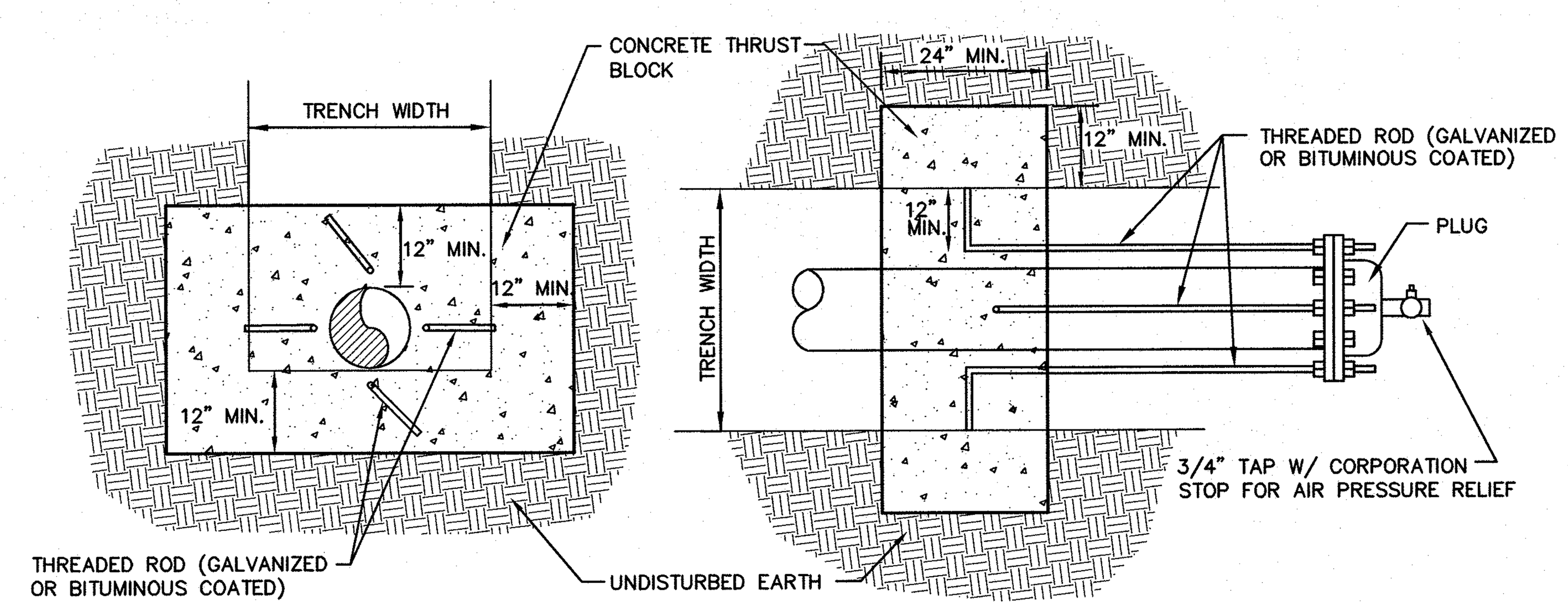
TYPICAL THRUST BLOCKS FOR BENDS

REVISION DATE - JANUARY 2, 2007



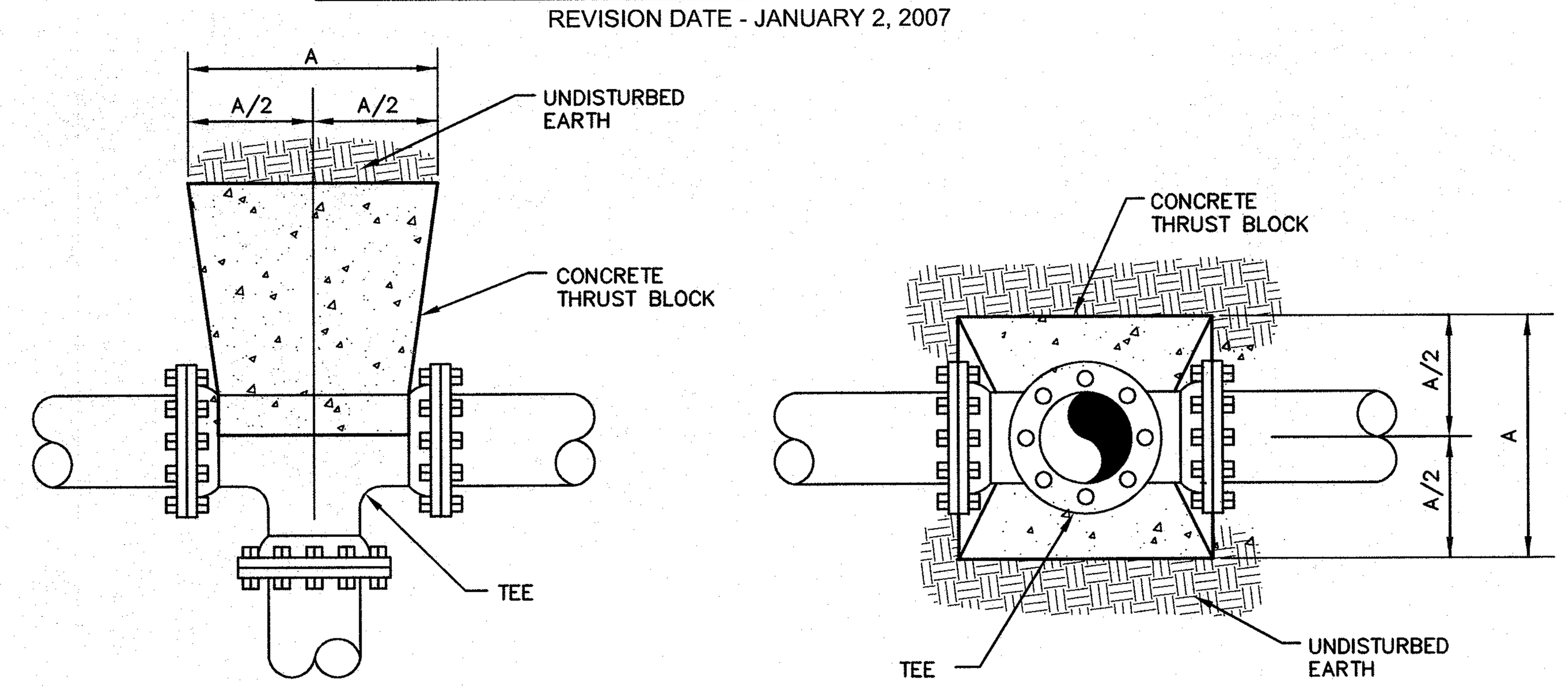
TYPICAL THRUST BLOCK FOR REDUCERS

REVISION DATE - JANUARY 2, 2007



TYPICAL THRUST BLOCK FOR PLUGS

REVISION DATE - JANUARY 2, 2007



TYPICAL THRUST BLOCKS FOR TEES

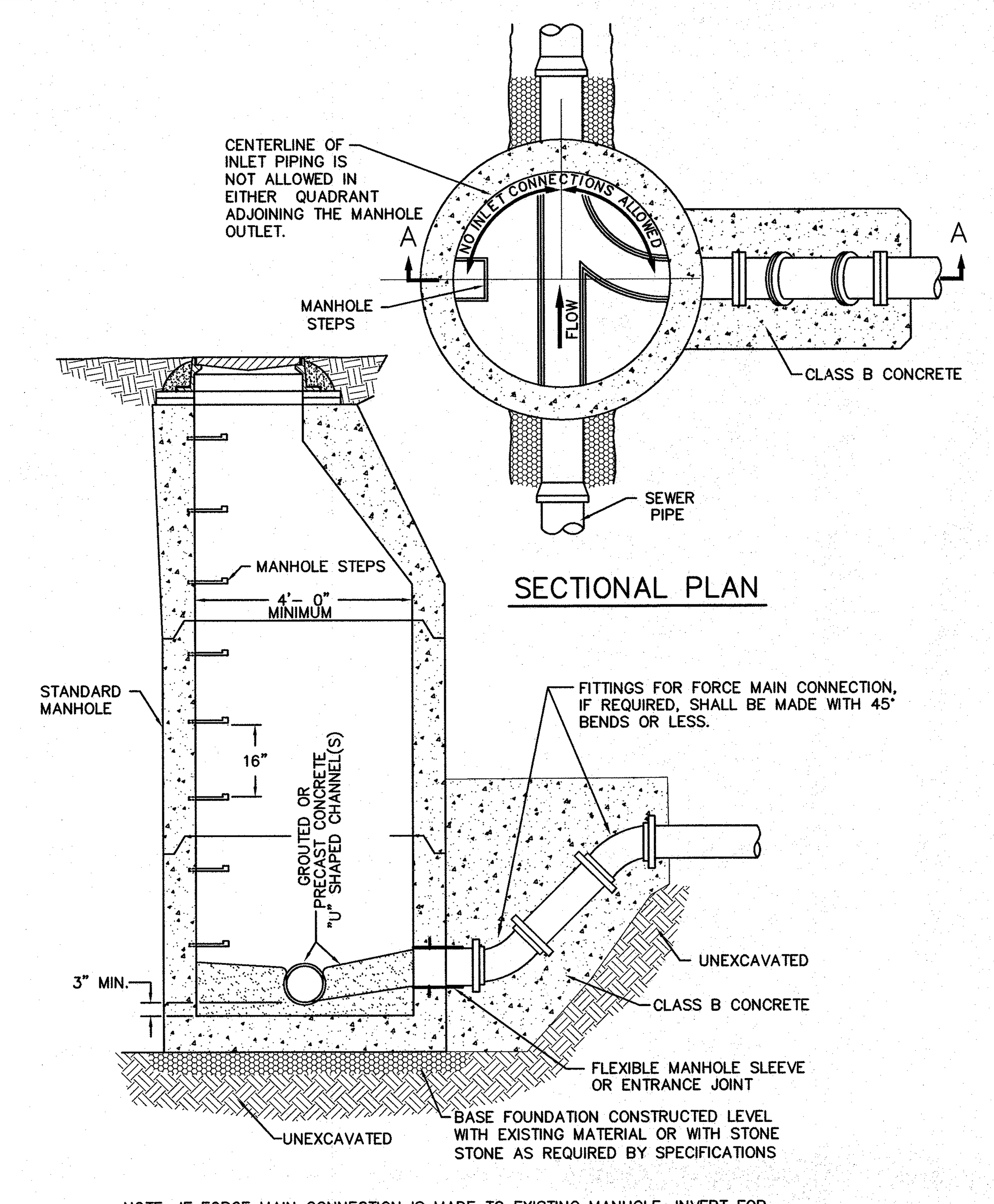
REVISION DATE - JANUARY 2, 2007

NOTES:
1. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. THE FITTING SHALL BE WRAPPED IN A LAYER OF POLYETHYLENE PLASTIC PRIOR TO POURING THE THRUST BLOCK.
2. ROD AND EYE BOLT DIAMETER SHALL BE A MINIMUM OF 3/4" AND SHALL MATCH THE SIZE OF THE BOLT PROVIDED WITH THE FITTING.
3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

	TYPE					
SIZE	11-1/4° BEND	22-1/2° BEND	45° BEND	90° BEND	TEE	PLUG
2-6	12	12	12	16	16	14
8	12	12	16	22	22	18
10	12	14	20	28	28	22
12	12	18	24	32	32	28
14	14	20	28	38	38	32
16	16	22	32	42	42	36
18	18	26	36	48	48	40
20	20	28	40	52	52	44
24	24	34	46	64	64	54
30	30	42	58	78	78	66
36	36	50	70	94	94	80
42	40	58	80	108	108	92
48	46	66	90	124	124	104

THRUST BLOCK DIMENSION "A"

REVISION DATE - JANUARY 2, 2007

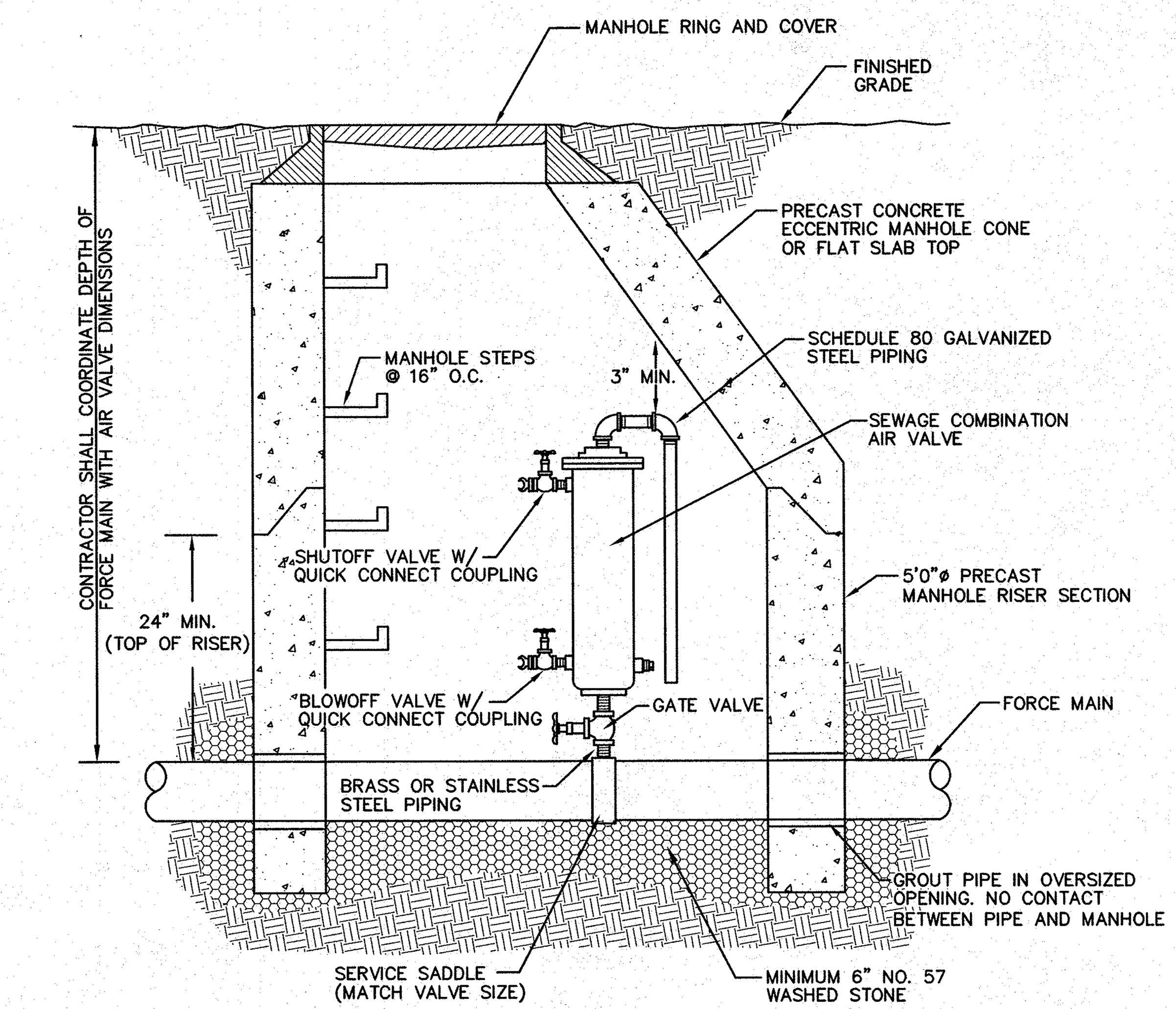


NOTE: IF FORCE MAIN CONNECTION IS MADE TO EXISTING MANHOLE, INVERT FOR FORCE MAIN SHALL BE CONSTRUCTED ON TOP OF EXISTING INVERT BENCH

SECTION A—A

FORCE MAIN CONNECTION

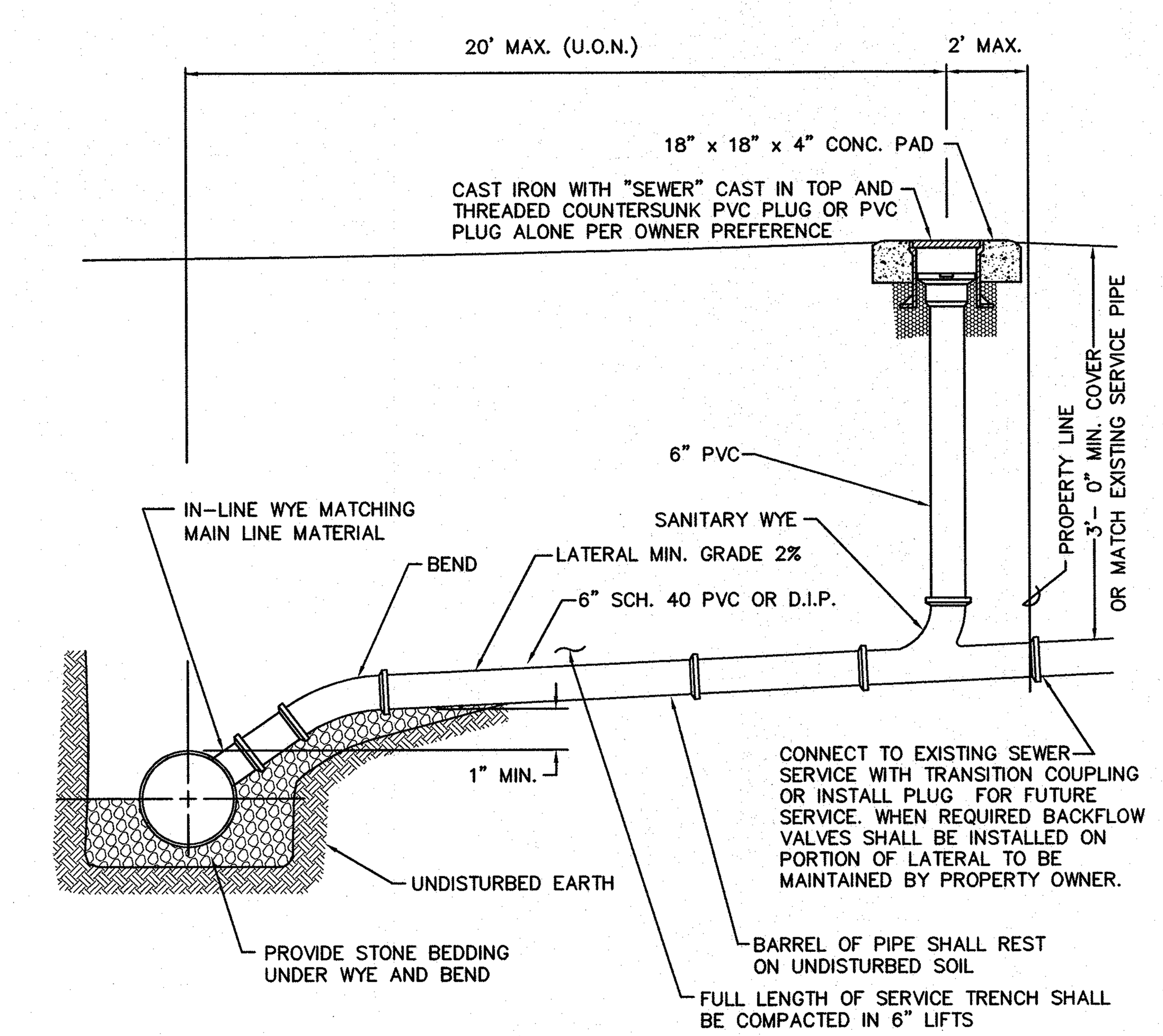
REVISION DATE - JANUARY 2, 2007



NOTES:
1. COMBINATION AIR VALVE TO BE INSTALLED AT ACTUAL HIGH POINT OF LINE.
2. COMBINATION AIR VALVE SHALL BE OFFSET IN MANHOLE TO PROVIDE ACCESS.
3. VALVE SIZE AS SHOWN ON DRAWINGS OR DETAILED IN THE SPECIFICATIONS.
4. ALL PIPING FOR COMBINATION AIR VALVE SHALL BE BRASS OR STAINLESS STEEL.
5. CONTRACTOR SHALL ADJUST THE DEPTH OF THE FORCE MAIN AT ALL HIGH POINTS TO ACCOMODATE THE INSTALLATION OF THE COMBINATION AIR VALVE.

SEWAGE FORCE MAIN COMBINATION AIR VALVE

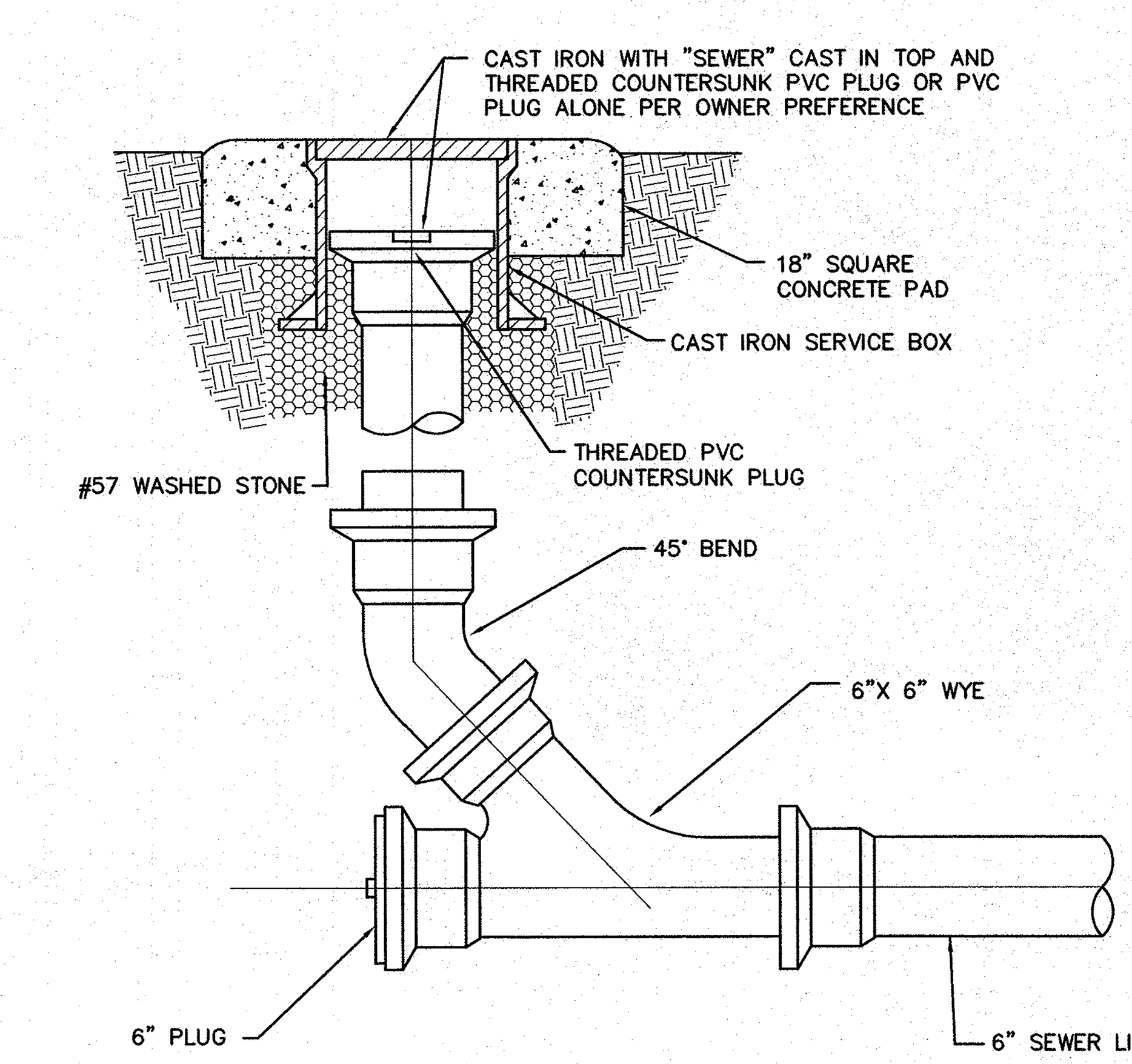
REVISION DATE - JANUARY 2, 2007



NOTE:
1. TAPPING SADDLES ARE APPROVED FOR CONNECTIONS TO EXISTING SEWER LINES ONLY

SANITARY SEWER SERVICE

REVISION DATE - JANUARY 2, 2007



CLEANOUT DETAIL

REVISION DATE - JANUARY 2, 2007

NO.	DATE	BY	REVISION DESCRIPTION

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55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

SEAL 22541 ENGINEER HARRY B. BUCKNER 10-22-2013

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

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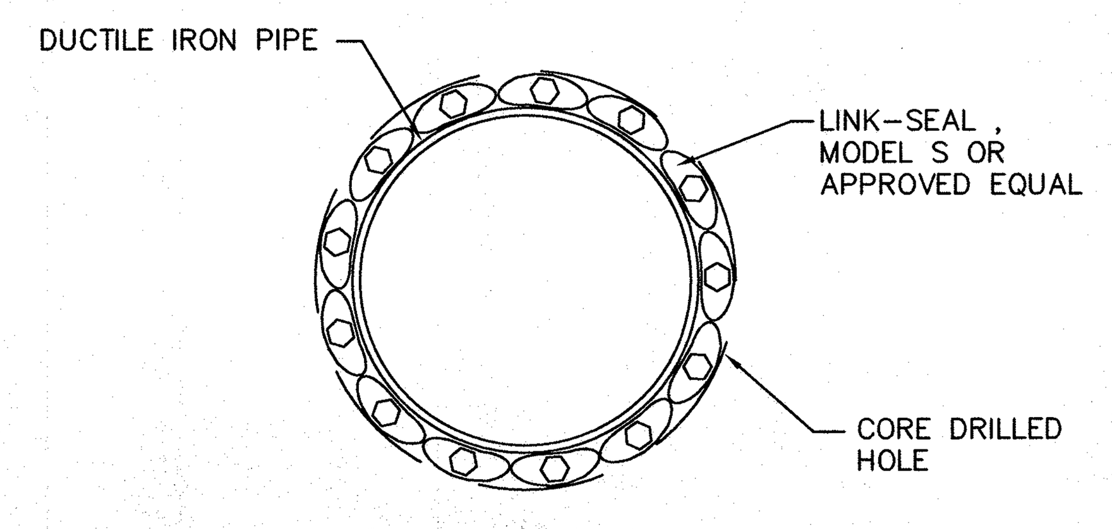
MISCELLANEOUS DETAILS

SHEET
C-502

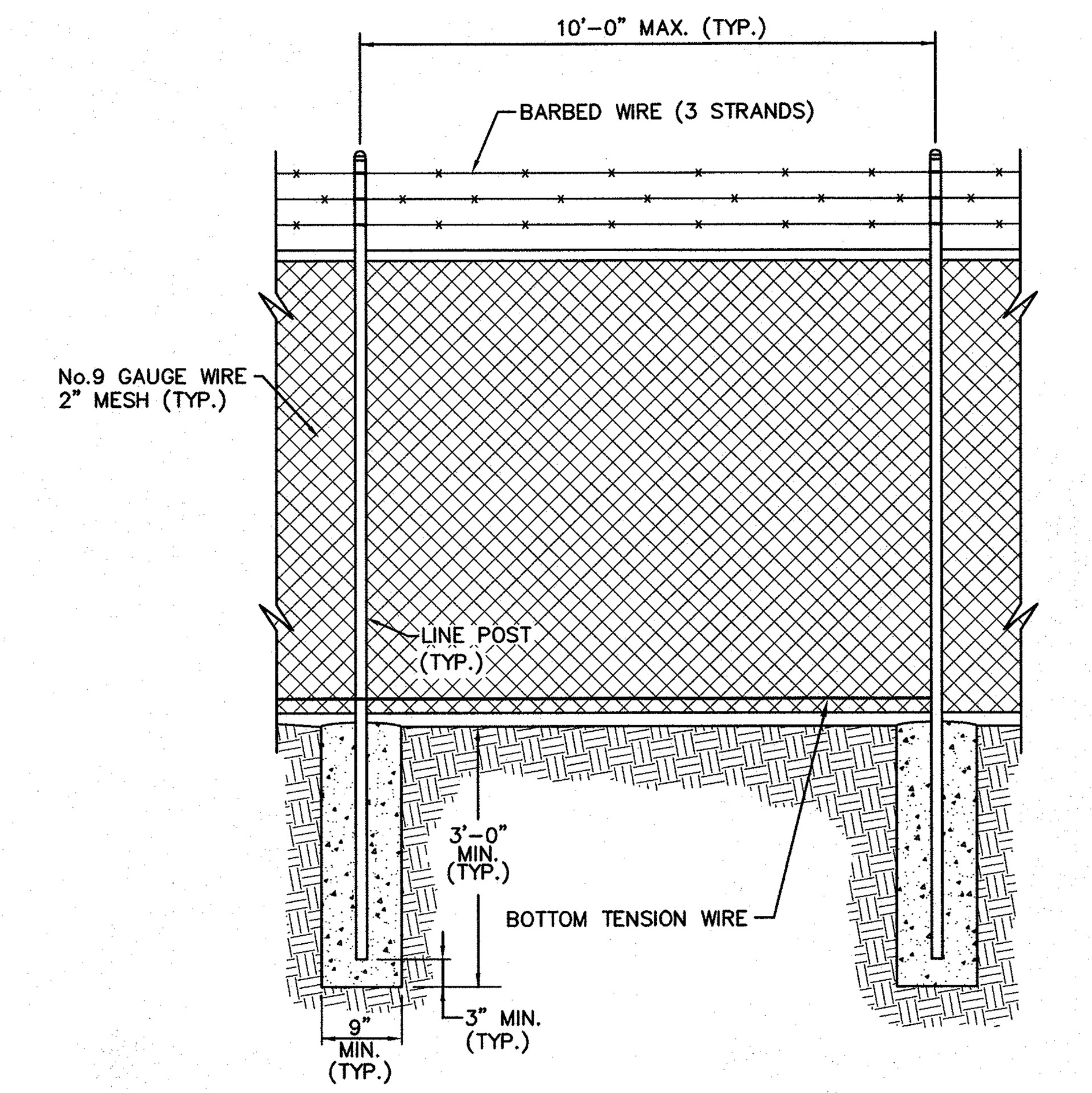


PIPE SIZE	CORE SIZE	LINK-SEAL MODEL NO.
4"	8"	LS-400
6"	10"	LS-400
8"	12"	LS-400

NOTES:
1. DO NOT GROUT LINK-SEAL IN PLACE
2. LINK-SEAL SIZE FOR WALL SLEEVES WILL VARY FROM TABLE
3. OTHER PIPE SIZES SHALL BE PER MANUFACTURERS SPECIFICATIONS

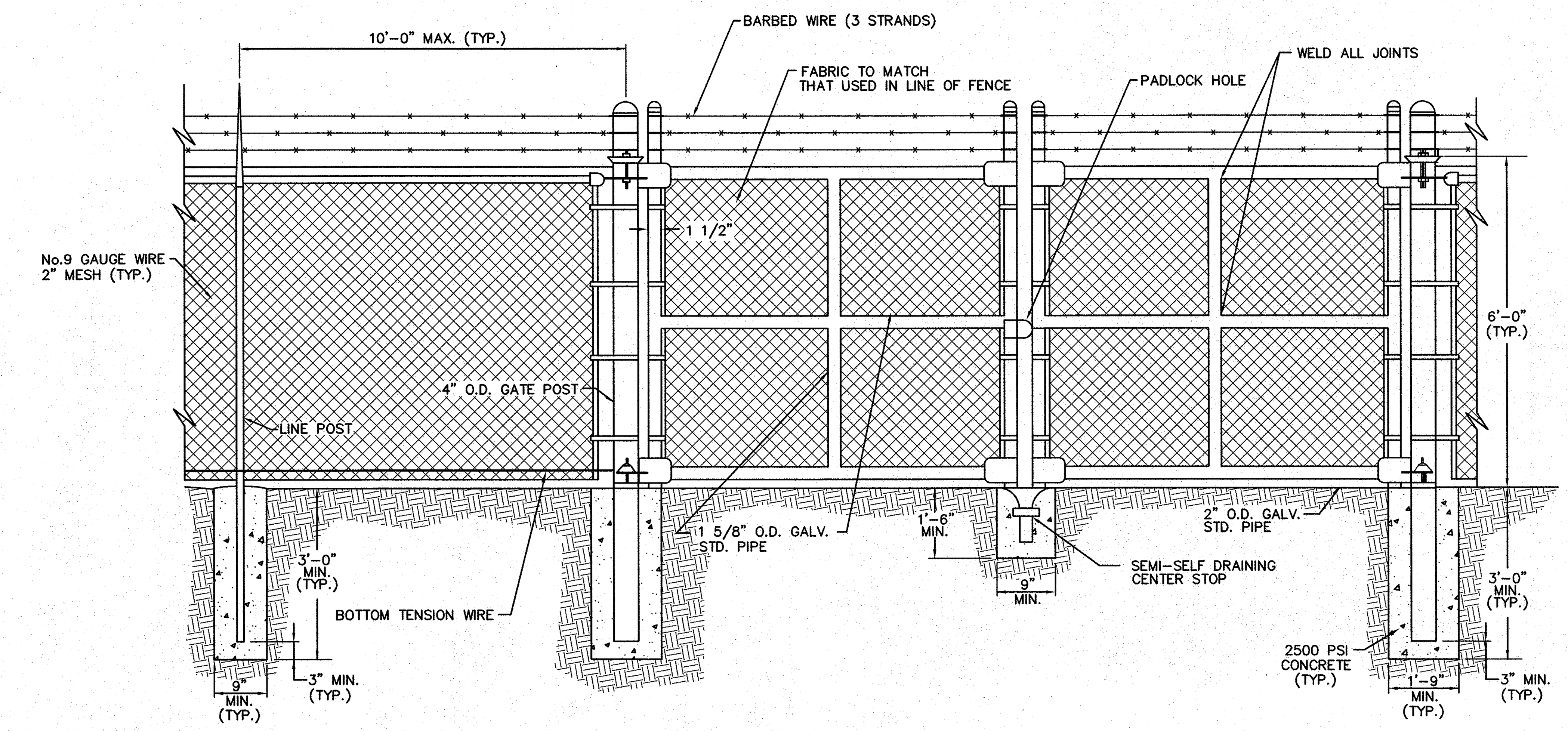
LINK-SEAL DETAIL - CORED OR CAST HOLES

REVISION DATE - NOVEMBER 3, 2008



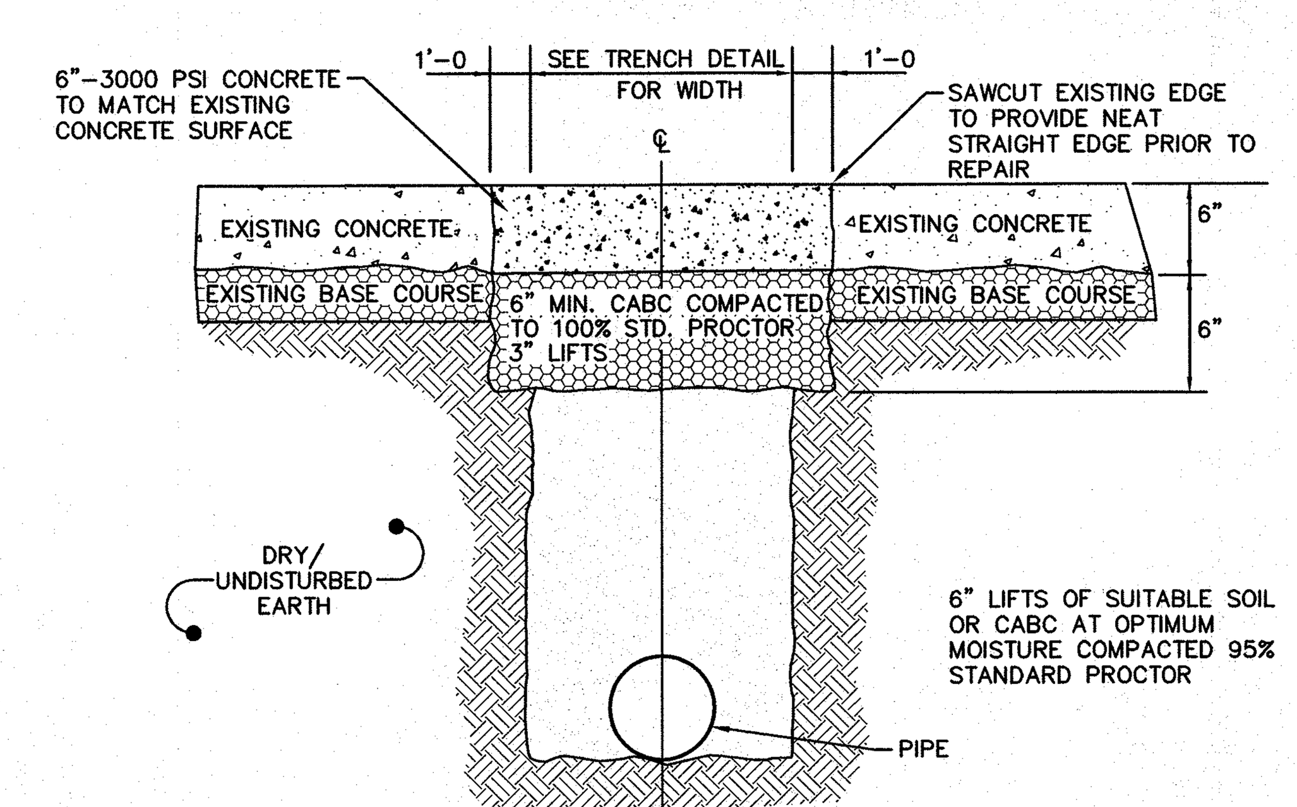
CHAIN LINK FENCE DETAIL

REVISION DATE - JANUARY 2, 2007



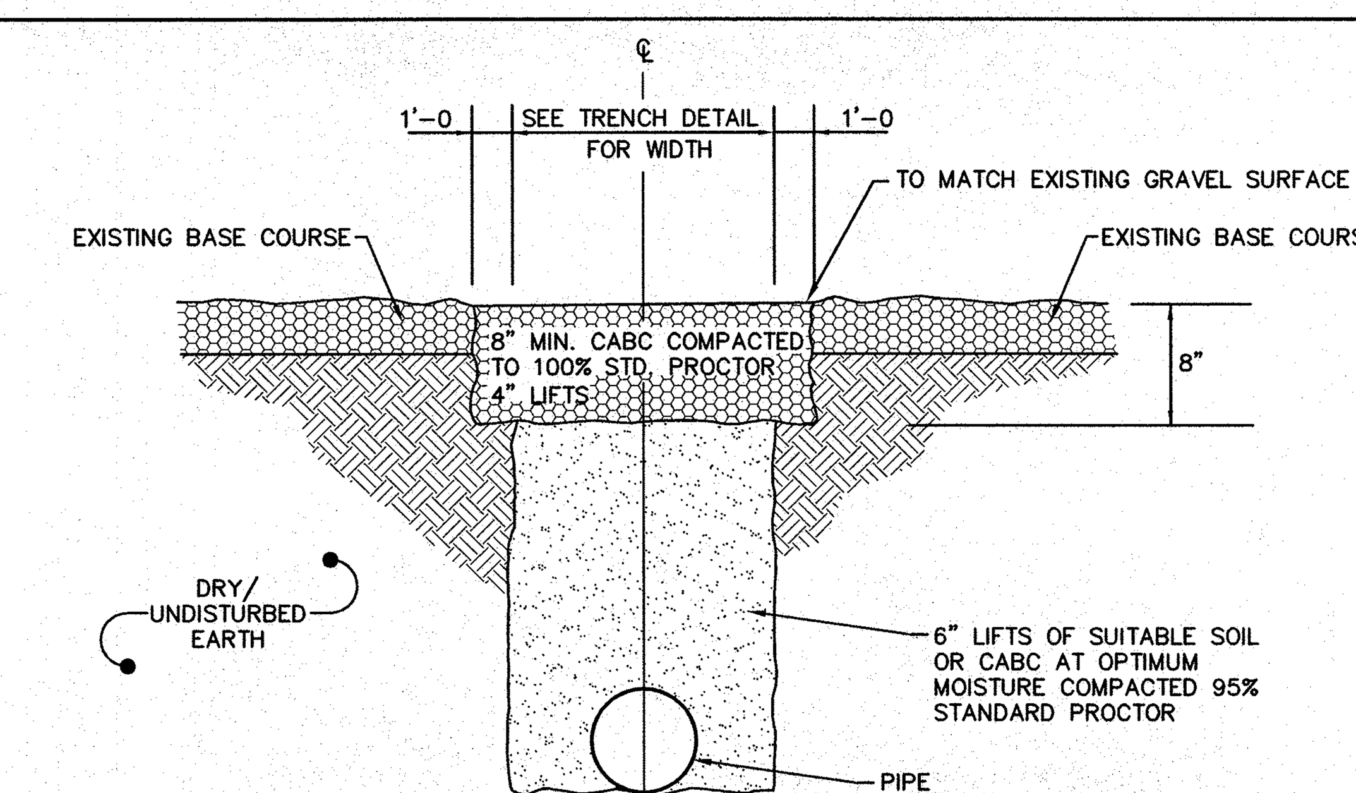
CHAIN LINK FENCE AND DOUBLE GATE ACROSS ACCESS ROAD DETAIL

REVISION DATE - JANUARY 2, 2007



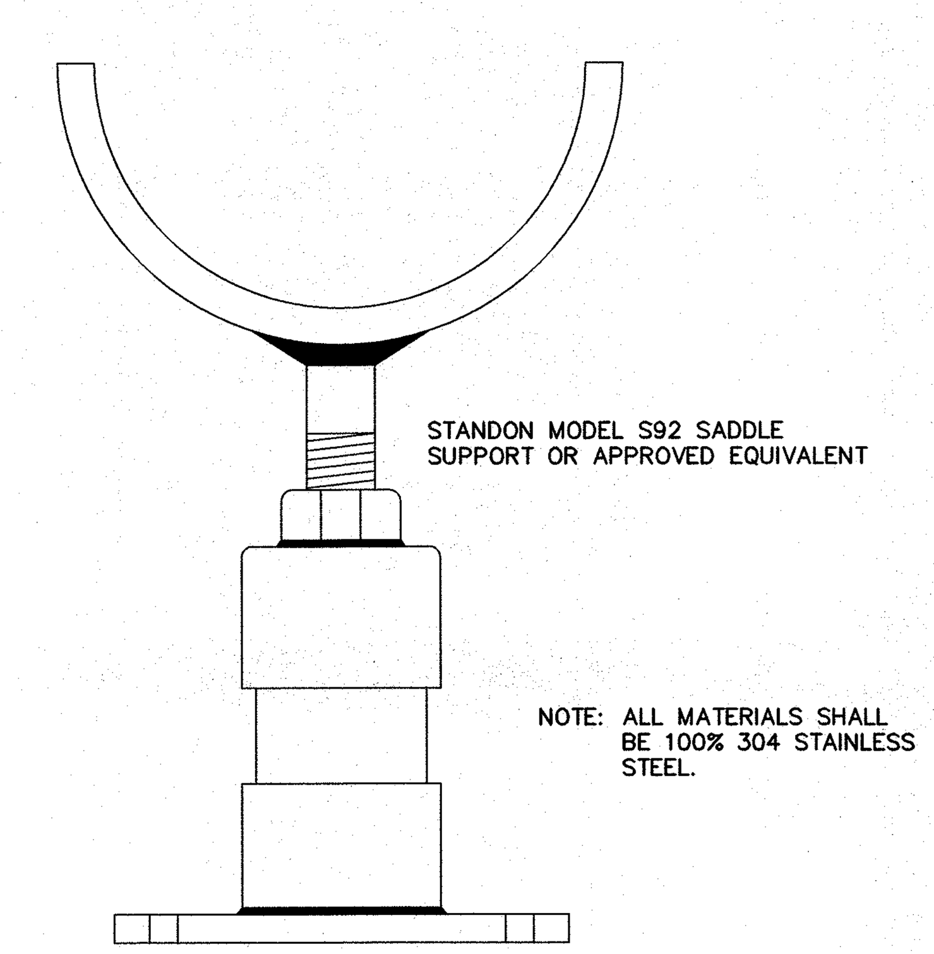
CONCRETE DRIVE REPAIR

NOT TO SCALE
REVISION DATE - NOVEMBER 3, 2008



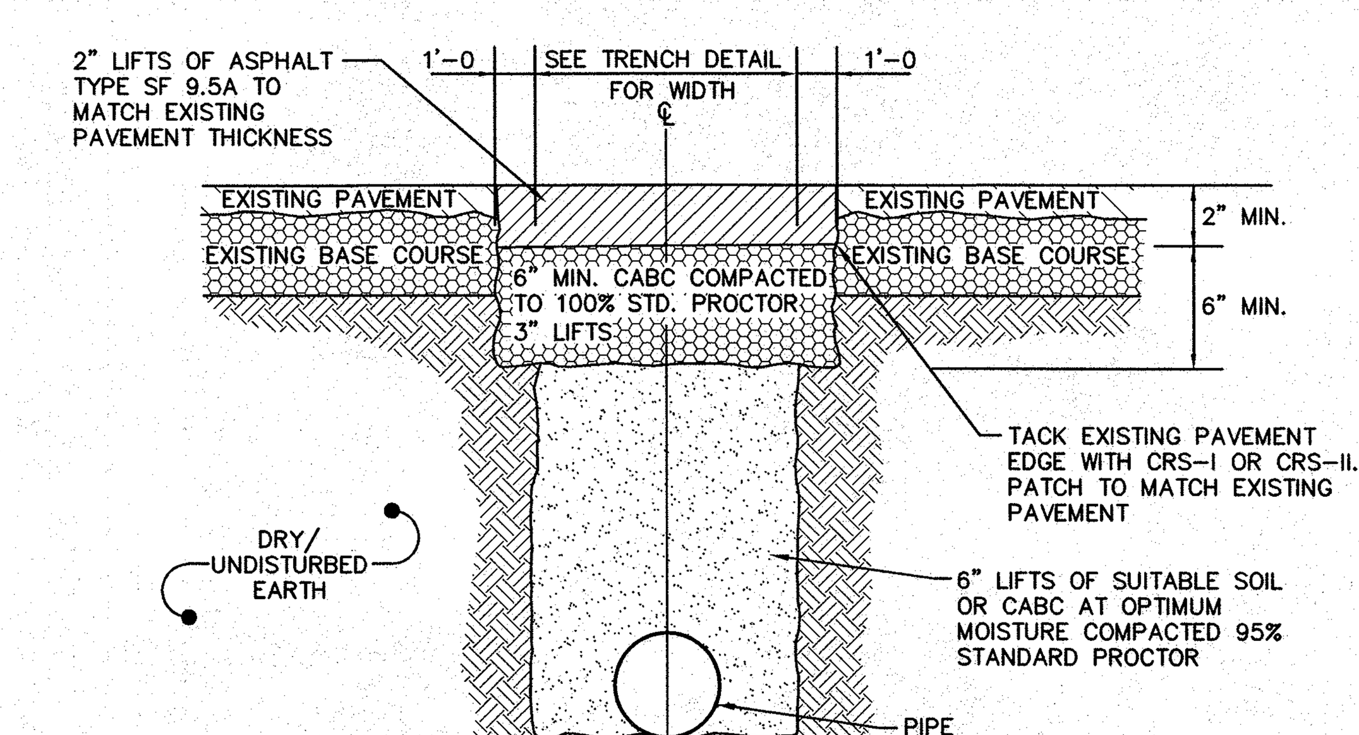
GRAVEL DRIVE REPAIR

NOT TO SCALE
REVISION DATE - NOVEMBER 3, 2008



ADJUSTABLE PIPE SUPPORT DETAIL

NOT TO SCALE



NOTE:
1. EDGE TO BE SAWED WITH A CONCRETE SAW TO A NEAT SQUARED EDGE. BROOMED CLEAN OF DUST BEFORE TACK COAT IS APPLIED.
2. EDGES TO BE TACKED WITH EMULSIFIED ASPHALT TACK CRS-I OR CRS-II.

ASPHALT DRIVE REPAIR

NOT TO SCALE
REVISION DATE - NOVEMBER 3, 2008

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SEAL 22541 HARRY B. BUCKNER ENGINEER
10-23-2013

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

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MISCELLANEOUS DETAILS

SHEET
C-503

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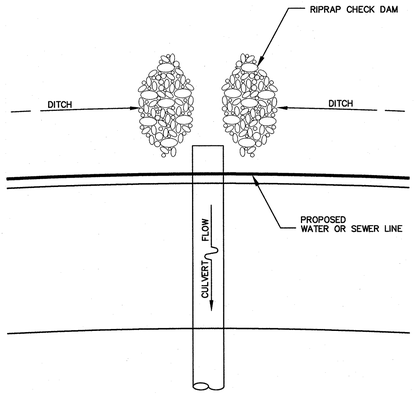
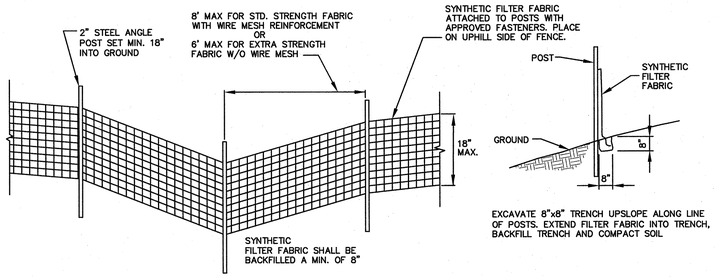


CULVERT INLET PROTECTION

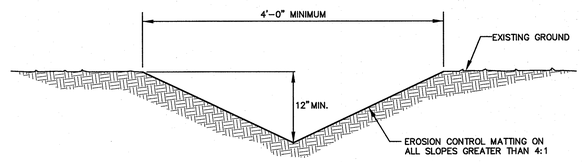
AS REQUIRED IN ACTIVE CONSTRUCTION AREA
TO PREVENT SEDIMENT FROM ENTERING CULVERTS



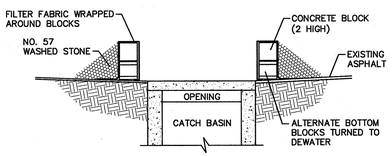
NOTES:

1. FILTER BARRIERS SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL AND DAILY DURING PROLONGED RAINFALL. REPAIR SHALL BE MADE AS NECESSARY.
2. FABRIC SHALL BE REPLACED PROMPTLY IF FOUND TO BE IN DISREPAIR.
3. SEDIMENT DEPOSITS SHALL BE REMOVED AFTER EACH STORM EVENT AND WHEN DEPOSITS REACH APPROXIMATELY 1/3 HEIGHT OF BARRIER.

SILT FENCE

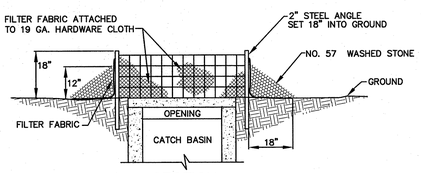


PERMANENT DRAINAGE SWALE



SECTION

EXISTING CATCH BASIN PROTECTION
(ASPHALT)



SECTION

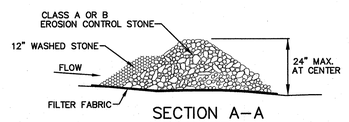
CATCH BASIN PROTECTION
(GRASS)

NOTES:

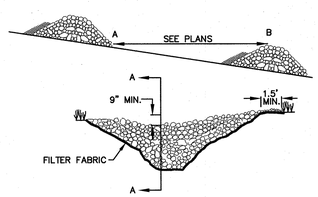
1. ATTACH WIRE AND FABRIC TO POSTS ON OUTSIDE OF FENCE WITH APPROVED FASTENERS.
2. FILTERS SHALL BE INSPECTED AFTER EVERY RAIN AND REPAIRED AS REQUIRED.
3. SEDIMENT SHALL BE REMOVED AFTER DEPOSITS REACH 1/3 HEIGHT OF BARRIER.

EXISTING CULVERT AND DROP INLET PROTECTION

AS REQUIRED IN ACTIVE CONSTRUCTION AREA
TO PREVENT SEDIMENT FROM ENTERING CULVERTS



SECTION A–A



FACE VIEW

STONE CHECK DAM:
STONE SHOULD BE PLACED OVER THE CHANNEL BANKS TO KEEP WATER FROM CUTTING AROUND THE DAM. L = THE DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION

THE FOLLOWING CRITERIA SHOULD BE USED WHEN DESIGNING A CHECK DAM:
- ENSURE THAT THE DRAINAGE AREA ABOVE THE CHECK DAM DOES NOT EXCEED 2 ACRES.
- KEEP THE MAXIMUM HEIGHT AT 2 FT AT THE CENTER OF THE DAM.
- KEEP THE CENTER OF THE CHECK DAM AT LEAST 9 INCHES LOWER THAN THE OUTER EDGES AT NATURAL GROUND ELEVATION.
- KEEP THE SIDE SLOPES OF THE DAM AT 2:1 OR FLATTER.
- STABILIZE OVERFLOW AREAS ALONG THE CHANNEL TO RESIST EROSION CAUSED BY CHECK DAMS.

RIPRAP CHECK DAM

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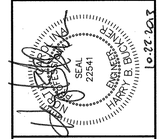

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

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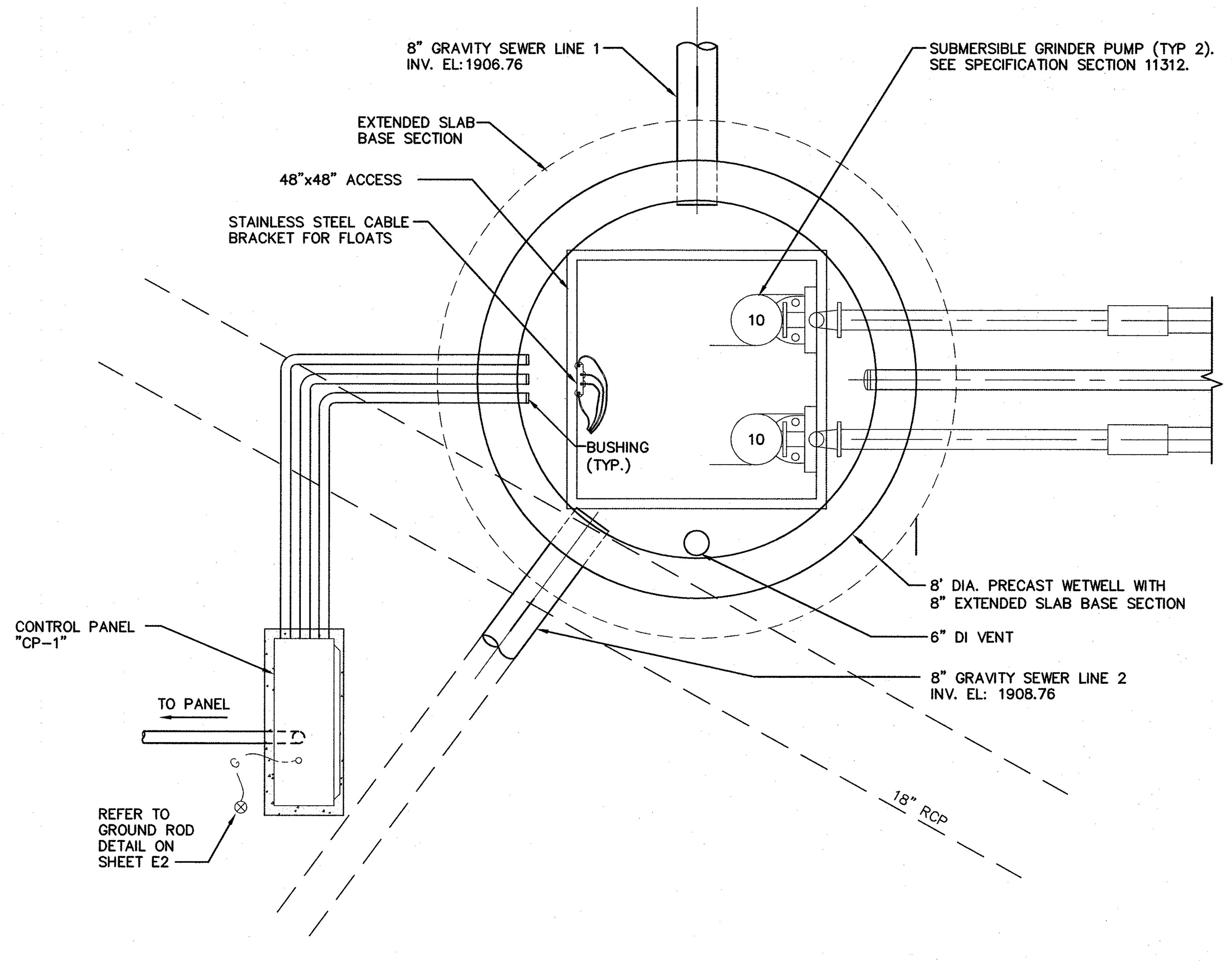
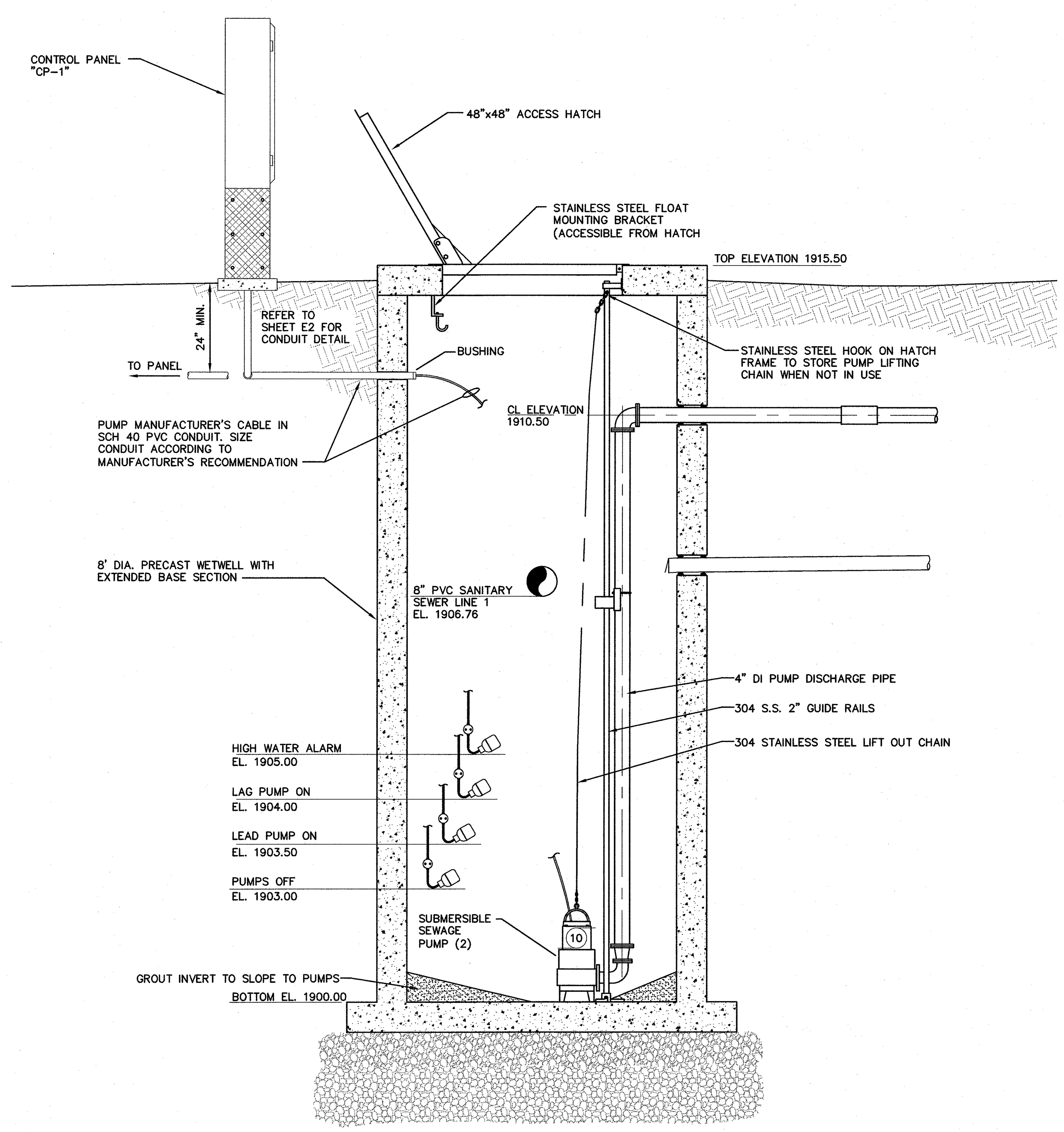
MISCELLANEOUS DETAILS

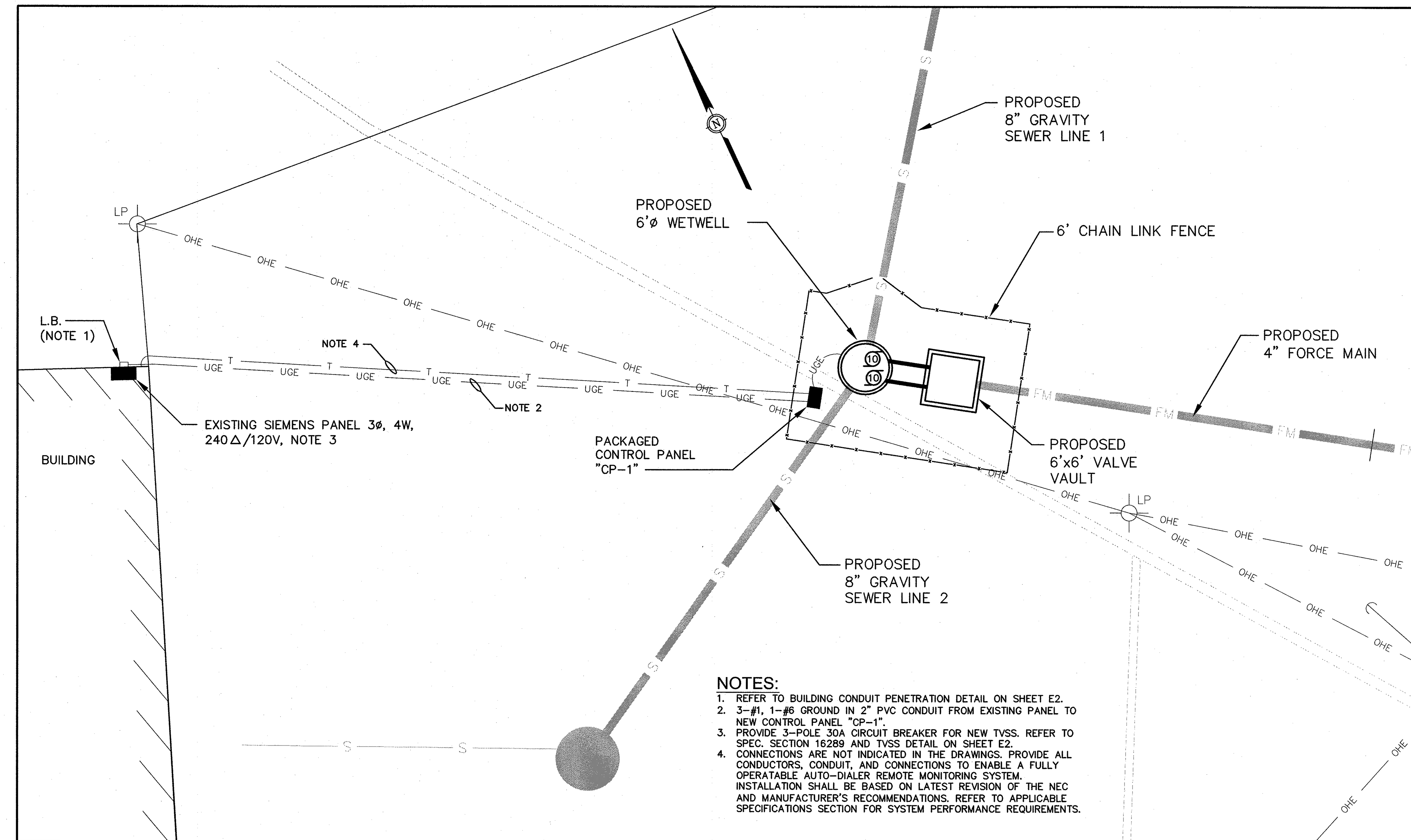
SHEET
C-504



PUMP STATION ELECTRICAL PLAN VIEW
NOT TO SCALE

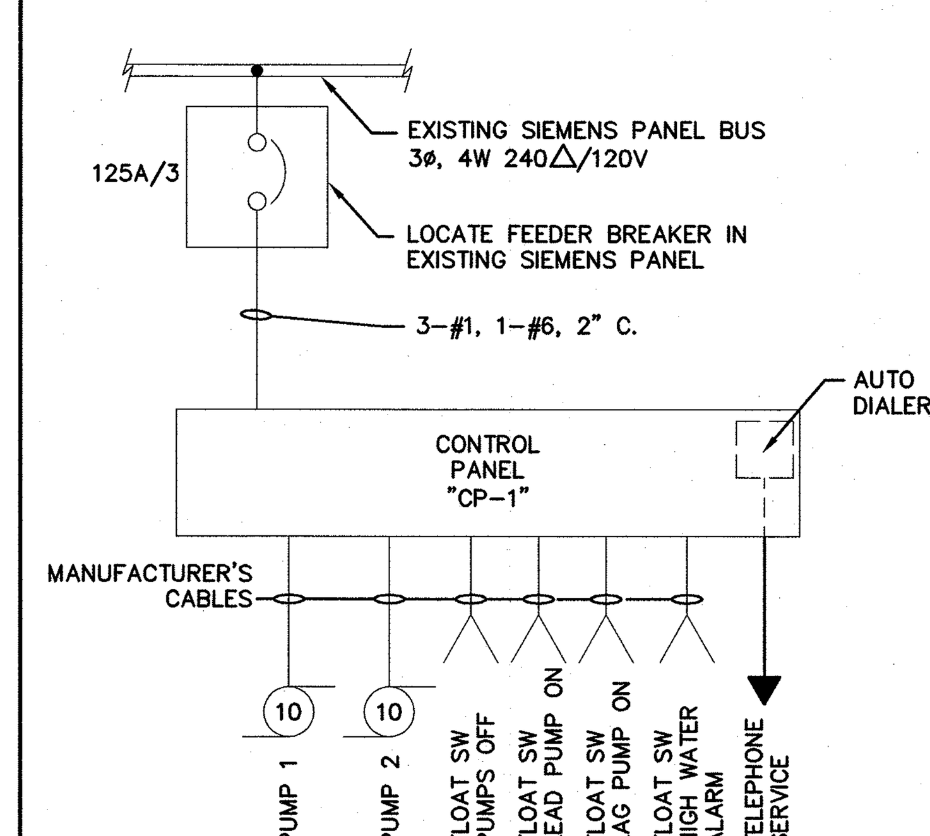


PUMP STATION ELECTRICAL SECTION VIEW
NOT TO SCALE



NOTES:
1. REFER TO BUILDING CONDUIT PENETRATION DETAIL ON SHEET E2.
2. 3-#1, 1-#6 GROUND IN 2" PVC CONDUIT FROM EXISTING PANEL TO NEW CONTROL PANEL "CP-1".
3. PROVIDE 3-POLE 30A CIRCUIT BREAKER FOR NEW TVSS. REFER TO SPEC. SECTION 16289 AND TVSS DETAIL ON SHEET E2.
4. CONNECTIONS ARE NOT INDICATED IN THE DRAWINGS. PROVIDE ALL CONDUCTORS, CONDUIT, AND CONNECTIONS TO ENABLE A FULLY OPERATABLE AUTO-DIALER REMOTE MONITORING SYSTEM. INSTALLATION SHALL BE BASED ON LATEST REVISION OF THE NEC AND MANUFACTURER'S RECOMMENDATIONS. REFER TO APPLICABLE SPECIFICATIONS SECTION FOR SYSTEM PERFORMANCE REQUIREMENTS.

PUMP STATION ELECTRICAL SITE PLAN
SCALE: 1" = 10'



NOTES:
1. ALL SPACE INSIDE OF WET WELL IS CLASSIFIED ELECTRICALLY ACCORDING TO THE NEC AS A CLASS I, DIVISION 1, GROUP D AND ALL ELECTRICAL CONSTRUCTION SHALL COMPLY WITH THE APPLICABLE CODE REQUIREMENTS.
2. THE CONTROL PANEL IS SPECIFIED WITH THE SEWAGE PUMPING EQUIPMENT. REFER TO APPLICABLE SPECIFICATIONS SECTION FOR CONTROL SYSTEM PERFORMANCE REQUIREMENTS.

SINGLE-LINE DIAGRAM
NOT TO SCALE

ELECTRICAL LEGEND

ITEM	DESCRIPTION
	DUPLEX RECEPTACLE
	SAFETY DISCONNECT SWITCH
	PANEL
	JUNCTION BOX
SUBSCRIPT	EQUIPMENT CONNECTION (SEE NOTE #1)
	SINGLE RECEPTACLE - SPECIAL PURPOSE
	10' X 3/4" GROUNDING ROD
LP	LIGHT POLE
PP	UTILITY POLE
	GUY WIRE ANCHOR
	ELECTRIC PUMP MOTOR ("#" INDICATES RATED HORSE POWER)
AMP/POLE	THERMO-MAGNETIC CIRCUIT BREAKER
	CIRCUIT IN EXPOSED CONDUIT
	CIRCUIT IN CONDUIT, 24" MIN. BELOW GRADE
	NUMBER OF HOT AND NEUTRAL CONDUCTORS IN CIRCUIT EACH LONG LINE REPRESENTS A NEUTRAL CONDUCTOR EACH SHORT LINE REPRESENTS A PHASE CONDUCTOR
X-#	HOMERUN CIRCUIT (PANEL LETTER & CIRCUIT NUMBER INDICATED)
G — G	AWG #2/0 COPPER GROUND WIRE 18" BELOW GRADE
UGE	UNDERGROUND ELECTRIC, 24" MIN. BELOW GRADE
OHE	OVERHEAD ELECTRIC
T	TELEPHONE

NOTES:
1. COORDINATE LOCATION, ROUGH-IN REQUIREMENTS, AND CONNECTION DETAILS WITH EQUIPMENT INSTALLER.

ABBREVIATIONS

A	AMPS
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
ATS	AUTOMATIC TRANSFER SWITCH
C	CONDUIT
CB	CIRCUIT BREAKER
CD	CONTROL DAMPER
CKT	CIRCUIT
E.C.	ELECTRICAL CONTRACTOR
EF	EXHAUST FAN
EG	ENGINE-GENERATOR SET
EUH	ELECTRIC UNIT HEATER
EX	EXISTING DEVICE/EQUIPMENT TO REMAIN
GC	GENERAL CONTRACTOR
GFI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
MCB	MAIN CIRCUIT BREAKER
MH	METAL HALIDE
MLO	MAIN LUGS ONLY
NTS	NOT TO SCALE
NEC	NATIONAL ELECTRIC CODE
P	PUMP
RECEPT.	RECEPTACLE
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
UH	UNIT HEATER
UON	UNLESS OTHERWISE NOTED
V	VOLTS
WP	WEATHER PROOF

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 18684 PHILIP A. FISHER 10-11-13

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

JOB NO.: 13.00377
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CADD BY: SAR, BW
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PUMP STATION ELECTRICAL PLAN, SECTION AND DETAILS

SHEET
E-101

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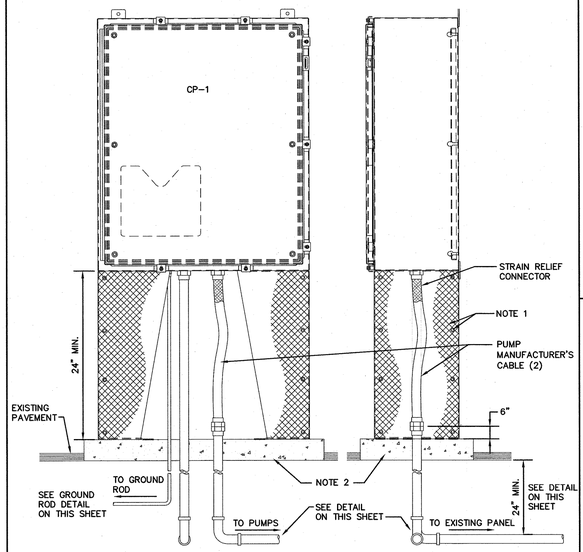
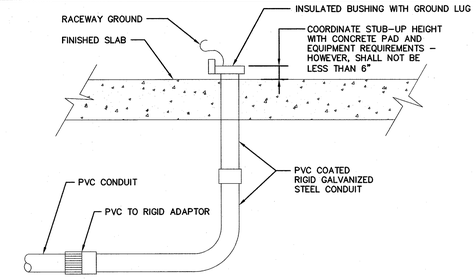


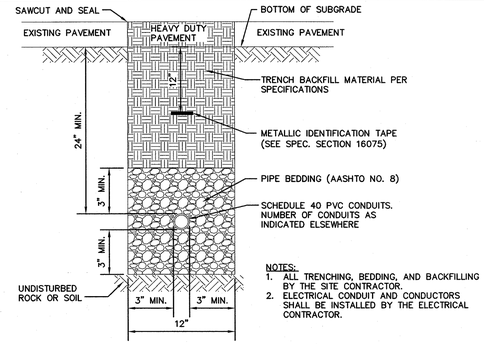
NOTES:
1. 1/2" STAINLESS STEEL FLATTENED MESH WITH 0.321" X 1.000" OPENINGS BOLTED TO ENCLOSURE SUPPORT LEGS, FRONT & BACK.
2. CONTROL PANEL MOUNTED TO CONCRETE PAD. PAD & MOUNTING TO BE DONE BY OTHERS.
3. NUMBER OF CONDUIT RISERS IS NOT ABSOLUTE IN THIS DETAIL.

ELECTRICAL ENCLOSURE DETAIL
NOT TO SCALE



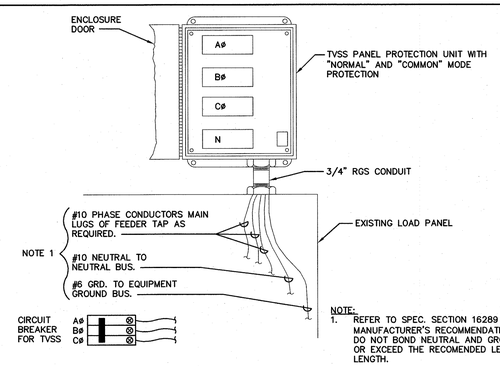
NOTES TO SPECIFIER:
1. THIS DETAIL APPLIES TO ALL UNDERGROUND CONDUITS WHERE PVC IS UTILIZED. PVC SHALL NOT BE EXTENDED ABOVE GRADE UNLESS SPECIFICALLY APPROVED.

TYPICAL CONDUIT STUB-UP
NOT TO SCALE



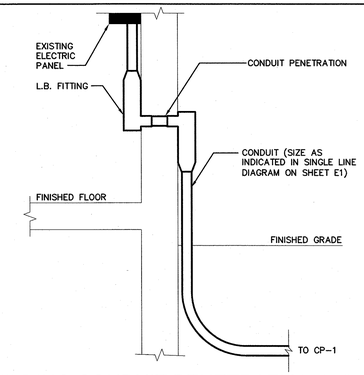
NOTES:
1. ALL TRENCHING, BEDDING, AND BACKFILLING BY THE SITE CONTRACTOR.
2. ELECTRICAL CONDUIT AND CONDUCTORS SHALL BE INSTALLED BY THE ELECTRICAL CONTRACTOR.

TYPICAL SITE ELECTRICAL TRENCH DETAIL IN EXISTING PAVEMENT
NOT TO SCALE

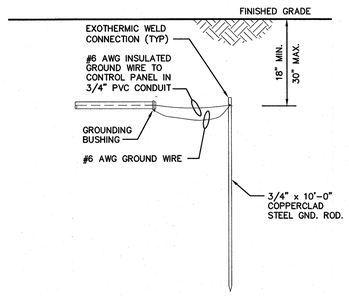


NOTE:
1. REFER TO SPEC. SECTION 16289 & MANUFACTURER'S RECOMMENDATIONS. DO NOT BOND NEUTRAL AND GROUND OR EXCEED THE RECOMENDED LEAD LENGTH.

TVSS DETAIL
NOT TO SCALE



BUILDING CONDUIT PENETRATION DETAIL
NOT TO SCALE



GROUND ROD DETAIL
NOT TO SCALE

NO.	DATE	BY	REVISION DESCRIPTION

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH: (828) 252-0575 FIRM LICENSE # C-0459

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 19884 PHILLIP A. REECE SHARE

PROPOSED SANITARY SEWER IMPROVEMENTS
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION - MADISON COUNTY
MADISON COUNTY, NORTH CAROLINA

JOB NO.: 13.00377
DATE: SEPTEMBER 2013
DESIGNED BY: JCM
CADD BY: SAR, BW
DESIGN REVIEW: PAR
CONST. REVIEW: ____
FILE NAME: 13.00377-E-501.dwg

ELECTRICAL DETAILS

SHEET
E-501

TECHNICAL SPECIFICATIONS

NCDOT MADISON COUNTY MAINTENANCE FACILITY

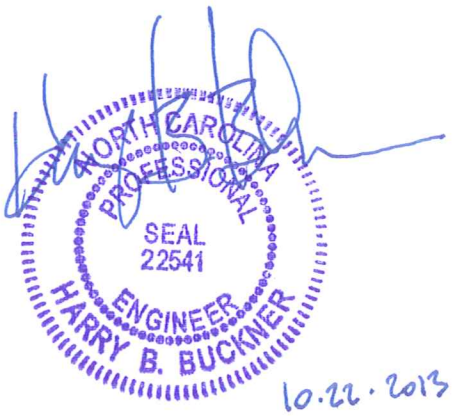
McGill
ASSOCIATES

CONSULTING ENGINEERS
ASHEVILLE, NORTH CAROLINA

TECHNICAL SPECIFICATIONS

NCDOT MADISON COUNTY MAINTENANCE FACILITY

Harry B. Buckner, PE



McGill ASSOCIATES

Engineering • Planning • Finance
Post Office Box 2259
Asheville, North Carolina 28802

September 2013

13.00377

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SECTION 01200 SPECIAL CONDITIONS

PART 1: GENERAL

1.01 SUMMARY OF WORK

The specifications and the accompanying drawings describe the work to be done and the materials to be furnished for the construction of sanitary sewer improvements for the North Carolina Department of Transportation Madison County Maintenance Facility. The Project generally consists of, but is not limited to, the construction of the following:

A. Approximately 985 linear feet of 8-inch sanitary sewer

B. Approximately 260 linear feet of 6-inch service sewer.

C. Approximately 1,610 linear feet of 4-inch force main.

D. A duplex grinder pump station, complete in place.

1.02 PROJECT MEETINGS

A. Preconstruction Conference: A preconstruction conference will be scheduled by the Engineer after issuance of the Notice of Award. The Contractor and his major subcontractors shall attend the meeting, which will be chaired by the Engineer or his representative. The purpose of the pre-construction conference will be to discuss administration of the Contract and the execution of work, and to answer any questions relative to performance of work under these Contract Documents. All decisions, instructions and interpretations made at this conference shall be binding and conclusive. The proceedings of this conference will be recorded and copies of the proceeding minutes will be issued to the Contractor for his use and distribution to his subcontractors.

B. Progress Meetings: The Contractor and any subcontractors, material suppliers or vendors whose presence is necessary or requested shall attend meetings, referred to as Progress Meetings, when requested by the Engineer or his representative for the purpose of discussing the execution of work. Each meeting will be held at the time and place designated by the Engineer or his representative. Any decisions, instructions and interpretations at these meetings shall be binding and conclusive on the Contractor and such decisions, instructions and interpretations shall be confirmed in writing by the Engineer or his representative. The proceedings of these meetings will be recorded and the Contractor will be

furnished with a reasonable number of copies for his use and for his distribution to the subcontractors, material suppliers and vendors involved.

1.03 PROJECT PAYMENTS AND RETAINAGE

A. The Owner may retain a portion of the amount otherwise due the Contractor. Except as provided elsewhere, the amount retained by the Owner shall be limited to the following:

1. Withholding of not more than 5% of the payment claimed until work is 50% complete.

2. When the contract is 50% complete no further retainage shall be withheld from periodic payments. However, the Owner may reinstate retainage (up to 5%) if they feel the work is unsatisfactory. The Owner may withhold additional retainage as necessary from periodic payments in a sum necessary to maintain total retainage of 2.5% of contract cost through the completion of the project.

3. When the work is substantially complete (operational or beneficial occupancy), the withheld amount shall be further reduced below 5% to only that amount necessary to assure completion.

4. The Owner may accept securities negotiable without recourse, conditions or restrictions, a release of retainage bond or an irrevocable letter of credit provided by the Contractor in lieu of all or part of the cash retainage.

B. For unit price projects, the Contractor may use the “Unit Bid Item Summary” form included at the end of this section, or a similar form that provides the required information.

C. Sales Tax Statement: When requested by the Owner, each request for progress payment submitted by the Contractor shall include a sales tax reimbursement statement. The Contractor shall utilize the form provided at the end of this section, or a similar form that provides the required information and certification.

1.04 SUBMITTALS

A. General: All transmittals from the Contractor shall be accompanied by a transmittal cover form that includes pertinent information related to the project and the particular transmittal. The Contractor shall use the “Transmittal Form” provided at the end of this section, or a similar form that includes the required information.

B. Construction Schedule: The Contractor shall, within ten (10) days after receipt of the Notice of Award, prepare and submit to the Engineer for approval a practicable construction schedule showing the order in which the Contractor proposes to carry on the work, the date on which he will start the several salient features and the contemplated dates for completing such salient features. The schedule may be in any form, at the option of the Contractor, but shall maintain current with each submittal for progress payment, at least the following information.

1. The various classes and area of work broken down into times projected for submittals, approvals and procurement; times for installation and erection; and times for testing and inspection.

2. The work completed and the work remaining to complete the project.

3. Any items of work which will delay the start or completion of other major items of work so as to delay completion of the whole project.

C. Schedule of Values: For lump sum projects, the Contractor shall, within thirty (30) days after the Notice of Award and prior to submitting the first Application for Payment, submit to the Engineer for approval a Schedule of Values for the project. The Schedule of Values shall establish the actual value of the components of the work and, after approval by the Engineer, shall be the basis for the Contractor's Applications for Payment. The Schedule of Values shall include separate line items for all major portions of the work.

D. Material Suppliers and Subcontractor Listings: As soon as possible, but in no case more than 30 days after receipt of the Notice of Award, the Contractor shall supply the names and addresses of all major material suppliers and subcontractors to the Engineer.

E. Shop Drawings and Samples: The Contractual requirements for shop drawings and samples are specified in the General Conditions and in the individual specification sections for each item. The Contractor shall submit shop drawings and samples accompanied by the "Submittal and Routing Form" included at the end of this section. Resubmissions, where required, shall be in accordance with the procedures established for the initial submittal.

F. Record Documents: Record drawings will not be required of the Contractor; however, to enable the Owner to prepare record drawings, the Contractor shall keep a complete and accurate record of changes and/or deviations from the Contract Documents and shop drawings, indicating the work as actually installed. Changes shall be neatly and correctly shown

on the respective portion of the affected document, using prints of the Drawings affected, or the Specifications, with appropriate supplementary notes. The record set of marked-up Drawings, shop drawings, and Specifications shall be kept at the job site during construction and be available for inspection by the Engineer and the Owner. These marked prints shall be included in the package of final documentation submitted before final payment is required.

1.05 TYPES AND LIMITS OF INSURANCE

A. Certificates of Insurance: Satisfactory certificates of insurance shall be filed with the Owner through the Engineer prior to starting any construction work on this contract. The Owner will be named as an additional insured on all policies of insurance and all certificates shall contain a 60-day Notice of Cancellation. The Notice to Proceed will not be issued until satisfactory certificates of insurance are filed.

1. Worker's Compensation and Employer's Liability: This insurance shall protect the Contractor and Owner against all claims under applicable state workmen's compensation laws. The Contractor and Owner shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a workmen's compensation law. This policy shall include an "all states" endorsement.

   The liability limits shall be not less than:

   a. Worker's Compensation .....Statutory
   b. Employer's Liability.....$100,000 each occurrence

2. Comprehensive Automobile Liability: This insurance shall be written in comprehensive form and shall protect the Contractor and Owner against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, and shall cover operation on or off the site of all motor vehicles licensed for highway use, whether they are owned, non-owned or hired.

   The liability limits shall be not less than:

   a. Bodily Injury ..... $100,000 each person
$300,000 each occurrence

   b. Property Damage ..... $100,000 each occurrence
$100,000 aggregate

3. Comprehensive General Liability: This insurance shall be written in comprehensive form and shall protect the Contractor and Owner against all claims arising from injuries to persons other than his employees or damage to property of the Owner or others arising out of any act or omission of Contractor or his agents, employees, or Subcontractors. The policy shall also include protection against claims insured by usual personal injury liability coverage and shall include a "protective liability" endorsement to insure the contractual liability assumed by the Contractor under the indemnification provisions in the General Conditions, and "Completed Operations and Products Liability" coverage (to remain in force during the correction period).

   To the extent that the Contractor's work, or work under his direction, may require blasting, explosive conditions, or underground operations, the comprehensive general liability coverage shall contain no exclusion relative to blasting, explosion, collapse of building, or damage to underground property.

   a. Bodily Injury ..... $100,000 each person
      $300,000 each occurrence
   b. Property Damage ..... $100,000 each occurrence
      $100,000 aggregate

4. Umbrella Liability Policy: This insurance shall protect the Contractor against all claims in excess of the limits provided under the workmen's compensation and employer's liability, comprehensive automobile liability, and general liability policies. The liability limits of the umbrella liability policy shall not be less than $5,000,000.

1.06 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall be responsible for delivery, storage and handling of all materials and equipment, unless otherwise noted. All material and equipment shall be shipped to arrive at the job site on the dates indicated on the purchase order. The following information shall be supplied:

   1. The contents and bill of lading, number of shipments.
   2. The method of shipments.
   3. The date of shipment.
   4. The name of the construction project.

B. Prior to shipment, all items shall be properly prepared to protect all critical areas from the effects of weather, normal expected transport and on site handling.

C. Items shall be tagged and marked with equipment and/or motor numbers as per the manner stipulated in the purchase order.

D. All spare parts and expendable supplies shall be properly crated, marked, and shipped to the job site on the date specified.

1.07 ENCROACHMENT AGREEMENTS

A. The Owner has been granted a right-of-way encroachment agreement from the North Carolina Department of Transportation for all work occurring within their right-of-way. All provisions of these arrangements are in accordance with the policies and procedures of each agency and are incorporated into the plans and specifications.

PART 2: PRODUCTS

2.01 EQUIPMENT AND MATERIAL STANDARDS

A. All equipment and materials of construction described in this specification shall meet the more stringent requirements of the applicable codes listed below:

1. OSHA - Occupational Safety and Health Administration.
2. ASTM - American Society for Testing Materials.
3. ANSI - American National Standards Institute.
4. AGMA - American Gear Manufacturers Association.
5. AISC - American Institute of Steel Construction.
6. AWS - American Welding Society.
7. NEC - National Electric Code.
8. NEMA - National Electrical Manufacturers Association.
9. API - American Petroleum Institute.

2.02 QUALITY ASSURANCE

A. All equipment shall, after installation by the Contractor, shall be inspected, tested and started up by a qualified representative of the equipment manufacturer. The Contractor and the manufacturer's representative shall complete the "Equipment Start-up Form" provided at the end of this section and submit the completed form to the Engineer.

B. The listing of a manufacturer in the specifications does not necessarily imply that the manufacturer's standard equipment meets the requirements

of the specifications, but that the manufacturer listed has the capability to meet the requirements of the specifications.

PART 3: EXECUTION

3.01 SPECIAL REQUIREMENTS

A. Limits of Construction: The Contractor shall confine all operations and personnel to the limits of construction as shown on the plans. There shall be no disturbance whatsoever of any areas outside the limits of construction nor shall the workmen be allowed to travel at will through the surrounding private property.

B. Construction Superintendent: The Contractor shall place in charge of the work a competent and reliable superintendent, who shall have the authority to act for the Contractor and who shall be accountable to the Engineer. The Contractor shall, at all times, employ labor and equipment sufficient to accomplish the several classes of work to full completion in the manner and time specified.

C. Site Conditions:

1. The Contractor shall maintain the work and project grounds free from rubbish, debris and waste materials during all phases of the work.

2. Immediately upon completion of the work and prior to final acceptance, the Contractor shall remove all rubbish, debris, temporary structures, equipment, excess or waste materials and shall leave the work and project grounds in a neat and orderly condition that is satisfactory to the Engineer and Owner.

D. Right of Entry: The Engineer and his representative will at all times have access to the work. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

E. Temporary Construction Services and Facilities: The Contractor shall obtain all necessary permits, licenses, etc. and shall pay all costs incident to the furnishing, installing and maintenance of temporary utility services and facilities required for the duration of the work.

F. Control of Erosion, Siltation, and Pollution:

1. Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall, if turbidity producing materials are present, be graded to control erosion within acceptable limits. Temporary erosion and sediment control measures such as berms, dikes or drains, if required to meet the above standards, shall be provided and maintained until permanent drainage and erosion control facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum. Fills and waste areas shall be constructed by selective placement to eliminate silts or clays on the surface that will erode and contaminate adjacent streams.

2. The Contractor shall take whatever measures are necessary to minimize soil erosion and siltation, water pollution, and air pollution caused by his operations. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control. The Contractor shall keep himself fully informed of all such regulations which in any way affect the conduct of the work, and shall at all times observe and comply with all such regulations. In the event of conflict between such regulations and the requirements of the specifications, the more restrictive requirements shall apply.

3. The Engineer shall have the authority to limit the area over which clearing and grubbing, excavation, borrow, and embankment operations are performed whenever the Contractor's operations do not make effective use of construction practices and temporary measures which will minimize erosion, or whenever construction operations have not been coordinated to effectively minimize erosion, or whenever permanent erosion control features are not being completed as soon as permitted by construction operations.

4. The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved secondary roads, haul roads, access roads, disposal sites, borrow and material pits, and production sites. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property.

5. The Contractor will not be directly compensated for any dust control measures necessary, as this work will be considered incidental to the work covered by the various contract items.

G. Disposal of Materials: Debris and waste materials, including all combustibles, shall be removed by the Contractor from the construction area unless otherwise approved in writing by the Owner or his Representative.

H. Quantities of Estimate: The estimated quantities of work to be done and materials to be furnished under this Contract shown in any of the documents, including the proposal, are given for use in comparing bids and to indicate approximately the total amount of the contract; and the right is especially reserved, except as herein otherwise specifically limited to, to increase or diminish the quantities as may be reasonably necessary or desirable by the Owner to complete the work contemplated by this Contract.

I. Utility Coordination: The Contractor shall make all necessary arrangements with private and public utility companies to avoid any possible damage to or interruption of utility equipment or service. The Contractor shall be responsible for all inquiries concerning locations of utility lines. Repair of any damage to public or private utilities resulting from this work shall be the responsibility of the Contractor.

J. Construction Surveying: All work shall be constructed in accordance with the lines, grades and elevations shown on the plans or as given by the Engineer in the field. The Contractor shall be fully responsible for maintaining alignment and grade. All principal controlling points and base lines for locating the principal components of the work together with a suitable number of benchmarks adjacent to the work will be provided by the Engineer. From this information, the Contractor shall verify benchmarks and develop and make all detail surveys needed for construction. The Contractor shall protect and safeguard all points, stakes, grade marks, monuments, and benchmarks at the site of the work and shall re-establish, at his own expense, any marks which are removed or destroyed due to his construction operations.

K. Laying Out Work:

1. It is imperative that the Contractor work within the shown rights of way or easements at all times, unless approved otherwise by the property owner and the Engineer.

2. The Contractor shall, at his expense, provide competent engineering survey services and shall provide and maintain accurate, detailed, survey work.

3. The plans and supplementary drawings shall not be scaled and the Contractor must verify all dimensions and elevations at the site prior to proceeding with the work. The Contractor shall also verify existing utility locations prior to purchasing materials affected by these locations.

L. Use of Explosives:

1. If the use of explosives is necessary for the execution of the work, the Contractor shall exercise the utmost care not to endanger life or property. The Contractor shall be responsible for any and all damage or injury to persons or property resulting from the use of explosives. Such responsibility shall include, but shall in no way be limited to, all damages arising from all forms of trespass to adjacent property as a result of blasting by the Contractor.

2. All explosives shall be stored in a secure manner, in compliance with all laws, and all such storage places shall be marked clearly "DANGEROUS EXPLOSIVES".

M. Use of Chemicals: All chemicals used during project construction, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in conformance with instructions.

N. Safety and Health Regulations:

1. The Contractor shall comply with all Federal, State and Local Safety and Health Regulations including the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (P.L. 91 - 596) and under Section 107 of the Contract Work Hours and Safety Standards Act (P.L. 91-54).

2. The Contractor shall provide continuous, safe access to all properties, both public and private, along the project in all cases where such access will be provided by the completed facility and shall conduct his operations in such a manner that inconvenience to the property owners will be held to a minimum.

O. Equipment and Material Storage: The Contractor shall plan his activities so that all materials and equipment can be stored within the project limits. There shall be no disturbance whatsoever of any areas outside the project limits without the prior approval of the Engineer.

P. Disturbed Areas: All areas disturbed as a result of the work of the Contractor shall be restored to the original or better condition.

Reasonable care shall be taken during construction to avoid damage to the Owner's property or that of any adjacent property owner(s).

Q. Tree and Plant Protection: No trees or shrubs except those specifically indicated, shall be removed or trimmed without prior approval from the Engineer. All trees and shrubs within the construction limits to be retained by the Owner shall be properly protected by fencing, posts or other means approved by the Engineer. Where any trees or shrubs are damaged or where limbs are required to be trimmed or removed because of operations under this Contract a qualified horticulturist shall be consulted and the trimming performed in the proper manner. Any landscape plantings severely damaged or which die as a result of the Contractor's operations shall be replaced at no additional cost to the Owner.

R. Temporary Sanitary Facilities: The Contractor shall be solely responsible for furnishing and maintaining temporary sanitary facilities during the construction period. Such facilities shall include but not be limited to, potable water supply and toilet facilities. Such facilities shall be in compliance with all applicable state and local laws, codes, and ordinances and shall be placed convenient to work stations and secluded from public observation. Once the project is completed all temporary sanitary facilities shall be removed by the Contractor.

S. Traffic Maintenance:

1. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient warning lights, danger signals, and signs, shall provide a sufficient number of flagmen to direct the traffic and shall take all necessary precautions for the protection of the work and the safety of the public.

2. All barricades and obstructions or hazardous conditions shall be illuminated as necessary to provide for safe traffic conditions.

3. Warning and caution signs shall be posted throughout the length of any portion of the project where traffic flow is restricted.

T. Special Provisions: NC Department of Transportation:

1. All Contractors doing work within the Department of Transportation right of way are to have a copy of the approved encroachment agreement, plans and special provisions on the job site.

2. The travelling public shall be warned of the construction with signing that is in accordance with the latest Manual on Uniform Traffic Control Devices.

3. Contact the appropriate utility company(ies) involved and make satisfactory arrangements to adjust utilities in conflict with the proposed work prior to construction.

4. Materials and workmanship shall conform to the North Carolina Department of Transportation's Standards and Specifications Manual.

5. Strict compliance with the Policies and Procedures for Accommodating Utilities on Highway Rights of Way Manual shall be required.

6. All earth areas disturbed shall be regraded and seeded in accordance with the North Carolina Department of Transportation standards and specifications.

7. Complete restoration including reestablishing ditch line, fertilizing, seeding, mulching, tacking of straw and all areas disturbed during construction will follow within a maximum of thirty (30) working days of the initial disturbing activity.

8. All open cuts shall conform to the North Carolina Department of Transportation Policies and Procedures for Accommodating Utilities on Highway Rights of Way Manual (pages 37-39).

9. All roadway signs which are removed due to installation will be reinstalled on the same day or as soon as possible.

10. The Contractor shall notify the local North Carolina Department of Transportation office at least 24 hours prior to construction.

3.02 WEATHER DELAYS

A. Extensions of Contract Time for Abnormal Weather:

1. If the basis exists for an extension of time in accordance with article 12.03 of the Standard General Conditions of the Construction Contract, an extension of time on the basis of Abnormal Weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard Baseline for the period of the contract.

2. In the event adverse weather other than those conditions described in Section C, "Adverse Weather and Rain Delay Days", delays construction activity, such as temperature extremes. The baseline must be adjusted to reflect the number of expected days as described in Section D, "Development of Adverse Weather Baseline".

3. In order to determine precipitation at the contract site the contractor shall maintain a rain gauge on site. The rain gauge should be read daily and documentation of Adverse Weather Days should be coordinated with the Engineer's Representative.

B. Standard Baseline for Average Climactic Range:

1. The Engineer has reviewed weather data available from the National Oceanic and Atmospheric Administration (NOAA) and determined a Standard Baseline of average climatic range for the City of Asheville, North Carolina. In the event that the standard baseline for the construction site differs significantly from the Asheville, North Carolina Standard Baseline it will be the Contractor's responsibility to provide documentation of said differences.

2. Standard Baseline shall be regarded as the normal and anticipatable number calendar days for each month during which construction activity shall be expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

3. Standard Baseline is as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
8	6	6	7	5	8	7	5	6	3	5	7

C. Adverse Weather and Rain Delay Days:

1. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours:

   a. Precipitation (rain, snow, and/or ice) in excess of two-tenths inch (0.20") liquid measure.

   b. Standing snow in excess of one inch (1.00").

2. Adverse Weather may include, if appropriate, "dry-out" or "mud" days:

   a. For rain days above the standard baseline,

   b. Only if there is a hindrance to site access or site work such as excavation, backfill, footings; and,

   c. At a rate no greater than 1 make-up day for each day or consecutive days of rain beyond the standard baseline that total 1.0 inch or more, liquid measure, unless specifically recommended otherwise by the Engineer.

3. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the Contractor's scheduled work day, including a weekend day or holiday if the Contractor has scheduled construction activity for that day.

D. Development of Adverse Weather Baseline:

1. Development of Adverse Weather Data – This is the process of collecting, compiling and analyzing the raw weather data (NOAA and other sources) that forms the baseline for estimating anticipated delays and project durations and determining the occurrence of unusually severe weather. The following actions make up the development process:

   a. Analyze the project scope and site geography to determine which weather parameters (temperature, precipitation, wind, etc.) are applicable. The parameters selected should present adverse conditions that could potentially delay construction activities.

   b. Review the technical specifications to determine the numerical values that will be assigned to each parameter in order to establish the anticipated adverse weather. Usually when two or more construction phases are affected by the same parameter, the less severe numerical value should be used (i.e. if roofing work is delayed by temperatures below 40 degrees and concrete work is delayed by temperatures below 32 degrees, then the numerical value used to define adverse weather should be 40 degrees unless some other factor renders the roofing phase insignificant in terms of schedule criticality).

   c. Compile the number of days per month that the anticipated weather is expected to be adverse by analysis of NOAA or other weather data. When at all possible, the last 10 years of consecutive data should be used to establish the baseline. However, in the absence of 10 years of data, a shorter period may be used. It may be necessary to extrapolate the number of calendar days that the temperature is expected to fall below the selected numerical value (say, 40 degrees) from raw data.

   d. Adverse weather data must be periodically updated in order to reflect changes in the 10-year averages and incorporate any necessary corrections derived from actual field experience. It is recommended that data used for

establishing adverse weather baselines be reviewed annually.

3.03 PROJECT CLOSE-OUT

A. Final Documentation: Prior to final payment, and before the issuance of a final certificate for payment in accordance with the provisions of the General Conditions, the Contractor shall file with the Engineer the documents listed hereinafter:

1. Guarantees: The Contractor's one (1) year guarantee required by the General Conditions and all other guarantees stated in the Specifications.

2. Affidavit and Waiver of Liens: As required by General Conditions. The Contractor shall utilize the form provided at the end of this section.

3. Consent of Surety Company to Final Payment.

4. Certified Final Sales Tax Statement (as required)

5. Certified Payroll Records (as required)

6. Project Record Documents: Record documents shall be as specified in Section 01200-1.04.F.

7. Operation and Maintenance Manuals: Submit at least three (3) sets of operation and maintenance manuals for all equipment, electrical valve actuators, electrical devices, and all other materials or devices with special operating and maintenance requirements.

B. Submittals: The above records shall be arranged in order, in accordance with the various sections of the Specifications, and properly indexed. At the completion of the work, the Contractor shall certify by endorsement thereof that each of the revised and marked-up prints of the Drawings and Specifications is complete and accurate.

C. No review or receipt of such records by the Engineer or the Owner shall be a waiver of any change from the Contract Documents or the shop drawings, or in any way relieve the Contractor of his responsibility to perform the work as required by the Contract Documents, and the shop drawings to the extent they are in accordance with the Contract Documents.

END OF SECTION

(Recommended Standard Forms follow)

UNIT BID ITEM SUMMARY

ITEM #	DESCRIPTION	UNIT MEAS.	CONTRACT BID QUAN.	CONTR. UNIT BID	TOTAL WORK LAST APPL.	WORK THIS APPL.	TOTAL WORK TO DATE	PAYMENT EARNED
A	B	C	D	E	F (H FROM LAST APPL.)	G	H (F&G)	I (EXH)

SALES TAX REIMBURSEMENT FORM

PROJECT _____

CONTRACTOR _____ OWNER _____

FOR PERIOD _____

VENDOR	ADDRESS	INVOICE	DATE	AMOUNT	N.C. TAX	COUNTY TAX	COUNTY NAME

I, _____, being duly sworn, certify that the foregoing statement of sales tax paid in connection with the referenced contract does not contain sales or use taxes paid on purchases of tangible personal property purchased by such contractors for use in performing the contract which does not annex to, affix to or in some manner become a part of the building or structure being erected, altered or repaired for the governmental entities as defined by G.S. 105-164.14(c) and is to the best of his/her belief, true and correct.

_____
Signature

_____
Title

Sworn to before me this _____ day of _____, 200 _____

My commission expires _____

_____
Notary Public

slstxstm.doc

TRANSMITTAL FORM

( ) Shop Drawings
( ) Printed Materials
( ) Other

Transmittal Date: _____
Return Date: _____

REFERENCE: _____
Project
_____
Owner
_____
Address
_____
Location

FOR: ( ) Transmittal Only
( ) Approval
( ) Approved as noted
( ) Revise & Resubmit

FROM: _____
Name
_____
Company
_____
Address
_____
telephone/fax

TO _____
Name
McGill Associates, P.A.
Company
_____
Address
_____
telephone/fax

Log #	Description	Copies	Sheet/Drawing #	Status

Project Ref. No. _____

By: _____
Signature

transmit.doc

McGill ASSOCIATES

ATTENTION: CONSTRUCTION ADMINISTRATION
SUBMITTAL AND ROUTING FORM
(TO BE USED WITH EACH INDIVIDUAL PLAN SUBMITTAL OR SHOP DRAWING)

SUBMITTAL AND APPROVAL (Contractor to complete)	
Project Name: _____	McGill Project #: _____
Contractor: _____	Submittal #: _____
Contract for: _____	Specification Section: _____
Submittal Title: _____	
Sheet/item numbers: _____	
_____	
_____	
Subcontractor: _____	Supplier: _____
Date Transmitted: _____	Date Needed: _____
Change from Contract Documents? Yes ____ No ____	Attached documentation: _____
Complete Submittal? Yes ____ No ____	_____
The Contractor must review and approve this submittal for all requirements and conformance to Contract documents prior to submittal to McGill Associates. Submittals forwarded without the Contractor's approval will be returned without review or comment.	
Reviewed by: _____	Date: _____

McGILL ASSOCIATES SUBMITTAL ROUTING (McGill to complete)

Date Received: _____ Logged _____ To: _____ Return by: _____

REVIEW CODES: 1 = **Approved**: 2 = **Approved as Noted**: 3 = **Revise & Resubmit**: 4 = **Not Approved**

Reviewed by (in order)	Review Code	**COMMENTS**	Date	Initials

Project Engineer's approval: _____ Date _____

CONTRACTOR'S FINAL AFFIDAVIT AND WAIVER OF LIEN

PROJECT: _____ OWNER: _____

_____ _____

_____ _____

CONTRACTOR: _____

_____

_____

CONTRACT AMOUNT: _____

STATE OF: _____ CONTRACT DATE: _____

COUNTY OF: _____ DATE: _____

This is to certify that all claims for labor, material, services and any other just claims arising out of the performance of this Contract have been satisfied, except for payment to subcontractors to be made out of retainage presently being held by the Owner, and that no claims or liens exist against this Contractor in connection with this contract; that to the best of our knowledge no claims or liens exist, and if any such claims or liens appear after payment of the retained amount due on the Contract, this Contractor shall save the Owner harmless on account thereof. After payment of the retained amount the undersigned does hereby waive, release and relinquish any and all claims or rights of lien presently held or hereafter accruing upon the above project.

CONTRACTOR: _____

BY: _____

TITLE: _____

Sworn to and subscribed before me this

_____ day of _____ 20 _____

_____

(Notary Public)

My Commission expires: _____

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APPLICATION FOR PAYMENT

PROJECT:

Application No.: _____
Date Notice Proceed: _____
Completion Date: _____
Days Remaining in Contract: _____
Percent Complete: _____

ENGINEER: **McGill Associates, P.A.**
Asheville, North Carolina

CONTRACTOR: _____ Federal ID # _____

Contractor's Address: _____

CONTRACT:	ORIGINAL CONTRACT AMOUNT	$_____
	APPROVED CHANGE ORDER AMOUNT	$_____
	REVISED CONTRACT AMOUNT	$_____
SUMMARY:	TOTAL WORK COMPLETED TO DATE	$_____
	TOTAL MATERIALS STORED ON SITE	$_____
	TOTAL EARNED THIS APPLICATION	$_____
	LESS ____% RETAINAGE	$_____
	SUBTOTAL	$_____
	LESS PREVIOUS PAYMENTS	$_____
	CURRENT PAYMENT DUE	$_____

SIGNATURES:

CONTRACTOR:

_____	_____	_____
Name	Title	Date

VERIFICATION:

IN ACCORDANCE WITH THE CONTRACT AND THIS APPLICATION FOR PAYMENT, THE CONTRACTOR HAS COMPLETED THE WORK STATED ABOVE AND IS ENTITLED THE FULL PAYMENT IN THE AMOUNT SHOWN.

ENGINEER: **McGill Associates, P.A.**

_____	_____	_____
Name	Title	Date

APPROVAL:

THIS APPLICATION IS HEREBY APPROVED FOR PAYMENT:

OWNER:

_____	_____	_____
Name	Title	Date

SECTION 01300 MEASUREMENT AND PAYMENT

01300.1 SCOPE

This section covers the method of measurement and payment for items of work under this contract.

01300.2 GENERAL

The total Bid Price for each section of the contract shall cover all work required by the Contract Documents. All costs in connection with the proper and successful completion of the work including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the work, shall be included in the unit and lump sum prices bid. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

01300.3 ESTIMATED QUANTITIES

All estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only a) as a basis for estimating the probable cost of the work and b) for the purpose of comparing the bids submitted for the work. The actual amounts of work performed and materials furnished under unit price items may differ from the estimated quantities. In some cases a unit price item has been added to the bid schedule for the purpose of establishing a cost basis in the event work associated with that item is required. No guarantee is expressed or implied that the quantities shown in the bid schedule shall be required to fulfill the Contract. The basis of payment for work and materials will be the actual amount of work installed and materials furnished. The Contractor agrees that he will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts thereof.

01300.4 WORK ITEMS

The following describes the method of measurement and payment for the bid items shown in the Bid Schedule.

ITEM 1 – MOBILIZATION

This work item consists of mobilization to and demobilization from the project site of all personnel, equipment and materials required to conduct the work specified in the contract documents.

Partial payments for this work item will be made with the first and second partial pay estimates paid on the contract, and will be made at the rate of 50% of the lump sum price for on each of these partial pay estimates. The amount for this work item in the approved schedule of values shall not exceed 3% of the total project bid. Mobilization shall include all costs for Contractor's bonds, insurance, temporary office facilities, sanitary and power, and all other miscellaneous costs.

ITEMS 2 & 3 –SANITARY SEWER LINE – PVC

Method of Measurement

Measurement of the sewer line will be the actual number of linear feet of sanitary sewer line by pipe type and size specified in the Bid Schedule, which has been properly incorporated into the completed and accepted work. Quantities of pipe shall be verified in the field by the Engineer. Pipe length shall be measured by horizontal lineal feet in place measured along the pipe center line with no deduction for fittings. Horizontal measurements through manholes shall be excluded.

Basis of Payment

The quantity of Sanitary Sewer Line will be paid for at the contract unit price for each type, size of pipe and depth as shown in the Bid Schedule. Price and payment shall constitute full compensation for furnishing all equipment, tools, labor and materials to complete the work as specified, including but not limited to the following items:

a. Erosion Control Measure installation, maintenance, and removal
b. Site Preparation (including clearing and grubbing)
c. Removal and Storage of Topsoil
d. Removal of Existing Sewer Lines (where applicable)
e. Removal of Existing Manholes (where applicable)
f. Abandonment of Existing Sewer Lines (where applicable)
g. By-Pass Pumping (where applicable)
h. Common Excavation, and Trench Backfilling and Compaction
i. Sheeting, Shoring, and Bracing
j. Dewatering Excavated Areas
k. Waste Material Disposal
l. Air, Mandrel, and Vacuum Testing
m. Pressure testing, in the case of force main installation

n. Fittings, in the case of force main installation
o. Restoration of Surfaces (including structures, landscaping, etc.)
p. Seeding and Mulching.
q. Connection of existing sewer main or service to new manhole.
r. Pipe Embedment Material per details.
s. Trench Rock Excavation not classified as rock excavation in Section 02222
t. Relocation of existing potable water lines and all other underground utilities as required.

ITEMS 4 & 5 – SANITARY SEWER MANHOLES

Method of Measurement

Quantities of manholes installed in accordance with the requirements of this section shall be verified in the field by the Engineer. Payment shall be made for the actual quantity of new standard manholes, manholes with watertight lids, and manholes with watertight lids and vents, by diameter, installed by the Contractor and approved by the Engineer at the respective unit price bid.

Basis of Payment

The quantity of manholes will be paid for at the contract unit price for each manhole, complete including but not limited to all foundation preparation, installation, removal and disposal of existing manhole (where applicable), backfill and compaction, concrete, pipe connections (including drop connections where applicable), boots, construction of invert, installation of frame and lid (standard or watertight as applicable), installation of vents (where applicable), landscaping, testing, and all related construction to complete the work as specified. Payment for manholes noted as replacements shall include excavation and removal of the existing manhole and disposal of the material.

ITEM 6 – 6” SANITARY SEWER SERVICE TAPS W/ CLEANOUTS

Method of Measurement

The quantity of service taps that are connected to the new sanitary sewer line will be the actual number of new services installed, connected to the home plumbing system and connected directly to the new line with all appurtenances, installed and accepted. Connection shall include installation of a wye, installation of a clean-out assembly, installation of up to 20 linear feet of 6-inch service lateral pipe as necessary to physically connect the new service lateral to the home sewer line at the existing property line, and all related appurtenances to complete the work as specified. The unit price bid shall include cost for excavation, materials, installation, backfill and compaction, and site restoration.

Basis of Payment

The quantity of services connected to the new sewer line will be paid for at the contract unit price for "6" Sanitary Sewer Service Taps w/ Cleanouts" complete but not limited to location of any and all existing service laterals, disconnection of the laterals from any existing system, by-pass pumping (when required), installation of sanitary wye, installation of a clean-out assembly (including wye-branch connection, 45° bend, riser pipe, and threaded plug), installation of 6-inch pipe, property owner consultation, and all backfill, compaction, and related work to complete the work as specified. Price and payment shall constitute full compensation for all work covered by this section, including furnishing all equipment, labor, and materials to complete the work in accordance with the specifications.

ITEM 7 – ADDITIONAL 6" PVC SEWER SERVICE LINE

Method of Measurement

Measurement of gravity sewer service line shall be the actual number of lineal feet of pipe installed, complete in place and accepted, measured horizontally from the end of the 20 feet of pipe included in pay item #2 to the location as directed in the field by the Engineer. This may include connection to an existing building plumbing system. No deductions in length will be made for fittings, valves, etc. Separate measurement items shall be made for each different size pipe.

Basis of Payment

Sewer Service Lines shall be paid for at the contract unit price bid for every pipe size shown on the Plans. The unit price bid for service line shall include all site preparation, excavation, sand on roads and driveways, pavement cuts, sewer line installation, temporary and permanent connections to existing sewer systems (as directed), removal of any existing fittings and/or valves (as directed), backfill, compaction, abandonment of existing service lines, testing, cleanup, grassing, mulching, and site restoration. The unit price bid shall include the placement of a 1-inch layer of sand on all pavement areas prior to stockpiling spoil material to facilitate cleanup, and shall include all other costs for cleanup and site restoration associated with the work. The Owner reserves the right to withhold up to 30% of the unit price bid for this item if, in the opinion of the Engineer and Owner, adequate site cleanup and restoration is not being performed.

ITEM 8 – SEWAGE COMBINATION AIR RELIEF VALVE

Work included under this line item of payment shall include furnishing and installing air relief valves in the sizes indicated at the locations shown on the drawings. The unit price shall include the costs for

all materials including, but not limited to, the combination air relief valve, tapping saddle, gate valves, all related piping and valves, precast manhole rider and cone with manhole ring and cover and all excavation, backfill and compaction, and site restoration.

ITEM 9 – GRAVEL DRIVEWAY REPAIR

Method of Measurement

Work associated with these line items shall include the finish detail of all trenches located within the site of the NCDOT maintenance Facility and other locations as shown on the plans. All repairs shall be in accordance with the detail shown on the plans, but in no case shall they be of less thickness than the existing pavement sections. The unit price bid shall include all cost for sawcutting existing pavement, removal and disposal of removed material, and installation of stone base as the surface material.

Basis of Payment

Drive repair shall be paid for at the unit price bid for the total linear feet of drive repair. Measurement shall be from the edge of drive to opposite edge of drive along the utility location. The contractor shall be responsible for width of trench as shown in plan details. Payment will not be made for excessive repair width due to Contractor negligence. Damages to private driveways resulting in the need for additional repair, which are caused due to Contractor negligence or from deviating from the project boundaries, shall be performed at Contractor's expense.

ITEM 10 – ASPHALT PAVEMENT REPAIR EXCLUDING OVERLAY

Method of Measurement

Work associated with this line item shall include the repair of all NCDOT roadway pavement at the locations shown on the plans. All repairs shall be in accordance with the plans and specifications, but in no case shall be of less thickness than the existing pavement sections. The unit price bid shall include all cost for saw cutting existing pavement surfaces, removal and disposal, installation of base, gravel, and pavement material. Asphalt overlay shall be paid for under separate line item.

Basis of Payment

Pavement repair shall be paid for at the unit price bid for the total linear footage of repair. Measurement shall be along the location of the sewer line. The contractor shall be responsible for the width of the trench as shown on the plan details.

ITEM 11– 2" ASPHALT OVERLAY

Method of Measurement

Work associated with this line item shall consist of placement of asphalt pavement surface course (type SF 9.5A or equal) overlay at the locations shown on the plans or as determined by the Owner or Engineer. Asphalt overlay shall be to the length, depth, and width specified by the Engineer as determined by field conditions. The unit price bid shall include all cost for providing the necessary equipment to perform the paving operation, pavement placement, traffic control, and replacement of pavement striping. Adjustment of manholes and water valves within area to be overlaid shall be considered incidental to asphalt overlay.

Basis of Payment

Pavement overlay shall be paid for at the unit price bid for the total number of square yards completed at the specified thickness. Measurement shall be along the surface of overlay.

ITEM 12 – SILT FENCE

Method of Measurement

Work associated with this line item shall consist of the placement of silt fence complete at the locations shown on the plans or as determined by the Owner or Engineer. Silt fence shall include materials, installation, maintenance, removal, and site restoration.

Basis of Payment

Silt fence shall be paid for at the unit price bid for the total number of linear feet of fence installed.

ITEMS 13 – RIP RAP OR WATTLE CHECK DAMS IN DITCH LINE

Method of Measurement

Work associated with this line item shall consist of installation and maintenance of rip rap or wattle check dams at the locations shown on the plans or as directed in the field by the Owner or Engineer. Check dams shall include all excavation, rip rap, washed stone, filter fabric, and site restoration necessary to complete each structure. Work shall also include removal, clean-up and restoration of check dams upon successful stabilization of surfaces.

Basis of Payment

Check dams shall be paid for at the unit price bid for the total number of units installed, removed, and restored.

ITEM 14 – CULVERT OR INLET PROTECTION

Method of Measurement

Work included in this line item of payment shall include furnishing, installing per detail, maintaining, and removing temporary culvert or inlet protection in locations shown on the drawings or as directed by the engineer.

Basis of Payment

Payment will be made on at the unit price bid for each “Culvert or Inlet Protection” installed and maintained in accordance with the specifications governing this project.

ITEM 15 – ROCK EXCAVATION

Method of Measurement

The quantity of rock removed to be paid for will be by cubic yard measured in place by the average end area method, based upon measurements made prior to and following excavation. Rock shall be measured as defined in Section 02222 of the specifications.

Allowable trench width will be as described in the plan details for maximum trench width or actual trench width (which ever is less) based on the size of the pipe being installed. Depth will be determined as 6-inches below the invert of the pipe being installed.

Basis of Payment

The quantity measured will be paid for at the Contract unit price per cubic yard for rock excavation. Such price and payment will be compensation for all work covered by this section including but not limited to drilling, explosives, loading of drill holes, blasting, removal and disposal of rock.

ITEM 16 – SELECT BACKFILL

Method of Measurement

Work associated with this line item shall consist of providing and placement of select backfill material to replace unsuitable material removed as a part of trench excavation as determined by the owner or engineer. Select backfill material shall be from an approved source

provided by the contractor. The unit price bid shall include all cost for providing the select backfill material including all excavation and hauling costs as well as all cost for the removal and disposal of unsuitable material.

Basis of Payment

Select backfill material shall be paid for at the unit price bid for the total number of cubic yards installed in place. Total number of cubic yards shall be computed by the engineer based upon the dimensions of the authorized area where select backfill is utilized.

ITEM 17 - WASHED STONE EMBEDMENT AND UNDERCUT

Method of Measurement

The quantity of additional washed stone to be paid for pipe bedding or undercut will be the actual amount of material, by lineal foot installed per pipe detail or for each 6-inches of depth (for undercut), which has been properly placed, compacted and incorporated into the completed and accepted work, as requested and approved by the Engineer. Please note that 6-inches of Class 1 embedment material shall be included in the unit price for all PVC pipe installed on this project. This pay item applies to additional washed stone needed for PVC lines for undercut excavation, and pipe bedding needed for ductile iron sewer lines due to wet conditions. Length and depth of stone bedding installed for DIP pipe bedding or undercut excavation shall be verified in the field by the Engineer.

Basis of Payment

The quantity of additional washed stone pipe bedding shall be paid for at the contract unit price per lineal foot installed per details for bedding or for each 6-inches of depth, complete including but not limited to hauling, placing, compaction, and other related construction. Placement of additional washed stone pipe bedding shall be in accordance with the standard details. The contractor shall provide the engineer haul tickets for each load of washed stone that is utilized for undercut excavation. Only washed stone that is authorized by the Engineer will be paid at the contract unit price under this item.

ITEM 18 – MISCELLANEOUS CONCRETE

Method of Measurement

Work associated with this line item shall consist of the placement of 3000 psi concrete at the locations shown on the plans or as determined by the owner or engineer. The unit price bid shall include all excavation, material

cost, formwork, placement, and site restoration necessary to complete the installation.

Basis of Payment

Miscellaneous concrete shall be paid for at the unit price bid for the total number of cubic yards as computed in the field based upon the dimensions of the area to receive concrete.

ITEM 19 – 80 GPM SUBMERSIBLE SEWER PUMP STATION

Method of Measurement

Work associated with this line item shall consist of the installation of a complete and functioning submersible wastewater grinder pump station. Work shall include all site work, grading, rock excavation and necessary backfill, shoring and dewatering as necessary, precast wetwell, pumps and accessories, valve vault, electrical work, control panel, CABC stone, fencing, all piping, fittings, and valves, erosion control, and all additional appurtenances necessary to complete the work as shown on the drawings and/or described in the specifications.

Basis of Payment

Payment for the 80 GPM submersible sewer pump station shall be made at a lump sum price for all work necessary to complete the station as specified.

END OF SECTION

SECTION 01705 MOBILIZATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of preparatory work and operations, including but not limited to those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, building, and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site. Included in this item will be the erection of all construction signs and signals, traffic warning devices, project sign and other preparatory signs.

PART 2: NOT USED

PART 3: NOT USED

END OF SECTION

SECTION 02211 CLEARING AND GRUBBING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Clearing and grubbing shall consist of the removal and satisfactory disposal of all trees, brush, stumps, logs, grass, weeds, roots, decayed vegetable matter, posts, fences, stubs, rubbish and all other objectionable matter resting on or protruding through the original ground surface and occurring within the construction limits or right-of-way of any excavation, borrow area, or embankment.

PART 2: NOT USED

PART 3: EXECUTION

3.01 GENERAL

A. Clearing and grubbing operations shall be completed sufficiently in advance of grading operations as may be necessary to prevent any of the debris from the clearing and grubbing operations from interfering with the excavation or embankment operations. All work under this section shall be performed in a manner which will cause minimum soil erosion. The Contractor shall perform such erosion control work, temporary or permanent, as may be directed by the Engineer in order to satisfactorily minimize erosion resulting from clearing and grubbing operations.

1. Clearing:

a. The work of clearing shall be performed within the limits established by the plans, specifications, or the Engineer.

b. Clearing shall consist of the felling and cutting up, or the trimming of, trees and the satisfactory disposal of the trees and other vegetation together with the down timber, snags, brush and rubbish occurring within the areas to be cleared. Trees and other vegetation, except such individual trees, groups of trees, and vegetation, as may be indicated on the plans to be left standing, and all stumps, roots and brush in the areas to be cleared shall be cut off 6” above the original ground surface.

c. Individual trees and groups of trees designated to be left standing within cleared areas shall be trimmed of all

branches to such heights and in such manner as may be necessary to prevent interference with construction operations. All limbs and branches required to be trimmed shall be neatly cut close to the whole of the tree or to main branches, and the cuts thus made shall be painted with an approved tree wound paint. Individual trees, groups of trees, and other vegetation, to be left standing shall be thoroughly protected from damage incident to construction operations by the erection of barriers or by such other means as the circumstances require.

d. The Engineer will designate all areas of growth or individual trees which are to be preserved due to their desirability for landscape or erosion control purposes. When the trees to be preserved are located within the construction limits, they will be shown on the plans or designated by the Engineer.

e. Clearing operations shall be conducted so as to prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. When such damages occur, all damaged areas shall be repaired, removed or otherwise resolved utilizing generally accepted practices at the Contractor's expense.

2. Grubbing:

a. Grubbing shall consist of the removal and disposal of all stumps, roots and matted roots from all cleared areas, except as herein specified.

b. In embankment areas, when the depth of embankment exceeds 3’-6” in height sound stumps shall be cut off not more than 6” above the existing ground level and not grubbed. Unsound or decayed stumps shall be removed to a depth of approximately 2’ below the natural ground surface.

c. All depressions excavated below the natural ground surface for or by the removal of stumps and roots shall be refilled with suitable material and compacted to make the surface conform to the surrounding ground surface.

3. Disposal of Cleared and Grubbed Material: Saw logs, pulp wood, cord wood or other merchantable timber removed incidental to clearing and grubbing shall remain the property of the Owner. All combustible matter shall be deposited at locations approved by the Engineer. Combustible matter may be burned or may be disposed of as stated above. Debris shall not be burned unless written permission or permit is issued by the Fire Marshall having jurisdiction in the area if applicable. The Contractor shall adhere to all limitations and conditions set forth in the permit. Burning shall be done at such time and in such a manner as to prevent fire from spreading and to prevent any damage to adjacent cover and shall further be subject to all requirements of State or Federal Governments pertaining to the burning. Disposal by burning shall be kept under constant attendance until all fires have burned out or have been extinguished.

END OF SECTION

SECTION 02220 EXCAVATION AND BACKFILL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. General:

1. The work covered by this section shall consist of furnishing all materials, labor, equipment and services for the excavation and backfill at all areas within the limits of the project. Work is limited to the areas of construction, and includes (but is not necessarily limited to) stockpiling of topsoil, site grading, excavation of footings and trenches, filling, backfilling, compaction, finish grading, spreading of topsoil, disposal of waste material, and proof rolling.

2. Perform all excavation, dewatering, sheeting, bracing, and backfilling in such a manner as to eliminate all possibility of undermining or disturbing the foundations of existing structures.

3. Requirements of the General and Supplemental Conditions apply to all work in this section. Provide all labor, materials, equipment, and services indicated on the drawings, or specified herein, or reasonably necessary for or incidental to a complete job.

4. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

5. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

6. Backfilling during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

1.02 SYSTEM DESCRIPTION

A. Excavation, General: Excavation consists of the removal and disposal of all materials encountered for footings, foundations, pipework, and other construction as shown on the drawings. Perform all excavation work in

compliance with applicable requirements of governing authorities having jurisdiction.

1.03 QUALITY ASSURANCE

A. Referenced Standards: Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Any requirements of these specifications shall in no way invalidate the minimum requirements of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown or specified.

1. ASTM C33: Standard Specifications for Concrete Aggregate

2. ASTM D698: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12" Drop.

3. ASTM D3282: Standard Recommended Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

4. Standard Specifications for Roads and Structures, North Carolina Department of Transportation, March 1, 2006 edition.

5. Erosion and Sediment Control Planning and Design Manual.

B. Unauthorized Excavation: Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

C. Existing Utilities:

1. Locate existing underground utilities in the area of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer immediately for directions as to procedure. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility companies.

1.04 SITE CONDITIONS

A. Site Information: No test borings or related subsurface information is available for the project area. Test borings and other exploratory operations may be undertaken by the Contractor at his own expense provided such operations are acceptable to the Owner.

PART 2: PRODUCTS

2.01 MATERIALS

A. Classification of Excavated Materials: Classification of excavated materials will be made as follows:

1. All materials excavated for this project, regardless of its nature or composition shall be classified as Unclassified Excavation, and shall be part of the lump sum price. No separate payment will be made for the excavation of rock or any unsuitable materials.

B. Classification of Other Materials:

1. Satisfactory Subgrade Soil Materials: Soils complying with ASTM D 3282, soil classification Groups A-l, A-2-4, A-2-5, and A-3.

2. Unsatisfactory Subgrade Soil Materials: Soils described in ASTM D 3282, soil classification groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also peat and other highly organic soils, unless otherwise acceptable to the Engineer.

3. Cohesionless Soil Materials: Gravels, sand-gravel mixtures, sands, and gravelly-sands.

4. Cohesive Soil Materials: Clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands.

5. Backfill and Fill Materials: Provide satisfactory soil materials for backfill and fill, free of masonry, rock, or gravel larger than 4” in any dimension, and free of metal, gypsum, lime, debris, waste, frozen materials, vegetable, and other deleterious matter. Use only excavated material that has been sampled, tested, and certified as satisfactory soil material.

6. Select Backfill: Select backfill is defined as backfill and fill material that is transported to the site from outside the project limits, and which meets the soil requirements specified above under “Backfill and Fill Materials.” Material excavated in conjunction with the

construction of this project cannot be considered as “select backfill” for payment purposes.

7. Pipe Bedding: Crushed stone or crushed gravel meeting the requirements of ASTM C 33, Gradation 67.

8. Inundated Sand: Sand for inundated sand backfill shall be clean with not more than 25% retained on a No. 4 sieve and not more than 7% passing a No. 200 sieve and shall have an effective size between 0.10 mm and 0.30 mm. Sand shall be deposited in, or placed simultaneously with application of, water so that the sand shall be compacted by a mechanical probe type vibrator. Inundated sand shall be compacted to 70% relative density as determined by ASTM D4253 and D4254.

9. Graded Gravel: Gravel for compacted backfill shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
1”	100
3/4”	85 - 100
3/8”	50 - 80
No. 4	35 - 60
No. 40	15 - 30
No. 200	05 - 10

The gravel mixture shall contain no clay lumps or organic matters. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. Gravel backfill shall be deposited in uniform layers not exceeding 12” in uncompacted thickness. The backfill shall be compacted by a suitable vibratory roller or platform vibrator to not less than 70% relative density as determined by ASTM D4253 and D4254.

2.01 EQUIPMENT

A. Mechanical Excavation:

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

2. Mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an

elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

PART 3: EXECUTION

3.01 PREPARATION

A. Dewatering:

1. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

2. All excavations for concrete structures or trenches that extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12” or more below the bottom of the excavation.

3. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches without causing damage to adjacent property.

4. The Contractor is responsible for obtaining any required permits or permissions necessary for the disposal of groundwater that is removed. Any discharged groundwater shall be clean and free of sediment.

5. The Contractor shall be responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

6. Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

B. Stabilization:

1. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and sufficiently stable to remain firm and intact under the feet of the workmen.

2. Subgrades for concrete structures or trench bottoms, which are otherwise solid but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not less than 6" below the bottom of the structure or pipe. Not more than 1/2" depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

C. Cutting Concrete or Asphalt Surface Construction:

1. All pavement cutting and repair shall be done in accordance with local ordinances. Cuts in concrete and asphaltic concrete shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be performed with a concrete saw in a manner which will provide a clean groove the complete thickness of the surface material along each side of the trench and along the perimeter of cuts for structures.

2. Concrete and asphaltic concrete over trenches excavated for pipelines shall be removed so that a shoulder not less than 12" in width at any point is left between the cut edge of the surface and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

3. Pavement or other surfaces removed for connections to existing lines or structures shall not be of greater extent that necessary for the installation.

4. Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks,

curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts as specified for payment.

D. Site Grade:

1. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish the surface within specified tolerances; compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

2. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Shape the subgrade as indicated on the drawings by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.

3.02 FIELD MEASUREMENTS

A. Alignment, Grade, and Minimum Cover:

1. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

2. Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation except where future surface elevations are indicated on the drawings.

B Limiting Trench Widths: Trenches shall be excavated to a width that will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. For the purposes of quantity measurements and payments, maximum trench widths shall be no greater than the pipe outside diameter plus 24” (12” either side of pipe).

3.03 PROTECTION

A. Temporary Protection: Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Sheeting and Bracing: Make all excavations in accordance with Federal, State, and Local health and safety rules and regulations, including those promulgated by the Department of Labor, Occupation Safety and Health Administration, "Safety and Health Regulations for Construction". Furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to support the sides of the excavation to comply with the above mentioned rules and regulations.

C. Blasting:

1. The Contractor shall be responsible for all damage caused by blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

2. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

D. Care and Restoration of Property:

1. Enclose the trunks of trees which are to remain adjacent to the work with substantial wooden boxes of such height as may be necessary to protect them from piled material, equipment or equipment operation. Use excavating machinery and cranes of suitable type and operate the equipment with care to prevent injury to remaining tree trunks, roots, branches and limbs.

2. Do not cut branches, limbs, and roots except by permission of the Engineer. Cut smoothly and neatly without splitting or crushing. In case of cutting or unavoidable injury to branches, limbs, and trunks of trees, neatly trim the cut or injured portions and cover with an application of grafting wax and tree healing paint as directed.

3. Protect by suitable means all cultivated hedges, shrubs and plants that might be injured by the Contractor's operations. Promptly heel in any such trees or shrubbery necessary to be removed and replanted. Perform heeling in and replanting under the direction of

a licensed and experienced nurseryman. Replant in their original position all removed shrubbery and trees after construction operations have been substantially completed and care for until growth is reestablished.

4. Replace cultivated hedges, shrubs, and plants injured to such a degree as to affect their growth or diminish their beauty or usefulness, by items of kind and quality at least equal to the kind and quality existing at the start of the work.

5. Do not operate tractors, bulldozers or other power-operated equipment on paved surfaces if the treads or wheels of the equipment are so shaped as to cut or otherwise injure the surfaces.

6. Restore all surfaces, including lawns, grassed, and planted areas that have been injured by the Contractor's operations, to a condition at least equal to that in which they were found immediately before the work was begun. Use suitable materials and methods for such restoration. Maintain all restored plantings by cutting, trimming, fertilizing, etc., until acceptance. Restore existing property or structures as promptly as practicable and do not leave until the end of construction period.

E. Protection of Streams: Exercise reasonable precaution to prevent the silting of streams. Provide at Contractor's expense temporary erosion and sediment control measures to prevent the silting of streams and existing drainage facilities. The Contractor shall size structures and conform fully with the North Carolina Sedimentation Pollution Control Act.

F. Air Pollution:

1. Comply with all pollution control rules, regulations, ordinances, and statutes which apply to any work performed under the Contract, including any air pollution control rules, regulations, ordinances and statutes, or any municipal regulations pertaining to air pollution.

2. During the progress of the work, maintain the area of activity, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride or more effective dust control, furnish and spread the material, as directed, and without additional compensation.

3.04 TRENCH EXCAVATION

A. Length of Trench:

1. No more trenches shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction.

2. Except where tunneling is indicated on the drawings, is specified, or is permitted by the Engineer, all trench excavation shall be open cut from the surface.

B. Trench Excavation:

1. General: Perform all excavation of every description and of whatever substance encountered so that the pipe can be laid to the alignment and depth shown on the drawings.

2. Brace and shore all trenches, where required, in accordance with Federal, State, and Local health and safety rules and regulations, including those promulgated by the Department of Labor, Occupation Safety and Health Administration, "Safety and Health Regulations for Construction".

3. Make all excavations by open cut unless otherwise specified or indicated on the drawings.

4. Width of Trenches: Excavate trenches sufficiently wide to allow proper installation of pipe, fittings and other materials. Measurement and payment quantities will be based on a maximum trench width of not more than 12” clear of pipe on either side at any point. Do not widen trenches by scraping or loosening materials from the sides.

5. Trench Excavation in Earth: Earth excavation includes all excavation of whatever substance encountered. In locations where pipe is to be bedded in earth excavated trenches, fine grade the bottoms of such trenches to allow firm bearing for the bottom of the pipe on undisturbed earth. Where any part of the trench has been excavated below the grade of the pipe, fill the part excavated below such grade with pipe bedding material and compact at the Contractor's expense.

6. Trench Excavation in Fill: If pipe is to be laid in embankments or other recently filled material, first place the fill material to the finish grade or to a height of at least one foot above the top of the pipe, whichever is the lesser. Take particular care to ensure maximum consolidation of material under the pipe location. Excavate the pipe trench as though in undisturbed material.

7. Trench Bottom in Poor Soil: Excavate and remove unstable or unsuitable soil to a width and depth, as directed by the Engineer, and refill with a thoroughly compacted gravel bedding.

8. Bell Holes: Provide bell holes at each joint to permit the joint to be made properly and to provide a continuous bearing and support for the pipe.

C. Trench Backfill:

1. General: Unless otherwise specified or indicated on the drawings, use suitable material for backfill which was removed in the course of making the construction excavations. Do not use frozen material for the backfill and do not place backfill on frozen material. Remove previously frozen material before new backfill is placed. Start backfilling as soon as practicable after the pipes have been laid, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, and proceed until its completion.

2. With the exception mentioned below in this paragraph, do not backfill trenches at pipe joints until after that section of the pipeline has successfully passed any specified tests required. Should the Contractor wish to minimize the maintenance of lights, and barricades, and the obstruction of traffic, he may, at his own risk, backfill the entire trench as soon as practicable after installation of pipe, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.

3. Material: The nature of the materials will govern both their acceptability for backfill and the methods best suited for their placement and compaction in the backfill. Both are subject to the approval of the Engineer. Do not place stone or rock fragments larger than 4" in greatest dimension in the backfill. Do not drop large masses of backfill material into the trench in such a manner as to endanger the pipeline. Use a timber grillage to break the fall of material dropped from a height of more than 5 feet. Exclude pieces of bituminous pavement from the backfill unless their use is expressly permitted.

4. Zone Around Pipe: Place bedding material to the level shown on the Drawings and work material carefully around the pipe to insure

that all voids are filled, particularly in bell holes. For backfill up to a level of 2 feet over the top of the pipe, use only selected materials containing no rock, clods or organic materials. Place the backfill and compact thoroughly under the pipe haunches and up to the mid-line of the pipe in layers not exceeding 6" in depth. Place each layer and tamp carefully and uniformly so as to eliminate the possibility of lateral displacement. Place and compact the remainder of the zone around the pipe and to a height of one foot above the pipe in layers not exceeding 6" and compact to a maximum density of at least 100 % as determined by ASTM D0698.

5. Tamping: Deposit and spread backfill materials in uniform, parallel layers not exceeding 12" thick before compaction. Tamp each layer before the next layer is placed to obtain a thoroughly compacted mass. Furnish and use, if necessary, an adequate number of power driven tampers, each weighing at least 20 pounds for this purpose. Take care that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval of the Engineer, be compacted by the use of suitable rollers, tractors, or similarly powered equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling and compacting as furnished by the Contractor.

6. Wet the material by sprinkling, if necessary, to insure proper compaction by tamping (or rolling). Perform no compaction by tamping (or rolling) when the material is too wet either from rain or applied water to be compacted properly.

7. Trench Compaction: Compact backfill in pipe trenches to the maximum density as shown on the drawings, or as listed in the subsection entitled COMPACTION, with a moisture content within the range of values of maximum density as indicated by the moisture-density relationship curve.

3.05 SITE GRADE

A. Placement and Compaction:

1. Place backfill and fill material in layers not more than 8" in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to the required percentage of maximum density for each area classification. Do not place backfill or material on surfaces that are muddy, frozen, or contain frost or ice.

2. In areas not accessible to rollers or compactors, compact the fill with mechanical hand tampers. If the mixture is excessively moistened by rain, aerate the material by means of blade graders, harrows, or other approved equipment, until the moisture content of the mixture is satisfactory. Finish the surface of the layer by blading or rolling with a smooth roller, or a combination thereof, and leave the surface smooth and free from waves and inequalities.

3. Place backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of backfill against structures. Carry the material uniformly around all parts of the structure to approximately the same elevation in each lift.

4. When existing ground surface has a density less than that specified under the subsection entitled COMPACTION for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

B. Grading Outside Building Lines: Grade to drain away from structures to prevent ponding of water. Finish surface free from irregular surface changes.

C. Planting Areas: Finish areas to receive topsoil to within not more than one inch (1") above or below the required subgrade elevations, compacted as specified, and free from irregular surface changes.

D. Walks: Shape the surface of areas under walks to line, grade, and cross-section, with the finish surface not more than 0" above or 1" below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.

E. Pavements:

1. Shape the surface of the areas under pavement to line, grade and cross section, with finish surface not more than 1/2" above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction.

2. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material.

3. Shape to line, grade, and cross section as shown on the drawings.

F. Protection of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

G. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather prior to acceptance of work, scarify surface, reshape, and compact to required density prior to further construction.

H. Unauthorized Excavation:

1. Unauthorized excavation consists of the removal of materials beyond indicated elevations without the specific direction of the Engineer. Under footings, foundations, bases, etc., fill unauthorized excavation by extending the indicated bottom elevation of the concrete to the bottom of the excavation, without altering the required top elevation. Lean concrete fill may be used to bring elevations to proper position only when acceptable to the Engineer.

2. For pipe trenches and elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer.

3.06 BACKFILL AROUND STRUCTURES

A. General: Unless otherwise specified or indicated on the drawings, use suitable material for backfill which was removed in the course of making the backfill and do not place backfill which was removed in the course of making the construction excavations. Do not use frozen material for the

backfill and do not place backfill upon frozen material. Remove previously frozen material before new backfill is placed.

B. Material: Approved selected materials available from the excavations may be used for backfilling around structures. Obtain material needed in addition to that of construction excavations from off-site borrow pits selected by the Contractor. Furnish all borrow material needed on the work. Place and compact all material, whether from the excavation or borrow, to make a dense, stable fill. Use fill material which contains no vegetation, masses of roots, individual roots over 18" long or more than 1/2" in diameter, stones over 4" in diameter, or porous matter. Organic matter must not exceed negligible quantities.

C. Placing Backfill: Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. Make special leakage tests, if required, as soon as practicable after the structures are structurally adequate and other necessary work has been done. Use the best of the excavated materials in backfilling within 2 feet of the structure. Avoid unequal soil pressures by depositing the material evenly around the structure.

3.07 COMPACTION

A. General: Control soil compaction during construction providing at least the minimum percentage of density specified for each area classification.

B. Percentage of Maximum Density Requirements: After compaction, all fill will be tested in accordance with Method "C" of ASTM D-698, unless specified otherwise. Except as noted otherwise for the zone around pipe, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place:

UNPAVED AREAS	Compact Full Depth to 92%
DRIVES AND PARKING	Top 24" - 100%
TRENCH BACKFILL (PAVED AREAS)	Compact full depth to 100%
TRENCH BACKFILL (UNPAVED AREAS)	Compact full depth to 95%
ALL OTHER BACKFILL	Compact full depth to 95%

C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed

because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.

D. Disposal of Surface Material: Upon approval of the Engineer, haul all surplus materials not needed or acceptable for backfill off-site.

3.08 FIELD QUALITY CONTROL

A. Soil Testing and Inspection Service: Compaction tests of all fill areas will be made by an independent testing laboratory. Such tests will be provided and paid for by the Owner, except that tests that reveal non-conformance with the specifications and all succeeding tests for the same area shall be at the expense of the Contractor until conformance with the specifications is established. The Owner will be responsible for paying for only the successful tests.

END OF SECTION

SECTION 02222 ROCK EXCAVATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of the blasting and excavation of rock material in cut areas. Rock excavation shall be classified material which cannot be removed with normal construction equipment such as hydraulic excavators, bulldozers with "rippers" and requires the construction practice of blasting.

1.02 DEFINITIONS

A. Rock is defined as being sandstone, limestone, flint, graphite, quartzite, slate, hard shale, or similar material that cannot be excavated without systematic drilling and blasting.

B. Should rock be encountered in two or more ledges, each ledge being not less than 3” thick and with interlying strata of earth, clay or gravel not more than 12” thick in each stratum, the entire volume between the top of the top ledge and the bottom of the bottom ledge will be classified as rock.

PART 2: NOT USED

PART 3: EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Blasting: The use of explosives shall conform to be in strict accordance with all Federal, State, County and local regulations and only after the approval of the Engineer. The Contractor shall be responsible for all damage caused by blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of excavation or trench.

B. When rock is encountered, all lines and grades will be held in accordance with the plans or adjusted only after approval of the Engineer.

C. When rock is encountered within the limits of construction, the Contractor shall notify the Engineer prior to any removal. Upon the Engineer's authorization, the Contractor shall remove the rock. The Contractor shall not be paid for rock removed without prior approval from the Engineer.

D. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

END OF SECTION

SECTION 02230 AGGREGATE BASE COURSE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of the construction of a base composed of an approved aggregate material hauled to the site, placed on the site, compacted, and shaped to conform to the lines, grades, depths, and typical sections shown on the plans or established by the Engineer.

PART 2: PRODUCTS

2.01 MATERIALS

A. Aggregate base course materials shall consist of crushed stone or uncrushed gravel, or other similar material having hard, strong, durable particles free of adherent coatings.

C. The Contractor shall furnish aggregate base course material produced in accordance with the requirements indicated herein for Type A, aggregate unless otherwise specified in the special provisions.

D. All aggregates shall be from approved sources. Sources will not be approved unless the material has satisfactory soundness and satisfactory resistance to abrasion. Satisfactory soundness will be considered to be a weighted average loss of not greater than 15% when subjected to five (5) alternations of the sodium sulfate soundness test in accordance with AASHTO T104. Satisfactory resistance to abrasion will be considered to be a percentage of wear of not greater than 55% when tested in accordance with AASHTO T96.

E. Aggregates shall be handled in such a manner as to minimize segregation.

F. Sites for aggregate stockpiles shall be grubbed and cleaned prior to storing aggregates, and the ground surface shall be firm, smooth, and well drained. A cover of at least 3” of aggregate shall be maintained over the ground surface in order to avoid the inclusion of soil or foreign material. Stockpiles shall be built in such a manner as to minimize segregation. When it is necessary to operate trucks or other equipment on a stockpile in the process of building the stockpile, it shall be done in a manner approved by the Engineer.

G. Stockpiles of different types or sizes of aggregates shall be spaced far enough apart, or else separated by suitable walls or partitions, to prevent the mixing of the aggregates.

H. Any method of stockpiling aggregates which allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the aggregate will not be permitted. Excessive degradation will be determined by sieve tests of samples taken from any portion of the stockpile over which equipment has been operated, and failure of such samples to meet all grading requirements for the aggregate will be considered cause for discontinuance of such stockpiling procedure.

I. Gradation: All standard sizes of aggregates shall meet the gradation requirements when tested in accordance with AASHTO T27.

PART 3: EXECUTION

3.01 CONSTRUCTION OF STONE BASE

A. The aggregate material shall be spread on the subgrade to a uniform loose depth and without segregation.

B. Where the required compacted thickness of base is 8" or less the base material may be spread and compacted in one layer. Where the required compacted thickness of base is more than 8", the base material shall be spread and compacted in two (2) or more approximately equal layers. The minimum compacted thickness of any one layer shall be approximately 4".

C. Each layer of material shall have been sampled, tested, compacted, and approved prior to placing succeeding layers of base material or pavement. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established, shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests. The minimum compaction for each layer shall be 100% standard proctor.

D. No base material shall be placed on frozen subgrade or base. Hauling equipment shall not be operated on subgrade or a previously completed layer of base material soft enough to rut or weave beneath the equipment.

E. The maximum speed of trucks hauling or traveling over any part of the subgrade or base shall be five (5) miles per hour.

F. The Contractor shall utilize methods of handling, hauling, and placing which will minimize segregation and contamination. If segregation occurs, the Engineer may require that changes be made in the Contractor's methods to minimize segregation, and may also require mixing on the road which may be necessary to correct any segregated material. No additional compensation will be allowed for the work of road mixing as may be required under this provision. Aggregate which is contaminated with foreign materials to the extent the base course will not adequately serve its intended use shall be removed and replaced by the Contractor at no additional cost to the Owner. The above requirements will be applicable regardless of the type of aggregate placed and regardless of prior acceptance.

3.02 QUALITY CONTROL

A. Tolerances:

1. After final shaping and compacting the base, the Engineer will check the surface of the base for conformance to grade and typical section and will determine the base thickness.

2. The thickness of the base shall be within a tolerance of ±1/2” of the base thickness required by the plans.

B. Maintenance: Where the base material is placed in a trench section, the Contractor shall provide adequate drainage through the shoulders to protect the subgrade and base until such time as shoulders are completed. The Contractor shall maintain the surface of the base by watering, machining, and rolling or dragging when necessary to prevent damage to the base by weather or traffic.

END OF SECTION

SECTION 02510 BITUMINOUS PAVING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section shall consist of the construction, production, delivery and placement of bituminous plant mix base, intermediate and surface courses properly laid on a prepared aggregate base course, in accordance with these specifications and in conformity with the lines, grades, thickness, and typical sections shown on the plans.

1.02 SUBMITTALS

A. The Contractor shall furnish copies of certified weight tickets for all asphalt placed on the project. The original of all tickets, including any voided tickets or tickets for rejecting mixture, shall become the property of the Engineer.

1.03 QUALITY ASSURANCE

A. Quality control and quality assurance are provided for through use of the Quality Management System, as discussed in Section 1 of the latest edition Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. All hot mix asphalt must be provided by a Certified Asphalt Plant, as covered in Section 5.3 of the latest edition Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

C. Asphalt plant equipment and operations shall meet the Specifications set forth in Section 5 and 6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Delivery and Acceptance of Asphalt Materials must conform to Section 2.40.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. The Engineer reserves the right to sample and test any shipment and to reject any material not meeting the requirements of the specifications.

1.04 DELIVERY AND STORAGE

A. Transportation of Bituminous Mixture:

Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

PART 2: PRODUCTS

2.01 MATERIALS

No recycled asphalt pavements are to be used.

A. Composition of Mixtures

1. In accordance with Section 4.6 of the latest edition of the Asphalt Mixtures shall be hauled in accordance with Section 6.9 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

2. The job mix formula for each mixture will establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to the aggregate, and a single temperature at which the mixture is to be discharged from the plant and shall be within the design limits specified for the particular type of bituminous mixture.

3. The job mix formula for each mixture shall be in effect until modified in writing by the Engineer.

4. All mixtures furnished for the work shall conform to the job mix formula within the tolerance ranges specified for the particular mix involved as specified herein.

5. Should a change in sources of aggregate materials be made, a new job mix formula will be required before the new mixture is produced.

6. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

7. Bituminous Base Course, Type B 25.0B

   a. The bituminous base course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

8. Bituminous Intermediate Course, Type I 19.0B:

   a. The bituminous intermediate course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

9. Bituminous Surface Course (SF 9.5A and S 9.5B):

   a. The bituminous surface course mixture shall conform to Table 2 in Section 4.6 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

10. Tack Coat

    a. Tack Coat shall conform to Section 9.31 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction System.

PART 3: EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Base Course, Type B 25.0B); Intermediate Course (I 19.0B); Surface Courses (SF 9.5A and S 9.5B):

1. General:

   a. All hot mix placement and compaction operations shall conform to Section 9.4 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

2. Spreading and Finishing:

a. Spreading and finishing of asphalt pavements shall be done in accordance with Section 9.5 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

3. Compaction:

a. Compaction of asphalt pavements shall be done in accordance with Section 9.7 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

4. Joints:

a. Transverse Joints:

i. Transverse joints are to be constructed in accordance with Section 9.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

b. Longitudinal Joints:

i. Longitudinal are to be constructed in accordance with Section 9.10 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

5. Weather, and Seasonal Limitations:

a. Placement of asphalt is limited in accordance with Section 9.4.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Tack Coat:

a. Tack coat shall be applied in accordance with Section 9.3 of the latest edition of the Superpave Hot Mix Asphalt/Quality

Management System of the North Carolina Department of Transportation Pavement Construction Section.

3.02 QUALITY CONTROL AND TESTING

A. Samples:

1. Sampling and testing shall be in accordance with Section 7 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

B. Surface Requirements:

1. Mat cross-slope and thickness shall be tested according to Section 10.1.8 of the latest edition of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

2. Surface texture shall conform to Section 10.1.9 of the Superpave Hot Mix Asphalt/Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. Smoothness shall conform to Section 10.2. Areas found to reveal non-conformance corrected by the Contractor by removal of the defective work and replacement with new material unless other corrective measures are permitted by the Engineer. The work and materials required in the correction of defective work shall be provided by the Contractor at no cost.

3. The Contractor shall repaint and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

4. All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

END OF SECTION

SECTION 02575 BITUMINOUS PAVEMENT REPAIRS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the repairs of pavement for all asphalt surfaces.

1.02 PERFORMANCE

A. Construction of the subgrade, base course, and paving shall be undertaken immediately after completion of all underground piping and structures, all curbs and gutters, all yard piping, all conduits and all other facilities passing beneath paved areas, and all structural slabs and foundations required within or adjacent to the paved areas.

B. Weather Limitations: Bituminous mixtures shall not be produced or placed during rainy weather, when the subgrade or base course is frozen or shows any evidence of excess moisture, when moisture on the surface to be paved would prevent proper bond, nor when the air temperature is less than 40 degrees F° in the shade away from artificial heat.

1.03 REFERENCES

A. All work and materials required under this section of the specifications shall conform to the applicable sections of the latest editions of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and the North Carolina Department of Transportation Pavement Construction Section Superpave Hot Mix Asphalt / Quality Management System.

PART 2: NOT USED

PART 3: EXECUTION

3.01 INSTALLATION

A. Preparation of Subgrade: The work covered under this section of this specification shall be performed in strict accordance with Section 500 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures.

B. Application of Aggregate Base Course: The work covered under this section of this specification shall be performed in strict accordance with Section 520 of the latest edition of the North Carolina Department of

Transportation Division of Highways Standard Specifications for Roads and Structures.

C. Bituminous Plant Mix - General: The work covered under this section of this specification shall be performed in strict accordance with Section 610 and Section 620 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Sections 2 through 6 and Section 9 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section, with the exception that recycled products are not permitted. For pavement repairs, see Section 654 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

D. Tack Coat: The work covered under this section of this specification shall be performed in strict accordance with Section 605 of the latest edition of the North Carolina Department of Transportation Division of Highways Standard Specifications for Roads and Structures and Section 9.3 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

E. Bituminous Base Course (Type B 25.0B): The work covered under this section of the specification shall be performed in strict accordance with Section 4 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

F. Bituminous Intermediate Course (Type I 19.0B): The work covered under this section of the specification shall be performed in strict accordance with Section 4 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

G. Bituminous Surface Course (Types SF 9.5A and S 9.5B): The work covered under this section of the specification shall be performed in strict accordance with Section 4 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section.

H. Traffic Markings: The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with North Carolina Department of Transportation requirements and specifications. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

I. Existing Utilities: All existing manhole and valve covers shall be raised by the Contractor as necessary prior to paving so that the tops of the covers are flush with the final surface. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

3.02 TESTING

A. All of the above work will be subject to thickness and compaction tests as deemed necessary by the Engineer and conforming to Section 10 of the Superpave Hot Mix Asphalt / Quality Management System of the North Carolina Department of Transportation Pavement Construction Section. Such tests will be provided and paid for by the Owner, except that tests which reveal non-conformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established, shall be at the expense of the Contractor. The Owner will be responsible for paying for only the successful tests.

END OF SECTION

SECTION 02730 SANITARY SEWER PIPE AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment, materials and incidentals necessary to install and complete the sanitary sewer and/or force main installation in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All sewer pipe and force main excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.02 SUBMITTALS

A. Shop drawings or submittals shall be required for the following:

1. All sizes and types of pipe on the project.
2. Pipe fittings and couplings.
3. All valves, valve boxes, manholes, manhole frames and covers, air relief valves or any other required for completion of the project.

1.03 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling. The Contractor shall store the pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the Engineer will reject the material as being unfit for installation.

PART 2: PRODUCTS

2.01 MATERIALS

A. Pipe:

1. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs and other imperfections, and true to theoretical shapes and forms throughout.

All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting materials which do not conform to the requirements of these specifications. Such material shall be marked by the Engineer and the Contractor shall remove it from the project site upon notice being received of its rejection.

2. As particular specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number except provisions in revised specifications which are clearly inapplicable.

3. Ductile Iron Sewer Pipe (DIP) – Gravity Sewer and Force Mains:

   a. Ductile Iron Pipe shall be as manufactured in accordance with ASTM A 746, ANSI Specification A21.50 and A21.51 and shall be Class 350 unless otherwise specified on the drawings or in the Bid Schedule.

   b. The pipe interior shall be cement mortar lined and seal coated, standard thickness, in accordance with ANSI Specification A21.4.

   c. The exterior of all pipe shall be coated with either a coal or asphaltic base bituminous pipe coating in accordance with ANSI Specification A21.8.

   d. Pipe shall be furnished with Slip Joints, Mechanical Joints, or Flanged Joints as indicated on the drawings and in accordance with the specifications described below:

   e. Slip Joints: This pipe joint shall be done by guiding the plain end of the pipe into the bell end until contact is made with a gasket and by exerting a sufficient compressive force to drive the plain end through the gasket until the plain end makes full contact with the base of the bell.

      i. Bells of slip-joint pipe shall be contoured to receive a circular rubber gasket and plain ends shall have a slight taper to facilitate installation.

      ii. The circular gasket shall be furnished by the pipe manufacturer and shall be manufactured in accordance with ANSI Specification A21.11.

      iii. The pipe manufacturer shall also furnish the lubricant used to assist in the pipe installation.

   f. Mechanical Joints: This pipe joint is essentially the same as the slip joint except it is furnished with a cast iron clamp which acts as a retainer to hold circular rubber gasket in

place. All mechanical type joints shall be furnished by the pipe manufacturer and manufactured in accordance with ANSI Specification A21.11.

i. All bolts shall be tightened by means of torque wrenches in such a manner that the following shall be brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

g. Flanged Joints: The flanged pipe joint is composed of a flat steel plate shop fitted on the threaded end of the ductile iron pipe. The flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true.

i. Flanged joints shall be furnished with 125 lb. flanges drilled in accordance with ANSI Specification B16.1.

ii. In general, flanged joints shall be made up with through bolts of the required size. Stud or tap bolts shall be used only where shown or required.

iii. Gaskets for flanged joints shall be the ring type of cloth inserted rubber or rubber with a minimum thickness of 1/8".

iv. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together. Bolts and gaskets shall be furnished by the installer of piping for joints connecting the piping with equipment, as well as for those between pipe and fittings, whether such equipment and piping is furnished by the installer or not.

h. Long Span Pipe: "Long span" type ductile iron pipe shall be used for unsupported spans greater than 20'-0". "Long span" ductile iron pipe and associated pipe joints shall be designed by the pipe manufacturer specifically for elevated crossings with unsupported spans shown on the drawings. The Contractor shall submit shop drawings from the pipe manufacturer for the long span pipe. Shop drawings shall include material specifications for the pipe and joints, and shall specify locations of joints with respect to the pier locations shown on the drawings. Long span ductile iron pipe shall be as manufactured by American, U.S. Pipe, or equal.

4. Polyvinyl Chloride Sewer Pipe (PVC):

   a. Gravity: Polyvinyl Chloride Pipe shall be as manufactured in accordance with ASTM D-3034, latest edition, and shall be suitable for use as a gravity sanitary sewer pipe. The standard dimension ratio (SDR) shall be 35 unless otherwise specified on the contract drawings.

   b. All polyvinyl chloride pipe joints shall be of an integral bell and spigot of the same material as the pipe. It shall have a solid cross-section with rubber "0" ring securely locked in place at the point of manufacture.

   c. Force Main: Polyvinyl chloride pipe shall be as manufactured in accordance with ASTM D-2241, latest edition, and shall be suitable for use as a sanitary sewer force main pipe. The standard dimension ratio (SDR) shall be 18 or 21 as shown on the contract drawings. PVC force main piping shall have a green exterior color. Under no circumstances shall pipe with a blue exterior color be accepted.

   d. Where PVC pipe is installed in iron pipe size (IPS), an IPS gasket shall be furnished with each fitting to insure compatibility.

5. Reinforced Concrete Sewer Pipe (RCP):

   a. Reinforced concrete sewer pipe shall be furnished in accordance with ASTM C-76, latest edition, and shall be suitable for use as a gravity sanitary sewer pipe. The pipe shall be Class III, wall thickness B, with spigot groove joint. The rubber "0" ring gasket shall form a flexible water-tight seal at the assembled pipe joint and manufactured in accordance with ASTM C-443.

   b. The pipe manufacturer shall furnish to the Engineer certification from an independent laboratory that the alkalinity of the pipe is at least 90% calcium carbonate equivalent. Certification shall also be furnished by the pipe manufacturer stating the type of aggregate used in the pipe.

6. Galvanized Steel Pipe and Fittings:

   a. Galvanized steel (mill) pipe shall be manufactured in accordance with AWWA Standard C202 and ASTM A370.

   b. The pipe is to be seamless (weldless) tubular steel pipe manufactured in straight standard length (21’-0”). Each length shall be subjected to an internal hydrostatic pressure test by the manufacturer. The Engineer may request

certified copies of the testing results for the pipe purchased for this project.

c. Unless otherwise stated in the bid schedule or noted on the drawings, the diameter shall mean the nominal inside diameter of pipe as covered by the applicable section(s) of AWWA C-202.

d. The maximum working water pressure, including water hammer allowance, for this pipe material shall be taken as 250 psi.

e. All pipe lengths shall be threaded National Standard Thread (NSPT) at the point of manufacture. Where other end preparation is required, it shall be as specified on the contract drawings.

7. Fittings: Whenever the sanitary sewer force main has a significant change in alignment or grade it will be necessary to furnish and install a fitting made of either cast/ductile iron or galvanized steel.

The specifications for the force main fittings are described below:

a. Cast Iron/Ductile Iron: All cast iron and ductile iron fittings shall be mechanical joint manufactured in accordance with ANSI Specification A-21.1 and AWWA Standard C-110 for underground piping.

The interior of the fittings shall be cement mortar lined and seal coated in accordance with ANSI Specification A21.4 and AWWA C-104.

b. Galvanized Steel: See Section 2.01.6 above.

8. Gate Valves: All gate valves shall be designed for a working pressure of 200 psi unless otherwise specified and shall have a clear waterway equal to the full nominal diameter of the pipe and shall be opened by turning counterclockwise. Each valve shall have the initials of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure. Valves shall be operated by handwheel or operating nut as herein specified and shall have an arrow cast in the metal indicating the direction of opening. Valves to be installed underground shall be non-rising stem type while valves installed above ground or in buildings and structures shall have rising stems. All gate valves 16” or larger shall have a 3” bypass with valve.

a. Gate Valves 2" and Smaller:

i. Gates valves 2" and smaller shall be all brass, single disc type, double seat tapered wedge type built to manufacturer's standards with material and construction conforming to AWWA C-500.

ii. Each valve shall have a 2" operating nut. Valves shall have screwed ends conforming to NPT standards.

b. Resilient Seated Wedge Valve:

i. Gate valves 3" through 24" diameter size shall be of the ductile iron body, resilient seated wedge type meeting the requirements set forth in AWWA C-509 and AWWA C-500. All valves shall be from one manufacturer and parts interchangeable.

ii. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in Table 2, Section 4.4 of AWWA C-509 and C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces with a fusion bonded epoxy paint conforming to AWWA C-550.

iii. The gate shall be fully covered with a rubber cover over all exterior and interior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part which houses the stem nut. The gate and rubber coat shall conform to ASTM D429.

iv. Valve stems shall be cast bronze. The stuffing box shall use "O"-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

v. Valves larger than 12" diameter shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve.

c. Double Disc Type Gate Valves:

i. Gate valves larger than 24" diameter size shall be of the ductile iron body, double disc parallel seat type meeting the requirements set forth in AWWA C-500. All valves shall be from one manufacturer and parts interchangeable. Valves shall have a working pressure of 150 psi.

ii. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces.

iii. The gates shall be high strength cast iron, sturdily proportioned without pockets on the backs. All cam surfaces shall open to the bottom. Gate rings shall be rolled into a dovetail groove under pressure to make a single insertable finish.

iv. Valves shall use bottom wedging type design with a two part floating wedge contact. The wedge and hook shall be separate castings and not a single piece.

v. Valve stems shall be cast bronze. The stuffing box shall use "O"-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

vi. Valves shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve. Valves shall have bronze rollers, tracks, and scrapers.

vii. All valves shall be supplied with a bypass as a part of the valve. Bypass shall be a minimum of 3" diameter with a 3" resilient seated wedge valve.

9. <u>Sewage Combination Air Relief Valves:</u>

a. The combination air valve shall be designed specifically for use on sanitary sewer pressure (force) mains. It shall be designed to exhaust large volumes of air from the system during filling of the main or on pump start-up. It shall also allow large volumes of air to enter the system during draining (prevents vacuum from forming). In addition, the valve shall release small amounts of accumulated air while the system is in normal operation (under pressure).

b. The combination air valve shall be provided in a single body constructed of cast iron. The float and stem shall be constructed of stainless steel. The needle and seat shall be constructed of Buna-N. The valve shall be equipped with an inlet valve.

c. Combination air valves shall be manufactured by APCO, Val-Matic, GA Industries, or approved equal.

10. Flexible Couplings: Whenever it becomes necessary to join sewer pipe lines of dissimilar materials or pipe sizes it shall be required to use a flexible coupling. The coupling shall be made of virgin polyvinyl chloride (PVC) and shall not harden and shall be impervious to all known soil conditions. The coupling shall provide a permanent leakproof seal approved by the Southern Building Code Congress and manufactured in accordance with ASTM #C-594-70. The couplings shall be as manufactured by Fernco Joint Sealer Company or an approved equal.

11. Manholes:

a Precast concrete manhole bases, risers and cones shall conform to ASTM C 478, latest revision of Precast Reinforced Concrete Manhole Sections. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes and where shown or specified. Cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.

b. Minimum compressive strength of concrete shall be 4,000 psi and the maximum permissible absorption shall be 6.5%. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes. Precast manhole section shall fit together readily and shall have a self-contained "O" ring rubber gasket conforming to ASTM C-443.

c. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer and his inspector. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478.

d. Frames and Covers:

i. Frames and covers shall be cast iron of superior quality, tough and even texture. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, well cleaned and coated with asphalt paint. This paint shall result in a smooth

coating, tough and tenacious when cold, not tacky and not brittle. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.

ii. The standard manhole casting shall be designed for heavy duty use with a 190 pound frame and 125 pound cover. Acceptable products include U.S. Foundry USF 669 ring and KL cover, or an approved equal. Frame and cover shall meet North Carolina DOT 840.54 standard unless otherwise noted.

iii. Special waterproof manhole frame and covers shall be installed only at those locations indicated on the contract drawings. Watertight rings and lids shall be U.S. Foundry 669-KL-BWTL with a 125-pound cover. Ring shall have a flat type gasket and cover shall be bolted down with a minimum of four (4) bolts.

iv. The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole. Concrete brick, set in mortar, shall be used to adjust the top of the frame and cover to finished grade; however, no more than four (4) courses of brick will be used for adjustment.

e. Manhole Steps:

i. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

ii. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the eccentric cone and so as to land upon a bench.

iii. Steps shall be vertically spaced no greater than sixteen (16) inches on center. Step width shall be a minimum of twelve (12) inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7).

iv. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

f. Manhole Inverts:

i. Manhole inverts and benches shall be constructed in accordance with the standard details shown on the drawings. Invert shall be a U-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe. The benches shall be constructed with a slope of 1" per foot to the channel.

ii. The channel and invert shall be constructed with a minimum of 2000 psi concrete or brick fill with concrete finish minimum 1" thick. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve with as large a radius as the diameter of the manhole will allow.

g. Manhole Drops: Standard drop manholes will be constructed only at those locations shown on the drawings or as approved by the Engineer. The design of the drop connection shall be in accordance with the standard detail drawing. The cost of the extra pipe, labor, etc. required to construct a drop manhole will be included in the unit price for the drop manhole at the depths listed.

h. Manhole Vents:

i. Where designated on the contract drawings, a 4" diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped in to the upper most section of the manhole, anchored in concrete and extended vertically to the elevation shown on the drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.

ii. The pipe material shall be Schedule 40 Galvanized Steel with two (2) coats of epoxy paint approved by the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

A. Excavation:

1. The work covered by this section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.

2. Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, water pipe, manholes, catch basins,

hydrants, watergates, sewer services, water taps, drainage structures, drainage ditches and other unclassified excavation as may be deemed necessary by the Engineer.

3. The excavation shall be done to the lines, grades, typical sections, and details shown on the plans or established by the Engineer. All work covered by this section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots which protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Engineer.

4. All trenches shall be excavated in accordance with all Federal, State, and Local Health and Safety regulations having jurisdiction at the project site.

5. All excavation shall be by open cut unless otherwise authorized by the Engineer. If the bottom of the excavation is found to consist of rock or any materials that cannot be excavated to give a uniform bearing surface, the material shall be removed to a depth at least 6" below established bottom grade and backfilled to grade with sand thoroughly compacted in place. Any excavations carried below the depths indicated, without specific directions, shall be backfilled in the same manner. The excavation shall be of sufficient width to allow a clearance of not less than 6" between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary.

6. <u>Sheeting, Bracing Trenches, and Trench Boxes:</u>

   a. If necessary, the Contractor will be required to keep the sides of the excavation vertical by sheeting and/or bracing or the use of a trench box to prevent movement by slides or settling of the sides of the trench, in such manner as to prevent injury or displacement of the pipe or appurtenances or diminish the working space required at the sides of the pipe. Also, the Contractor may be required for the purpose of preventing injury to persons or property or adjacent structures in place or to be constructed, to leave sheeting and bracing in place. Sheeting and bracing shall be provided in accordance with all applicable Federal, State and Local safety and health regulations.

b. No sheeting or bracing shall extend closer than 2'-0" off the ground surface, or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. It is understood that the Owner will be under no obligation to pay for sheeting or bracing left in place by the Contractor. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom

7. Excavated materials to be used for backfill will be approved by the Engineer, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance. Materials which are excess to the needs of the project will be disposed of according to the section on "Waste Material Disposal.".

8. <u>Pipe Foundations:</u>

a. The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections as shown on the plans for the type of pipe being installed.

b. The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the plans. Any deviation or field adjustment will require the approval of the Engineer. When a representative of the Engineer is present on the site and is so requested by the Contractor, he may check the position of grades and lines but the Contractor shall be responsible for the finished work conforming to exact and proper line and grade.

c. Whenever the nature of the ground will permit, the excavations at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade.

d. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly

tamped to prepare a new foundation for the pipe. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe.

e. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6". A suitably tamped and shaped foundation of approved material shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

f. Where the foundation material is found to be of poor supporting value, the Engineer may make minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as directed by the Engineer, within limits established on the plans, and backfilling with either an approved material secured from unclassified excavation or borrow excavation at the nearest accessible location along the project, or foundation conditioning material consisting of crushed stone or gravel approved by the Engineer as being suitable for the purpose intended. The selection of the type of backfill material to be used for foundation conditioning will be made by the Engineer.

g. The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing and no pipes shall be laid until the water has been removed from the trench. Water so removed from the trench must be disposed of in such a manner as not to cause injury to work completed or in progress.

h. Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the Engineer will require the pipe to be laid on a washed stone foundation per detail. Foundation stone shall be placed by the Contractor and compensation will be allowed the Contractor for the work, based on the unit prices provided in the bid schedule for undercut excavation if greater than 6" below the bottom of the pipe. Class I embedment for DIP shall be used only for wet conditions and only as directed by the Engineer. Compensation shall based on unit prices. No additional payment for Class I embedment shall be made for PVC sewer pipe.

B. Installing Pipe and Appurtenances:

1. Laying Pipe:

a. The layout of gravity sanitary sewer lines and invert elevations at governing points are as shown on the drawings.

b. The Contractor shall do all layout work for lines and grades from that information shown on the drawings or as furnished by the Engineer.

c. When a laser beam instrument is used to set line and grade, the unit must be maintained in good working order, and the calibration checked daily for both alignment and percent grade. In the event the required accuracy of alignment and grade is not adhered to, the Engineer will prohibit the use of laser beams.

d. Pipe shall be laid with bell ends facing in the direction of pipe laying, unless directed otherwise by the Engineer. In all cases, pipe is to be installed in strict accordance with the manufacturer's recommendations and the contract material specifications. The Engineer may augment any manufacturer's installation recommendations if, in his opinion, it will best serve the interest of the Owner.

e. Proper tools, implements, and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean, sound and free from defects. It shall be laid on the prepared foundation, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

f. When cutting short lengths of pipe, a pipe cutter, as approved by the Engineer, will be used and care will be taken to make the cut at right angles to the centerline of the pipe or on the exact skew as shown on the plans. In the case of push-on pipe, the cut ends shall be tapered with a

portable grinder, or coarse file to match the manufactured taper.

g. During times when pipe laying is not in progress, the open ends of pipe shall be closed and no trench water or other material shall be permitted to enter the pipe.

h. Where the pipe is laid on a grade of 20% or greater, the laying shall start at the bottom of the slope and proceed upward with the bell end of the new pipe upgrade. All pipe laid on a grade of 20% or greater shall require thrust blocking or keying as shown on the drawings and standard details.

i. Where pipe lines of different materials are joined together, a standard sewer repair coupling shall be used. The couplings shall be Eastern Standard Sewer Repair Couplings (Mission Rubber Company), the Fernco Joint Sealer Company or an equal product approved by the Engineer.

j. All gravity sewer shall have minimum 12" vertical separation from storm sewer and shall have minimum 10'-0" horizontal separation from water mains or 18" vertical separation below the bottom of the water main. In the event these separations cannot be met, sanitary sewer and the water main, if applicable, shall be constructed of ductile iron pipe as directed by the Engineer or as shown on the drawings. In addition, all gravity sewer shall have a minimum 100'-0", horizontal separation from wells or other water supplies.

2. Manholes:

a. Sanitary sewer manholes shall be installed at each break in line or grade in each sanitary sewer line as shown on the contract drawings.

b. The manhole foundation shall be prepared so as to provide a firm, level area on which to place the precast concrete manhole base section. When poor foundation soil is encountered or excess groundwater exists, the foundation shall be excavated 12" below the final subgrade elevation backfilled with washed stone to provide a proper foundation.

c. The manhole sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the heavy concrete pieces. The manhole shall be set plumb and adjusted to the final finished surface grade with brick and mortar.

d. Pipe openings shall be exactly aligned to that of the pipe entering and leaving the manhole. The gravity sanitary sewer pipe lines shall be placed in the manhole openings, properly aligned, and set to grade. Sanitary sewer shall be connected to the manholes using lock joint flexible manhole sleeves or equal.

e. For large diameter pipe where a flexible rubber sleeve is not available, the pipe line shall be sealed into the manhole using an expanding type or non-shrink type grout.

f. For manhole steps, refer to the precast manhole section above.

3. Manhole Frames and Covers: The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole. Concrete brick, set in mortar, shall be used to adjust the top of the frame and cover to finished grade; however, no more than four (4) courses of brick will be used for adjustment.

4. Manhole Inverts:

a. Manhole inverts and benches shall be constructed in accordance with the standard details shown on the drawings. Invert shall be a U-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe. The benches shall be constructed with a slope of 1" per foot to the channel.

b. The channel and invert shall be constructed with a minimum of 2000 psi concrete or brick fill with concrete finish minimum 1" thick. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve with as large a radius as the diameter of the manhole will allow.

5. Manhole Drops: Standard drop manholes will be constructed only at those locations shown on the drawings or as approved by the Engineer. The design of the drop connection shall be in accordance with the standard detail drawing. The cost of the extra pipe, labor, etc. required to construct a drop manhole will be included in the unit price for the drop manhole at the depths listed.

6. Manhole Vents:

a. Where designated on the contract drawings, a 4" diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped in to the upper most

section of the manhole, anchored in concrete and extended vertically to the elevation shown on the drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.

b. The pipe material shall be Schedule 40 Galvanized Steel with two coats of epoxy paint approved by the Engineer.

7. Fittings (Force Main):

a. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum dimensions shown on the drawings or as directed. Thrust blocks shall be made of concrete and shall bear directly against the undisturbed trench wall. Where possible, the backing shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a polyethylene film placed between the fittings and the poured concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three days after installation of the concrete thrust blocks unless otherwise approved by the Engineer.

b. Where trench conditions are, in the opinion of the Engineer, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.

c. Concrete for thrust blocks shall consist of a mix of Portland Cement, fine and coarse aggregate and water to produce concrete with a minimum compressive strength at 28 days of not less than 3000 psi when tested in accordance with ASTM Specifications C 39 or C 42. Sakrete or any similar material will not be permitted under any circumstances.

8. Gate Valve and Valve Box (Force Main):

a. When shown on the contract drawings, a standard gate valve shall be installed in the sanitary sewer force main. Before setting each valve, the Contractor shall make sure the interior is clean and shall test the valve for proper opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the drawings, and at the exact location(s) shown on the drawings.

b. A standard type valve box shall be installed over each underground sanitary sewer force main valve. All valve boxes shall be set plumb with their top set flush with the finished grade.

c. Trench backfill shall be properly tamped for a distance of 3'-0" on each side of the valve and valve box.

9. Sewage Combination Air Relief Valve (Force Main):

a. A sanitary sewage combination air relief valve shall be installed at the locations shown on the contract drawings and the actual high points in the line.

b. A combination air relief valve installation, as shown in detail in the contract drawings, shall consist of the force main tap, air relief valve, precast concrete manhole sections, and standard heavy duty iron frame and cover.

10. Exposed Pipe:

a. Exposed pipe to be installed inside tanks, wetwells, vaults and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed ductile iron pipe shall utilize flanged joints unless otherwise noted.

b. All exposed cast or ductile iron pipe, fittings and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint manufacturer. Color of paint shall be as selected by the Owner.

C. Backfilling and Compaction:

1. Backfill trenches immediately after approval of the pipeline construction.

2. Pipes:

a. PVC pipe shall be installed using Class I embedment for 6" below the pipe and to the spring line per the standard detail. Class I embedment shall be defined as #67 washed stone or approved equal per NCDOT Standard Specifications. No additional payment shall be made for Class I embedment for PVC pipe.

b. For DIP pipe with backfill material other than Class I embedment, use backfill carefully placed in uniform layers not exceeding 6" in thickness to a depth of 2'-0" over the top

of the pipe. Place material and fill the area under the pipe haunches. Place each layer, moisten; then uniformly compact by use of hand, pneumatic, or mechanical tampers exercising care to prevent lateral displacement. Areas of backfill 2'-0" over top of pipe to top of trench, shall be backfilled with a material containing no rocks larger than 6" in the greatest dimension and shall be free of material with an exceptionally high void content. The initial backfill shall meet the same requirements except no rocks over 4" in diameter will be allowed.

c. Moisten backfill above 2'-0" over the top of the pipe and place in 8" layers. Compact each layer with hand, pneumatic or mechanical compactor. Puddling or flooding of trench for consolidation of backfill or use of wheel rolling by construction equipment will not be permitted.

d. Foundation stone as required for wet or unstable conditions per the details, shall be defined as #57 or #67 stone per NCDOT Standard Specifications or approved equal. Foundation stone shall be used only as directed by the Engineer and payment shall be per the contract unit prices for undercut.

3. If material excavated from the trench is unsuitable to be used as backfill, "select backfill" shall be transported to the site by the Contractor from outside the project limits to be used as backfill material. Material excavated in conjunction with the construction of the project is not considered "select backfill" for payment purposes.

4. Roadways and Road Crossings: Use backfill placed in uniform layers not exceeding 6" in thickness for full trench depth and width, thoroughly compacted with mechanical tampers under optimum moisture conditions to 95% compaction (100% for the top 2'-0" of subgrade beneath pavements). Replace removed paving and base course with new material of equal or better quality and of the same texture and color as the adjacent roadway.

5. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to 95% of the Standard Proctor Test (100% for the top 2'-0" of subgrade beneath pavements) for the various types of backfill material. Methods of backfilling shall be in strict accordance with the pipe manufacturer's recommendations. All backfill material shall have been approved by the Engineer. Select backfill material shall be used when requested by the Engineer.

6. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.

7. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material at no cost to the Owner. Pipe which becomes mis-aligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor at no cost to the Owner.

8. The Contractor shall maintain all pipes installed in a condition that they will function continuously from the time the pipe is installed until the project is accepted.

9. Cleanup:

   a. Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.

   b. Cleanup and seeding is part of the pipeline installation. No more than 3,000 LF of sewer line may be laid prior to completion of cleanup of the first section of pipeline laid. To facilitate this the Owner reserves the right to withhold up to 30% of the unit price bid for sewer line if in the opinion of the Owner and Engineer completed sections have not been properly cleaned.

3.02 QUALITY CONTROL

A. Testing:

1. Line Cleaning:

   a. Prior to inspection of any section(s) of gravity sanitary sewer pipe or force main the Contractor shall completely clean the lines of all debris, silt, etc. The pipe line shall be ready for use by the Owner and shall be proved to be in first class condition and constructed properly in accordance with the drawings and specifications,

b. The Contractor shall maintain the project, insofar as his construction work is concerned, in first class condition for such time as is necessary to satisfy the Engineer that all installations are correct and acceptable.

2. Inspection and Testing (Gravity Sewer):

a. Alignment and grade between manholes shall be tested by the Engineer by flashing a light between manholes. A full circle of light shall be seen when reviewed from the adjoining end of the line. All defects disclosed as a result of this test shall be corrected by the Contractor at his expense.

b. PVC pipe shall pass a go-no go Mandrel sized to 95% of the pipe diameter with the pipe in place and properly backfilled. All pipe which will not pass the Mandrel shall be relaid or replaced by the Contractor at no additional cost. The allowable deflection (less than 5%) shall be calculated using the pipe stiffness formula in ASTM D 2321. The mandrel test shall not take place until the final backfill has been in place for 30 days (minimum).

c. When the sewers are completed they shall be inspected by the Engineer for conformance with the provisions of the plans and specifications, particularly line and grade, and tested to determine the amount of ground water infiltration into the sewer. All visible and audible leaks will be stopped and the remaining infiltration will be measured using a V-notch weir and/or other devices, which shall be furnished by the Contractor. The Contractor shall also furnish all required assistance for measuring the infiltration.

d. If infiltration into the whole system or any segment thereof exceeds 100 gallons per 24 hours per inch of diameter per mile of sewer, necessary corrective measures shall be taken by the Contractor to limit the infiltration to the maximum specified above. The Engineer shall decide the number and length of segments of sewer line on which the testing shall be performed.

e. All gravity sanitary sewer lines shall be subjected to a low pressure air test to determine the presence of damaged pipe or faulty installation. The Contractor will furnish all facilities and personnel for conducting the test(s).

f. The acceptance air test shall be made after backfilling has been completed and compacted and in the presence of the

Engineer. The test shall be performed as described under ASTM C 828, latest edition, Standard Practice for Low Pressure Air Testing of V.C. Pipe lines.

i. Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

$$C = \frac{0.17 \times D^2 \times L}{T} + Q$$

Where: C=Required Compressor Capacity (cfm)
T=Required Test Time (min)
D=Pipe Internal Diameter (feet)
L=Length of Test Section (feet)
Q=Allowable Air Loss Rate (cfm)

The following allowable air loss rates will be used for all pipe tests:

PIPE SIZE	Q (cfm)	PIPE SIZE	Q(cfm)
4”	2.0	15”	4.0
6”	2.0	18”	5.0
8”	2.0	21”	5.5
10”	2.5	24”	6.0
12”	3.0		

ii. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 PSIG. At 3.5 PSIG, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of the groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of five (5) readings will be required for each test.

iii. If the time for the air pressure to decrease from 3.5 PSIG to 2.5 PSIG is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This

process shall be repeated until all sewer sections pass the air tests.

Minimum Test Time for Pipe

Pipe Size	4"	6"	8"	10"	12"	15"	18"	21"	24"
LENGTH TESTED									
25	0:04	0:10	0:17	0:22	0:26	0:31	0:36	0:44	0:53
50	0:09	0:20	0:35	0:44	0:53	1:02	1:12	1:29	1:47
75	0:13	0:30	0:53	1:06	1:20	1:34	1:48	2:14	2:40
100	0:17	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:33
125	0:22	0:50	1:29	1:51	2:13	2:36	3:00	3:43	4:27
150	0:26	1:00	1:47	2:13	2:40	3:07	3:36	4:27	5:20
175	0:31	1:10	2:04	2:35	3:07	3:39	4:12	5:12	6:14
200	0:35	1:20	2:22	2:58	3:33	4:10	4:48	5:57	7:07
225	0:40	1:30	2:40	3:20	4:00	4:41	5:24	6:41	8:00
250	0:44	1:40	2:58	3:42	4:27	5:13	6:00	7:26	8:54
275	0:49	1:50	3:16	4:05	4:53	5:44	6:36	8:10	9:47
300	0:53	2:00	3:33	4:27	5:20	6:15	7:12	8:55	10:41
325	0:58	2:10	3:51	4:49	5:47	6:47	7:48	9:40	11:34
350	1:02	2:20	4:09	5:11	6:14	7:18	8:25	10:24	12:28
375	1:06	2:30	4:27	5:34	6:40	7:49	9:01	11:09	13:21
400	1:11	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:14
425	1:15	2:50	5:02	6:18	7:34	8:52	10:13	12:38	15:08
450	1:20	3:00	5:20	6:40	8:00	9:23	10:49	13:23	16:01
475	1:24	3:10	5:38	7:03	8:27	9:54	11:25	14:07	16:55
500	1:29	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48
525	1:33	3:30	6:14	7:47	9:21	10:57	12:37	15:37	18:42
550	1:38	3:40	6:31	8:09	9:47	11:28	13:13	16:21	19:35
575	1:42	3:50	6:49	8:32	10:14	12:00	13:49	17:06	20:28
600	1:47	4:00	7:07	8:54	10:41	12:31	14:25	17:51	21:22

iv. For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$L_e = \frac{d^2 \times l}{D^2}$$

Where: L_e=Effective Pipe Length (added to Total Test Length)
d=Diameter of Service Lateral Pipe
l=Length of Sewer Lateral
D=Diameter of Sewer Main Pipe being tested

g. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine, at his own expense, the source(s) of leakage, and repair or replace all defective materials or workmanship. The repaired section(s) of line shall be re-tested to insure conformance with the requirements of these contract specifications.

3. Inspection and Testing (Force Main):

a. When the sanitary sewer force main is completed, the Engineer shall inspect the line for conformance with the provisions of the drawings and specifications, particularly with respect to alignment and depth.

b. All newly constructed sanitary sewer force main and valved sections shall be subjected to a hydrostatic pressure-leakage test. Force mains shall be tested in sections not to exceed 4,000 lineal feet per test section. The Contractor shall install sufficient additional valves if not shown on the drawings to allow testing.

c. Each completed section of the pipeline shall be plugged at both ends and slowly filled with water. As the main is being filled with water in preparation of the test, all air shall be expelled from the pipe. The main shall be subjected to hydrostatic pressure of 100 pounds per square inch for a period of two hours unless otherwise specified. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.

d. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measure of the water added during the test until the rate has stabilized at the constant value for three consecutive 15 minute periods.

e. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than ten (10) gallons per inch of pipe diameter per mile of pipe per 24 hours.

f. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.

g. Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping in buildings, structures or on bridges.

h. The Contractor shall notify the Engineer when the work is ready for testing with all testing done in the presence of the Engineer. All labor, equipment, water and materials, including meters and gauges, shall be furnished by the Contractor at his own expense.

4. Inspection and Testing (Manholes): Manholes shall be constructed to provide a true circular inside diameter with properly corbeled tops, satisfactory inverts and properly placed steps and castings. Any visible leaks in the manholes shall be completely stopped to the satisfaction of the Engineer.

B. Final Acceptance:

1. The Engineer will notify the Contractor, in writing, as to the satisfactory completion of the work in any or all sections of gravity sanitary sewer pipe, force main and manholes, included in the project.

2. Upon such notification, the Contractor shall immediately remove all construction equipment, excess materials, tools, debris, etc. from the site(s) and leave the same in a neat, orderly condition acceptable to the Engineer.

3. Final landscaping requirements and restoration of surfaces shall then be completed by the Contractor in accordance with their respective specifications and as shown on the drawings.

END OF SECTION

SECTION 02731 SANITARY SEWER SERVICE CONNECTION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered under this section shall consist of furnishing all materials, labor, equipment, and services for the complete installation of a sanitary sewer service connection from the sanitary sewer (gravity) main line to the edge of the property to be served as shown on the project drawings.

PART 2: PRODUCTS

2.01 MATERIALS

A. Main line connections shall use a "wye" branch constructed by the same material as the main line.

B. Sewer service lines shall be constructed of either PVC (Schedule 40) or Ductile Iron (CL350) as shown on plans.

C. When joining pipes of different materials, a flexible, watertight, rubber transition coupling shall be used.

PART 3: EXECUTION

3.01 INSTALLATION

A. Connection to Main: The standard sewer service connection shall be 4” in diameter unless shown otherwise on the drawings, and shall connect to the main at a "wye" branch connection installed with the pipe line as it is being laid. The "wye" branch shall be of the same material as the main pipe line. Direct taps into the sewer main will not be acceptable unless approved by the Engineer prior to the laying of the main line.

B. Connection to Manhole: When shown on the drawings or directed by the Engineer, a sewer service connection shall be made into a manhole. The connection shall be made at the manhole invert. The invert shall be rebuilt so as to provide a smooth transition from service connection to main line. Inverts and benches shall be constructed in such a way as to prevent the deposition of solids in the manhole.

C. Service Lines: The service line shall be installed from the "wye" branch connection to the edge of the public or utility right-of-way as shown on the plans.

Less than 3’-0” of cover will require the use of ductile iron pipe.

D. Cleanout and Plug: At the edge of the public or utility right-of-way, a "cleanout" shall be installed. The cleanout shall consist of a "wye" branch connection, 45° bend, riser pipe, and threaded plug installed flush with finished ground elevation.

The end of the utility owner's sewer service connection shall terminate at the end of the pipe which will normally extend five feet beyond the "wye" branch for the cleanout. A watertight plug shall be installed at the end of this line until such time as the property owner connects his facilities to the sewer system.

END OF SECTION

SECTION 02830 FENCING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the installation of fencing, complete as shown on the plans and described herein.

1.02 SYSTEM DESCRIPTION

A. Unless otherwise indicated on the plans, all fencing will be 6'-0" nominal height, using 2", 9-gauge woven wire mesh fabric with 3 strands of barbed wire hung on angle brackets. The fencing will be supported by posts and a top rail.

1.03 QUALITY ASSURANCE

A. The Manufacturer shall be reputable and shall be experienced in the manufacture of chain link fencing.

1.04 SUBMITTALS

A. Shop Drawings: Six (6) sets of shop drawings shall be submitted to the Engineer for approval. Shop drawings shall include material specifications and manufacturer's drawings.

1.05 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered, stored and handled in strict accordance with the manufacturer's recommendations, and shall be properly protected.

1.06 WARRANTY

A. All materials shall be warranted to be free from defects in workmanship and design for a period of one (1) year.

PART 2: PRODUCTS

2.01 MATERIALS

A. Chain Link Fencing:

1. Fabric shall be zinc coated Class II chain link per ASTM Specification A-392-Latest Revision.

2. Barbed wire shall have a Class 3 galvanized coating per ASTM A121-Latest Revision and consist of two 12-1/2 gauge stranded wire lines with 14 gauge barbs in a four point pattern on 5” centers.

3. Top rail shall be 1-1/4" standard weight pipe.

4. Line posts shall be 2" standard weight pipe, or 4.1 lb. per foot "H" section.

5. End, corner and pull posts shall be 2-7/8" OD pipe ± 5.79 lb. per foot, or 3-1/4” by 3-1/4” roll formed sections with integral fabric loops, 5.14 lb. per foot.

B. Swing Gate Posts: Posts for swing gates shall be sized according to the following gate leaf widths:

		lb. per lin. ft.
Up to 6'	3-1/3" x 3-1/2" roll formed section or 2-7\8" OD Pipe	5.14 5.79
Over 6' to 13'	4" OD Pipe	9.11
Over 13' to 18'	6-5/8" OD Pipe	18.97
Over 18'	8-5/8" OD Pipe	24.70

C. Gate Frames: Gate frames shall be 1.90” OD connected with fittings riveted at each corner. Each frame shall have 3/8” diameter adjustable truss rods. Gates shall have positive type latching devices with provision for padlocking; and drive gates shall have a center plunger rod, catch, and semi-automatic outer catches.

D. Coatings: All posts, rails, and appurtenances shall be hot-dipped zinc coated steel according to ASTM Specifications A-120-Latest Revision and A-123-Latest Revision or A-153-Latest Revision whichever is applicable. Pipe posts shall have tops which exclude moisture.

PART 3: EXECUTION

3.01 INSTALLATION

A. Posts:

1. Each post shall be set plumb in a foundation of 2,500 psi concrete having a minimum diameter of 9" or three times the diameter of the post and at least 36" deep. Line posts shall be evenly spaced 10'-0" or less apart, true to line.

2. Top rail shall pass through line post tops to form a continuous brace within each stretch of fence and securely fastened to terminal posts. End, corner, pull and gate post trussed to line posts with 3/8" rods and tighteners.

B. Fabric: Fabric shall be connected to line posts with 6-gauge wire clips 14" on center; to top rails with 9-gauge wires 24" on center; to terminal, corner and gate posts by integrally weaving into the post or by using 3/4" by 1/4" tension bars fastened to the post by 11-gauge x 1" wide steel bands and 3/8" bolts and nuts spaced 14" on center.

END OF SECTION

SECTION 02905 RESTORATION OF SURFACES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing of all labor, equipment and materials necessary for the proper restoration of existing surfaces disturbed or damaged as a result of construction operations which are not specifically scheduled or specified for topsoil and seeding, paving, landscaping or other surfacing.

B. In general, the types of replacement included in this section are seeding along pipelines, concrete sidewalks, driveways, roadways, ditches, lawns and landscaped areas, and curb and gutter.

C. Any damage to existing structures shall be repaired using materials and workmanship equal to those of original construction.

PART 2: NOT USED

PART 3: EXECUTION

3.01 RESTORATION OF SURFACES

A. Seeding Along Pipelines:

1. All ground surfaces along pipelines, which are not classified as lawns, landscaped areas, or pavement areas, but would be classified as open fields, shall be raked smooth and seeded in accordance with Section 02931 entitled Seeding, Fertilizing and Mulching. Large rocks, clumps of earth and excessive spoil material shall be removed from the area prior to seeding.

2. Shoulders of all roads shall be restored as specified for lawns and landscaped areas.

3. Wooded areas not classified as lawns shall be restored to as near their original condition as possible.

B. Concrete Sidewalks:

1. Concrete walks removed in connection with, or damaged as a result of, construction operations under the Contract shall be replaced with new construction. Such walks shall be constructed of

Class B concrete on a thoroughly compacted subgrade, shall have a vertical thickness, unless otherwise noted, of not less than 4" or the thickness of the replaced walk where greater than 4".

2. Walks shall be float finished, edged with an edging tool, and grooved at intermediate intervals not in excess of the width of the walk, uniform throughout the length of the walk in any one direction.

C. Driveways:

1. Unless otherwise noted, unpaved driveways shall be surfaced with not less than 4" of CABC, topped with 4" of stone, gravel, or other materials equal to that found in the original driveway. Driveways shall be left in a condition better than their original condition.

2. Concrete drives shall be replaced with Class B concrete and shall have equal thickness and reinforcing steel to that of the original drive. Prior to placing the concrete a 6" aggregate base course shall be placed in the drive area.

3. Unless otherwise noted, bituminous or Asphaltic concrete drives shall be restored to original base and asphalt thicknesses or a minimum of 6" aggregate base course and a 2" surface course, whichever is greater. Base material shall be compacted in 3-inch lifts and Type SF 9.5A or S 9.5B asphalt compacted in 2-inch lifts to match existing pavement section. All work shall be in accordance with the section entitled Bituminous Pavement Repairs.

D. Roadway Replacement:

1. Bituminous or Asphaltic pavements shall include all areas paved with blacktop, built-up pavements or oil and stone, tar and stone and similar pavements constructed with a bituminous or asphalt and stone materials.

2. Immediately upon completion of installation of underground piping and structures, the trench shall be backfilled and the roadway shall be repaired. Provide materials as specified in the Contract Drawings. If, in the opinion of the Engineer, the area adjacent to the excavation has not been damaged to the extent that the base course need to be replaced, restoration may consist of a surface course of sufficient thickness to meet the existing pavement.

3. Portland cement concrete roadways shall be replaced with Class B Concrete and shall have equal thickness and reinforcing steel as

the original roadway. An aggregate base course with a thickness of 6” shall be placed prior to the placing of concrete.

4. Differential settlement of restored pavements shall be corrected immediately.

5. The Contractor shall repair and restripe any traffic markings that were damaged, removed or covered during construction. All work shall be done in accordance with NCDOT requirements and specifications.

6. All existing manhole and valve covers shall be raised, as required, by the Contractor prior to paving. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made.

E. Ditches: Ditches shall be regraded to the original grade and line. The surface of all ditches shall be returned to the same condition as found before commencing work.

F. Lawns and Landscaped Areas:

1. Lawns and landscaped areas shall be regraded and replaced as follows:

a. Grading shall be to the grade existing before construction of the work under this Contract.

b. Lawn replacement shall be in accordance with Section 02900 entitled Landscaping. Topsoiled areas shall be replaced with topsoil of equal quality and quantity.

2. Landscaped areas shall be replaced with shrubs, hedges, ornamental trees, flowers, or other items to original condition.

G. Curb and Gutter: Curb and gutter removed with or damaged as a result of construction operations, injured or disturbed by the Contractor, his agents, or employees, shall be replaced with new construction to a condition similar and equal to that existing before damage was incurred. Class B Concrete shall be used in curb and gutter replacement.

H. Damage to Structures: Any damage to existing structures shall be repaired of materials and workmanship equal to those of original construction. Extensively damaged structures, where the structural stability has been affected or which cannot be repaired in a suitable fashion shall be replaced entirely. Replacement shall not commence until

approval of the plan of replacement has been given by the Engineer. Replacement costs shall be responsibility of the Contractor.

END OF SECTION

SECTION 02931 SEEDING, FERTILIZING AND MULCHING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing of all labor, equipment and materials necessary for the landscaping of all areas of the site disturbed by construction operations and all earth surfaces of embankments including rough and fine grading, topsoil if required, fertilizer, lime, seeding and mulching. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth of the grasses or legumes.

PART 2: PRODUCTS

2.01 MATERIALS

A. Fertilizer:

1. The quality of fertilizer and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Fertilizer Law and regulations adopted by the North Carolina Board of Agriculture.

2. Fertilizer shall be 10-10-10 grade. Upon written approval of the Engineer a different grade of fertilizer may be used, provided the rate of application is adjusted to provide the same amounts of plant food.

3. During handling and storing, the fertilizer shall be cared for in such a manner that it will be protected against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer shall be pulverized to its original conditions before being used.

B. Lime:

1. The quality of lime and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Lime Law and regulations adopted by the North Carolina Board of Agriculture.

2. During the handling and storing, the lime shall be cared for in such a manner that it will be protected against hardening and caking.

Any hardened or caked lime shall be pulverized to its original condition before being used.

3. Lime shall be agriculture grade ground dolomitic limestone. It shall contain not less than 85% calcium and magnesium carbonates and shall be of such fineness that at least 90% will pass a No. 10 sieve and at least 50% will pass a No. 100 sieve.

C. Seed:

1. The quality of seed and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Seed Law and regulations adopted by the North Carolina Board of Agriculture.

2. Seed shall have been approved by the North Carolina Department of Agriculture or any agency approved by the Engineer before being sown, and no seed will be accepted with a date of test more than nine (9) months prior to the date of sowing. Such testing however, will not relieve the Contractor from responsibility for furnishing and sowing seed that meets these specifications at the time of sowing. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the Contractor may elect, subject to the approval of the Engineer, to increase the rate of seeding sufficiently to obtain the minimum pure live seed contents specified, provided that such an increase in seeding does not cause the quantity of noxious weed seed per square yard to exceed the quantity that would be allowable at the regular rate of seed.

3. During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents, or other causes.

4. Seed shall be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, and Bermuda Grass. The specifications for restricted noxious weed seed refers to the number per pound, singly or collectively, of Blessed Thistle, Wild Radish, Canada Thistle, Corncockle, Field Bindweed, Quackgrass, Dodders, Dock, Horsenettle, Bracted Plantain, Buckhorn or Wild Mustard; but in no case shall the number of Blessed Thistle or Wild Radish exceed 27 seeds of each per pound. No tolerance on weed seed will be allowed.

D. Mulch: Straw mulch shall be threshed straw of oats, rye or wheat free from matured seed of noxious weeds or other species which would grow and be detrimental to the specified grass.

E. Tackifier: Emulsified asphalt or organic tackifier shall be sprayed uniformly on mulch as it is ejected from blower or immediately thereafter. Tackifier shall be applied evenly over area creating uniform appearance. Rates of application will vary with conditions. Asphalt shall not be used in freezing weather.

PART 3: EXECUTION

3.01 PREPARATION

A. Protection of Existing Trees and Vegetation:

1. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, and smothering of trees by stockpiling construction materials or excavated materials, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

2. Provide protection for roots over 1-1/2" diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out and cover with earth as soon as possible.

3. The Contractor shall not remove or damage trees and shrubs which are outside the Clearing Limits established by the Owner or those within the Clearing Limits designated to remain.

4. Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to the Engineer. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

5. Replace trees scheduled to remain and damaged beyond repair by construction operations, as determined by the Engineer, with trees of similar size and species. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at the Contractor's expense.

B. Grading:

1. Rough grading shall be done as soon as all excavation required in the area has been backfilled. The necessary earthwork shall be accomplished to bring the existing ground to the desired finish elevations as shown on the Contract Drawings or otherwise directed.

2. Fine grading shall consist of shaping the final contours for drainage and removing all large rock, clumps of earth, roots and waste construction materials. It shall also include thorough loosening of the soil to a depth of 6" by plowing, discing, harrowing or other approved methods until the area is acceptable as suitable for subsequent landscaping operations. The work of landscaping shall be performed on a section by section basis immediately upon completion of earthwork.

3. Upon failure or neglect on the part of the Contractor to coordinate his grading with seeding and mulching operations and diligently pursue the control of erosion and siltation, the Engineer may suspend the Contractor's grading operations until such time as the work is coordinated in a manner acceptable to the Engineer.

C. Seedbed Preparation:

1. The Contractor shall cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. Uneven and rough areas outside of the graded section, such as crop rows, farm contours, ditches and ditch spoil banks, fence line and hedgerow soil accumulations, and other minor irregularities which cannot be obliterated by normal seedbed preparation operations, shall be shaped and smoothed as directed by the Engineer to provide for more effective seeding and for ease of subsequent mowing operations.

2. The soil shall then be scarified or otherwise loosened to a depth of not less than 6" except as otherwise provided below or otherwise directed by the Engineer. Clods shall be broken and the top 2" to 3" of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows; or by other methods approved by the Engineer.

3. On 2:1 slopes a seedbed preparation will be required that is the same depth as that required on flatter areas, although the degree of

smoothness may be reduced from that required on the flatter areas if so permitted by the Engineer.

4. On cut slopes that are steeper than 2:1, both the depth of preparation and the degree of smoothness of the seedbed may be reduced as permitted by the Engineer, but in all cases the slope surface shall be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches in which the seeding materials can lodge.

5. On cut slopes that are either 2:1 or steeper, the Engineer may permit the preparation of a partial or complete seedbed during the grading of the slope. If at the time of seeding and mulching operations such preparation is still in a condition acceptable to the Engineer, additional seedbed preparation may be reduced or eliminated.

6. The preparation of seedbeds shall not be done when the soil is frozen, extremely wet, or when the Engineer determines that it is in an otherwise unfavorable working condition.

D. Application Rates: Seed shall be applied by means of a hydro-seeder or other approved methods. The rates of application of seed, fertilizer and limestone shall be as stated below.

1. Lime and Fertilizer: In the absence of a soil test, the following rates of application of limestone and fertilizer shall be:

   a. 4,000 pounds limestone per acre
   b. 1,000 pounds 10-10-10 (N-P_2O_5-K_2O) fertilizer per acre and the remaining quantity applied when vegetation is three (3) inches in height or 45 days after seeding, whichever comes first.

2. Mulch: Mulch shall be applied at the following rates per acre:

   a. 3,000-4,000 pounds straw mulch, or
   b. 1,500-2,000 pounds wood cellulose fiber.
   c. 35-40 cubic yards of shredded or hammermilled hardwood bark
   d. 1,200-1,400 pounds of fiberglass roving

3. Seed: The kinds of seed and the rates of application shall be as contained in this table. All rates are in pounds per acre. *See Notes 1 and 2*.

a. Fall and Winter (Normally August 1 to June 1)
80 pounds of Ky-31 tall fescue and 15 pounds of rye grain

b. Summer (Normally May 1 to September 1)
100 pounds of Ky-31 tall fescue

NOTES:

1. On cut and fill slopes having 2:1 or steeper slopes, add 15 pounds of sudangrass to the planned seeding in summer seeding or 25 pounds of rye cereal per acre in fall and winter seeding, if seeded September to February.

2. These seeding rates are prescribed for all sites with less than 50% ground cover and for sites with more than 50% ground cover where complete seeding is necessary to establish effective erosion control vegetative cover. On sites having 50% to 80% ground cover where complete seeding is not necessary to establish vegetative cover, reduce the seeding rate at least one-half the normal rate.

E. Application:

1. Equipment to be used for the application, covering or compaction of limestone, fertilizer, and seed shall have been approved by the Engineer before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition, or if the equipment operation damages the seed.

2. Limestone, fertilizer, and seed shall be applied within 24 hours after completion of seedbed preparation unless otherwise permitted by the Engineer, but no limestone or fertilizer shall be distributed and no seed shall be sown when the Engineer determines that weather and soil conditions are unfavorable for such operations.

3. Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed at the specific rate of application and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.

4. Seed shall be distributed uniformly over the seedbed at the required rate of application, and immediately harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. The depth of covering shall be as directed by the Engineer. If two kinds of seed are to be used which require different depths of covering, they shall be sown separately.

5. When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If two kinds of seed are being used which require different depths of cover, the seed requiring the lighter cover may be sown broadcast or with a special attachment to the drill, or drilled lightly following the initial drilling operation.

6. When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Engineer.

7. Immediately after seed has been properly covered, the seedbed shall be compacted in the manner and degree approved by the Engineer.

8. When adverse seeding conditions are encountered due to steepness of slope, height of slope, or soil conditions, the Engineer may direct or permit that modifications be made in the above requirements which pertain to incorporating limestone into the seedbed; covering limestone, seed, and fertilizer; and compacting the seedbed.

9. Such modifications may include but not be limited to the following:

    a. The incorporation of limestone into the seedbed may be omitted on

        i. cut slopes steeper than 2:1;

        ii. on 2:1 cut slopes when a seedbed has been prepared during the excavation of the cut and is still in an acceptable condition; or

        iii. on areas of slopes where the surface of the area is too rocky to permit the incorporation of the limestone.

    b. The rates of application of limestone, fertilizer, and seed on slopes 2:1 or steeper or on rocky surfaces may be reduced or eliminated.

    c. Compaction after seeding may be reduced or eliminated on slopes 2:1 or steeper, on rocky surfaces, or on other areas where soil conditions would make compaction undesirable.

F. Mulching:

1. All seeded areas shall be mulched unless otherwise indicated in the special provisions or directed by the Engineer.

2. Mulch shall be spread uniformly at a rate of two (2) tons per acre in a continuous blanket over the areas specified.

3. Before mulch is applied on cut or fill slopes which are 3:1 or flatter, and ditch slopes, the Contractor shall remove and dispose of all exposed stones in excess of 3" in diameter and all roots or other debris which will prevent proper contact of the mulch with the soil.

4. Mulch shall be applied within 24 hours after the completion of the seeding unless otherwise permitted by the Engineer. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.

5. Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

6. Mulch shall be held in place by applying a sufficient amount of asphalt or other approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall meet the approval of the Engineer. Where the binding material is not applied directly with the mulch it shall be applied immediately following the mulch operation.

7. The Contractor shall take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind, water, or other causes and shall promptly remove any blockage to drainage facilities which may occur.

G. Maintenance:

1. The Contractor shall keep all seeded areas in good condition, reseeding and mowing if and when necessary as directed by the Engineer, until a good lawn is established over the entire area seeded and shall maintain these areas in an approved condition until final acceptance of the Contract.

2. Grassed areas will be accepted when a 95% cover by permanent grasses is obtained and weeds are not dominant. On slopes, the

Contractor shall provide against washouts by an approved method. Any washouts which occur shall be regraded and reseeded until a good sod is established.

3. Areas of damage or failure due to any cause shall be corrected by repair or by being completely redone as may be directed by the Engineer. Areas of damage or failure resulting either from negligence on the part of the Contractor in performing subsequent construction operations or from not taking adequate precautions to control erosion and siltation as required throughout the various sections of the specifications shall be repaired by the Contractor as directed by the Engineer at no cost to the Owner.

END OF SECTION

SECTION 03301 MISCELLANEOUS CONCRETE CONSTRUCTION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers concrete construction, complete, including reinforcement therefore.

PART 2: PRODUCTS

2.01 MATERIALS

A. Reinforcing: Bar reinforcement shall be intermediate grade new billet steel conforming to the requirements of ASTM A-615. Unless otherwise noted, all reinforcing bars shall be grade 60. Wire fabric reinforcement shall consist of steel wire conforming to the requirements of ASTM A-185, latest revision.

B. Concrete: All concrete shall be equivalent to ready mix concrete manufactured and delivered in accordance with the requirements of ASTM C-94, latest revision and having a compressive strength at 28 days of 4000 psi, except as noted herein. The concrete manufacturer shall assume the responsibility of the design of the concrete mix in accordance with Alternate No. 2 of ASTM C-94. Air entrained concrete shall be used for all concrete exposed to the elements.

a. Cement shall be Type 1 or Type 1A "Portland" cement conforming to ASTM C-150, latest revision or ASTM C-175, latest revision respectively.

b. Aggregates shall conform to ASTM C-33, latest revision. Coarse aggregate shall be crushed rock or gravel and graded from 3/4" to #4 sieve for walls and slabs and from 2" to #4 sieve for mass or foundation concrete. Fine aggregate shall be natural sand.

c. Mixing water shall be proportioned so that slump when measured with standard slump cone does not exceed the following:

i. Slabs in grade ..... Max. 4", Min. 3"

ii. Footings..... Max. 5", Min. 3"

iii. All others ..... Max. 6", Min. 3"

d. Premolded joint filler strips shall be resilient compressive, bituminous and fiber material saturated, with at least 35% and not

over 50% by weight of asphalt. Poured type joint composition for expansion joints shall be elastic compound made up of asphalt and colloidal mineral fillers.

PART 3: EXECUTION

3.01 FORMS

A. Forms shall be wood, metal, structural hardboard or other suitable material that will produce the required surface finish. Forms placed for successive pours for continuous surfaces shall be fitted to accurate alignment to assure a smooth completed surface free from irregularities, and shall be sufficiently tight to prevent the loss of mortar. No forms shall be left permanently in place without approval of the Engineer. Holes resulting from removal of form ties shall be filled solid within 12 hours after removal of forms with cement mortar.

3.02 PLACEMENT

A. Concrete shall be placed as nearly as possible in its final position. Runways for wheeled equipment shall not be supported on the reinforcement. Concrete shall be placed and compacted in layers not over 18 inches deep. Vibrators may be used provided they are used under experienced supervision and the mixture is dry enough to prevent segregation. Form vibrators shall not be used. Vibration shall not be used for transporting or moving concrete inside the forms. No more concrete shall be placed than can be consolidated and finished the same day as placed. Free fall of concrete shall be limited so that no segregation of materials occurs.

3.03 JOINTS

A. Construction of joints not indicated on drawing shall be approved by the Engineer in advance of pour. Joints in foundation walls shall be keyed. Before depositing of concrete is resumed, the hardened surface shall be roughened, cleaned and wetted surfaces shall be slushed with a coating of neat cement grout against which the new concrete shall be placed before the new grout has attained its set.

3.03 FINISHING

A. After stripping forms, all voids and honeycombs shall be patched by chipping and scarifying the defective area and treating it with an approved bonding tended that all such voids be patched, not merely plastered. Grout mixture shall consist of one part Portland cement and one part sand. Immediately following removal of forms, all fins and irregular

projections shall be removed from all surfaces except from those which are not to be exposed or waterproofed.

B. Slabs shall be struck off and consolidated by approved machine or hand methods, so that upon completion, the surface shall be true to grade as shown on drawings and free of surface voids. All floors shall have monolithic steel trowel finish unless otherwise indicated on the drawings. Exterior walks shall be compacted, screeded and floated to a true even surface with wood floats and then broomed.

END OF SECTION

SECTION 11312 SUBMERSIBLE GRINDER SEWAGE PUMPS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of furnishing and installing two (2) grinder submersible sewage pumps, controls and accessories.

B. The pump station shall include duplex grinder submersible pumps with motors installed on lift-out rail systems, access hatch, controls, piping, valves and other necessary appurtenances as shown on the drawings and in accordance with the specifications herein stated.

C. Unless otherwise noted, all materials and equipment supplied under this Section shall be new, of good quality, and in good condition.

1.02 SYSTEM DESCRIPTION

A. Pump Design: Each pump shall be of the submersible grinder type with submersible motor. Pump shall be designed for automatic connection to the discharge connection elbow, guided by no less than two guide rails extending from the top of the station to the discharge elbow. Requirements **per pump** are as follows:

Pumping conditions shall be as follows:

Capacity	80 GPM
Total Head	126 Feet
Maximum Speed	3450 RPM
Minimum Shutoff Head	200 Feet
Discharge Size	3 Inches
Power Requirement	230 volt, 3 phase, 60Hz
Maximum Horsepower	10 HP

1.03 QUALITY ASSURANCE

A. Manufacturer: The pumps and all appurtenances shall be supplied by reputable manufacturers with at least ten (10) years of experience.

B. Factory Tests:

1. General: The pumps shall be tested at the factory under simulated field conditions for excessive vibration, leaks, and operation of all automatic systems. The controls shall be adjusted to start and stop

the pumps to satisfy field conditions. For each unit, a pump performance curve shall be produced from the factory testing. Its veracity shall be certified and the curves shall be identifiable by serial numbers of pumps and motors. **Manufacturer shall submit six (6) copies of a certified curve for each pump to the Engineer prior to the shipment of the pump.** Engineer will judge adequacy of performance and distribute copies of curves appropriately.

2. Pump Test: The pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory:

   a. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.

   b. A motor and cable insulation test for moisture content or insulation defects shall be made.

   c. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

   d. The pump shall be run submerged in water to a minimum of six (6) feet.

   e. After operational test (d), the insulation test (b) is to be performed again.

   A written statement indicating the foregoing steps have been done with each pump shall be supplied to the Engineer prior to shipment of the pump.

1.04 SUBMITTALS

A. Shop Drawings: The manufacturer shall supply a minimum of five (5) sets of standard Submittal Drawings and Parts List. Standard submittals will consist of:

   1. Pump Outline Drawing
   2. Control Data
   3. Access Frame
   4. Typical Installation Guides
   5. Technical Manuals
   6. Parts List

B. Verification of Pumping Application: As part of the shop drawing submittal, the manufacturer shall supply a letter certifying that the manufacturer has reviewed the Contract drawings and specifications, including all

addendums, and that the equipment and related accessories included in the shop drawing submittal are suitable for installation in the pumping applications proposed for the project.

C. Operation and Maintenance Manuals: The manufacturer shall furnish three (3) complete sets of operation and maintenance manuals for the pumps supplied.

1.05 DELIVERY, STORAGE AND HANDLING

A. The equipment and materials shall be delivered, stored and handled in strict accordance with the manufacturer's recommendations.

B. **Pumps and their electrical components can become damaged and require frequent maintenance and/or their operating life may be shortened if pumps and pump cords are subjected to moisture prior to startup of the pump station. Therefore, pumps and their electrical components shall be stored indoors in dry conditions and not within the wet well. Contractor shall not install pumps and their electrical components in the wet well until wet well construction is complete, the wet well is dewatered, the wet well is cleaned, the pump station is ready for startup, and the Engineer has released, in writing, the pumps for installation. Failure by the Contractor to obtain a written release from the Engineer in a timely manner will not constitute extension of the project's completion date.**

1.06 WARRANTY

A. Pump Warranty: The pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and material for a period of five (5) years or 10,000 hours under the Municipal Wastewater-Permanent Installation Warranty Policy or one (l) year under the Industrial-Permanent Installation Warranty Policy under normal use, operation and service. The warranty shall be in printed form and apply to all similar units.

B. Appurtenances Warranty: All accessories and appurtenances shall be warranted against defects in workmanship and materials for a period of one (1) year.

1.08 MANUFACTURER AND SUPPLIER INFORMATION

A. Manufacturer Nameplate: A manufacturer's nameplate shall be securely and permanently mounted to each individual piece of equipment furnished under this Section. The nameplate shall be constructed of a durable, non-corrosive material. Critical information shall be clearly engraved or

otherwise permanently stamped on the nameplate, and shall be fully legible. The information contained on the manufacturer nameplate shall include at least the following:

1. Manufacturer's Serial Number
2. Name, address and telephone number of equipment manufacturer
3. Model and/or Part Number, including pump impeller sizes, when applicable
4. Performance Criteria (i.e., capacity, design point, etc.)
5. Motor size, speed and voltage
6. Enclosure Type or Rating
7. Any other pertinent information

Note: All equipment shall include a nameplate with a manufacturer serial number validating the equipment as new. Failure to meet these requirements will be cause for rejection of the equipment.

B. Supplier and Service Information: A durable nameplate, stamp or sticker shall be adhered to each individual piece of equipment containing the name, address, and telephone number of the local business that supplied the equipment, and the name, address and telephone number of the local business that can provide service and replacement parts for the equipment. A 24-hour emergency service telephone number should also be included.

PART 2: PRODUCTS

2.01 EQUIPMENT

A. Pumps: Pumps shall be installed in such a way that solids are fed in an upflow direction to the impeller with no feet, rails or other obstructions below inlet. Impeller shall be of the recessed type to provide unobstructed passage of ground solids through the volute. Impeller shall be ductile iron and driven by a stainless steel shaft key. Enclosed or semi-open impellers which might become obstructed during grinding or add excessive radial loads shall not be considered as equal.

B. Grinder Assembly: Grinder assembly shall consist of a single rotating grinder impeller and a single stationary shredding ring mounted directly below pump volute inlet. Grinder impeller shall thread onto shaft and shall be locked with a screw and washer. Shredding ring shall be held in place by a steel retaining clamp. Both shredding ring and grinder impeller shall be removable without dismantling pump. No adjustment of grinder assembly shall be necessary to provide proper grinder operation. Multiple

grinder impeller assemblies requiring initial or periodic axial adjustment for proper operation shall not be considered equal. Grinder impeller and shredding ring shall be made of 440C stainless steel hardened to 50-60 Rockwell.

Grinder assembly shall be capable of macerating materials in normal domestic sewerage, including items used in maintaining normal sanitary hygiene such as: disposable diapers, sanitary napkins, rubber and the like into a fine slurry.

C. Motor Design:

1. Motors shall be sealed; submersible type, each rated at 10 Hp (maximum), 3-Phase, 230 Volts, 60 Hz, with a 1.3 service factor.

2. Motors shall be sized to ensure that they are non-overloading throughout the entire pump curve associated with this application.

3. Stator winding shall be of the open type with insulation good for 180^{o} C (356^{o} F) maximum temperature. Winding shall operate in clean high dielectric oil that lubricates bearings and seals and transfers heat from windings to outer shell. Motor shall be heat shrunk into housing for proper alignment and superior heat transfer.

4. Motor shall have two heavy duty ball bearings to support pump shaft and take radial and thrust loads and a sleeve guide bushing directly above the lower seal to take radial load and act as a flame path for seal chamber. Ball bearings shall be designed for a minimum B10 life of 30,000 hours.

5. A heat sensor thermostat shall be imbedded in top of winding and be connected in series with the motor starter coil in control box to stop motor if temperature rises in motor to over 220^{o} F for any reason. Thermostat to reset automatically when temperature drops to a safe limit. Motors shall also be equipped with a moisture sensor which signals an alarm if moisture is present between the two seals.

6. Pump motor cables shall be suitable for submersible pump applications. Cable sizing shall conform to NEC requirements for the full load currents of the motors.

C. Motor Design:

7. Motors shall be of the sealed, submersible type, conforming to all requirements set forth in Part 1.02 of this Specification, and have a 1.15 service factor.

8. Motors shall be sized to ensure that they are non-overloading throughout the entire pump curve associated with this application.

9. Stator winding shall be of the open type with insulation good for 180^{o} C (356^{o} F) maximum temperature. Winding shall operate in clean high dielectric oil that lubricates bearings and seals and transfers heat from windings to outer shell. Air-filled motors which do not have the superior heat dissipating capabilities of oil-filled motors shall not be considered equal.

10. Motor shall have two heavy duty ball bearings to support pump shaft and take radial and thrust loads and a sleeve guide bushing directly above the lower seal to take radial load and act as a flame path for seal chamber. Ball bearings shall be designed for a minimum B10 life of 50,000 hours. Stator shall be heat shrunk into motor housing for proper alignment.

11. A heat sensor thermostat shall be attached to and embedded in top of winding and be connected in series with the motor starter coil to stop motor if temperature rises in motor to over 130^{o} C for any reason. Thermostat to reset automatically when temperature drops to a safe limit. Three (3) heat sensors shall be used on 3-phase motors. The common motor pump and grinder shaft shall be 416 stainless steel.

12. Pump motor cables shall be suitable for submersible pump applications. Cable sizing shall conform to NEC requirements for the full load currents of the motors.

D. <u>Seals</u>:

1. Motor shall be protected by two mechanical seals mounted in tandem with a seal chamber between the seals. Seal chamber shall be oil filled to lubricate seal face and to transmit heat from shaft to outer shell.

2. Seal face shall be carbon and ceramic and lapped to a flatness of one light band.

3. A double electrode shall be mounted in the seal chamber to detect any water entering the chamber through the lower seal. Water in the chamber shall cause a red light to turn on at the control panel. This signal shall not stop motor but shall act as a warning only, indicating service is required.

E. Pump and Motor Casting:

1. All castings shall be of high tensile cast iron and shall be treated with phosphate and chromate rinse.

2. All fasteners shall be 304 stainless steel.

F. Bearing End Cap: Upper motor bearing cap shall be a separate casting for easy mounting and replacement.

G. Power Cables:

1. Power cord and control cord shall be triple sealed. The power and control conductor shall be single strand sealed with epoxy potting compound and then clamped in place with rubber seal bushing to seal outer jacket against leakage and to provide for strain pull. A third sealing area shall be provided by a terminal board to separate the cable entry chamber from the motor chamber. Cords shall withstand a pull of 300 pounds.

2. Insulation of power and control cords shall be type SOOW. Both control and power cords shall have a green carrier ground conductor that attaches to motor frame.

H. Lift-Out Rail System:

1. Rail system shall consist of a seal fitting that mounts vertically into a stationary discharge casting. A simple downward motion shall connect pump and seal fitting to the stationary discharge casting. Seal fitting shall seal with two "O" rings and a tapered rubber seal ring into funnel of discharge case. Discharge casting shall be furnished with flanged discharge pipe connections for a duplex system. Valve casting and discharge casting shall be painted with a high quality, lead free, alkyd enamel finish. An upper guide plate shall be attached to pump to support life-out fitting and guide pump on rails. Lifting lugs shall be cast into the motor housing and a stainless steel chain and clevice shall be furnished for lifting each pump.

2. Two hold down brackets shall be provided to prevent pump and seal fitting from rising on rails. Guide rails shall be 1-1/2" stainless steel pipe.

3. Rail support and mounting bushing shall be mounted to basin wall and shall not be attached to basin cover or cover frame.

4. Guide rail support shall be adjustable so that perfect vertical alignment of the rails can be obtained.

I. All exposed hardware shall be 300 series stainless steel. No fabricated steel parts shall be used.

J. Controls:

1. Furnish and install one (1) duplex automatic pump control panel, in a NEMA 4, stainless steel enclosure with an interior swing-out panel door housing a 110-volt convenience outlet, hand/off/automatic pump selector switch, elapsed time meters, pilot lights, panel heater, and a red globe, alarm light fixture. Panel shall be supplied with mounting feet keeping the panel a minimum of 18" above the top surface of the concrete pad.

   For each 230 Volt, 3 Phase, 60 Hertz pump motor, there shall be included: a combination circuit breaker/overload unit providing overload protection, short-circuit protection, reset and disconnect for all phases; NEMA rated, reduced-voltage solid state motor controller with integral overload, phase loss, and phase reversal protection; four (4) float level sensors shall be provided for pump operation.

   For external pilot circuitry, a 120 Volt single-phase control circuit transformer with disconnect circuit breaker and overload protection, shall be included an automatic electric alternator for two pumps. Terminal board for connection of line, pump, and level sensors shall be provided. Pump casing moisture and high temperature indicator alarms and reset push buttons shall be provided. An audible and visual high water alarm shall be provided.

   Each pump shall be operated with an H-O-A switch. In hand mode, the pumps shall operate continuously until the switch is manually put in the off mode. In automatic mode, the pumps shall operate based on water level. There are four float switches; pumps on, lead on, lag on, and high water alarm. When the lead float is tripped, the pump shall turn on. If the water level continues to rise and the lag float is tripped, the lag pump shall turn on and both pumps shall operate until the pumps' off float is tripped. The pumps shall then return to lead/lag operation. After each cycle, the alternator shall switch the lead pump operation, to provide equal use of the pumps

2. The control panel shall include a battery backed, telephone alarm dialer. The dialer shall have at least four-points with alarms input as follows:

a. Alarm No. 1 – Power Failure

b. Alarm No. 2 – High Wet Well Level

c. Alarm No. 3 – Pump Failure

d. Alarm No. 4 – Spare

K. Access Frames and Doors:

1. The Contractor shall furnish all materials, labor, and equipment necessary to completely install access frame(s) and door(s). The access door(s) shall be pre-assembled from the manufacturer.

2. **The final size and location of the wet well access door(s) shall be closely coordinated with the pump manufacturer so as to assure that the pumps supplied will have the ability to be pulled for maintenance.** The wet well and valve vault access doors shall be reinforced to support a minimum live load of 300 psf with a maximum deflection of 1/150th of the span.

3. The access doors shall be gasketed and watertight. All access doors shall be lockable.

4. Operation of the doors shall be smooth and easy with controlled operation throughout the entire arc of opening and closing. Operation of the door shall not be affected by temperature. Entire door, including all hardware components, shall be highly corrosion resistant. 316 stainless steel hardware shall be provided for all doors. Stainless steel hardware shall include all parts of the latch and lifting mechanism assemblies, hold open arms and guides, and all brackets, hinges, pins and fasteners.

5. The cover shall be 1/4" (6.3 mm) aluminum diamond pattern. The channel frame shall be 1/4" (6.3mm) extruded aluminum with bend down anchor tabs around the perimeter. A continuous EPDM gasket shall be mechanically attached to the aluminum frame to create a barrier around the entire perimeter of the cover and significantly reduce the amount of dirt and debris that may enter the channel frame.

6. Hinges shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.

7. Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to

provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate. Springs shall have an electrocoated acrylic finish. Spring tubes shall be constructed of a reinforced nylon 6/6-based engineered composite material. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover. Hardware shall be anticorrosion throughout. The guide rail shall attach to the access frame assembly with 300 series stainless steel fasteners.

8. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug.

9. Stainless steel hinges, each having a minimum 1/4" (6.3 mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame. Cover shall be equipped with a hold open arm, which automatically locks the cover in the open position.

10. Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

11. The Contractor shall check as-built conditions and verify the manufacturer's access door details for accuracy to fit the application prior to fabrication. The Contractor shall comply with the access door manufacturer's installation instructions. The Contractor shall furnish mechanical fasteners consistent with the access door manufacturer's instructions.

12. Manufacturer shall guarantee against defects in material and workmanship for a period of twenty-five (25) years from the date of purchase. Should a part fail to function in normal use within this period, the manufacturer shall furnish a new part at no charge.

PART 3: EXECUTION

3.01 INSTALLATION

A. All equipment and materials shall be installed in strict accordance with the manufacturer's recommendations.

3.02 QUALITY CONTROL AND FIELD TESTING

A. Quality Control: The pump supplier shall furnish the services of a technical representative for two (2) days to inspect the installation and provide start-up and operator training.

B. Field Testing:

1. Each pump shall be field tested by the manufacturer's technical representative to demonstrate that the pump performance meets the requirements of the drawings and specifications. The manufacturer shall provide and install any gauges, meters or other devices needed for the field tests.

2. Pump start-up and testing shall be done in the presence of the Engineer and shall demonstrate conformance to the conditions shown on the contract drawings.

3.03 SPARE PARTS

A. The Contractor shall furnish one (1) complete set of spare parts as detailed below for each pump supplied on this contract. Spare parts shall be conveyed to the Owner.

Upper and Lower Mechanical Seal	Wear Ring
Motor Cable	Cable Entry Washer
Cable Grommet	O-Ring Kit
Inspection Plug Washer	Impeller Bolt
Upper Bearing	Impeller Key
Lower Bearing	

B. All special tools necessary for the maintenance and repair of the mechanical equipment in this section shall be furnished by the Contractor. Two (2) sets shall be provided to the Owner.

C. Supply of Lubricants: One (1) year supply of greases and lubricants based on the manufacturer's recommendations shall be furnished.

END OF SECTION

SECTION 16051 COMMON WORK RESULTS FOR ELECTRICAL

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Common electrical installation requirements.
3. Cutting and patching for electrical construction.
4. Touchup painting.

1.03 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

PART 2: PRODUCTS (not used)

PART 3: EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

F. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

3.02 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.03 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Cutting and patching for electrical construction.
2. Touchup painting.

3.04 CLEANING AND PROTECTION

A. On completion of installation inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 16060 GROUNDING AND BONDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Ground rods.

C. Field quality-control test reports.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

4. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.02 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-Clad Steel; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors.

3.02 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

   b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

   1. Power and Lighting Equipment or System with Capacity More Than 1000 KVA: 3 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 16075 ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.03 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials shall comply with UL 969.

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 - PRODUCTS

2.01 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

C. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.02 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.03 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: CONTROL CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Power, Communications, Control, and Fiber Optic Circuits:
1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 8 mils (0.2 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 300 lbf (1334 N), and 12,500 psi (86.1 MPa).

2.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.05 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.06 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.07 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at **6 to 8 inches below finished grade**. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

I. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

B. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated.

C. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Controls with external control power connections.

D. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.

c. Process control equipment and instruments.

END OF SECTION

SECTION 16120 CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW.

2.02 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR INSULATION APPLICATIONS AND WIRING METHODS

A. Feeders: Type THHN-THWN, single conductors in raceway.

B. Branch Circuits: Type THHN-THWN, single conductors in raceway.

C. Class 1 Control Circuits: Type THHN-THWN, in raceway.

D. Class 2 Control Circuits: Type THHN-THWN, in raceway.

E. Underground: Type XHHW, in raceway.

3.02 INSTALLATION OF CONDUCTORS AND CABLES

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

D. Support cables according to Division 16 Section "Hangers And Supports For Electrical Systems."

E. Identify and color-code conductors and cables to match existing color coding or as required by Code.

3.03 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 16130 RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.03 DEFINITIONS

A. RGS: Rigid galvanized steel conduit

B. RNC: Rigid nonmetallic conduit

C. PVC Coated RGS: 40 mil PVC coated rigid galvanized steel conduit

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. Fittings for Conduit (Including all Types): NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

C. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: PVC coated RGS
2. Underground Conduit: RNC, Type EPC- 40-PVC, direct buried.
3. Boxes and Enclosures, Aboveground: NEMA 250, Type 4, stainless steel.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed: Rigid steel conduit
2. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Complete raceway installation before starting conductor installation.

C. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

D. Install no more than the equivalent of three 90-degree bends in any conduit run.

E. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

F. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances.

a. Couple steel conduits to ducts with adapters designed for this purpose.

b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 72 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.04 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 16289 TRANSIENT VOLTAGE SUPPRESSION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes field-mounted TVSS for low-voltage (120 to 600 V) control equipment.

1.03 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

B. Product Certificates: For TVSS devices, from manufacturer.

C. Operation and Maintenance Data: For TVSS devices to include in emergency, operation, and maintenance manuals.

D. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

C. Comply with NEMA LS 1.

D. Comply with UL 1449.

E. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.

2. Operating Temperature: -40 to 160°F.

3. Humidity: 5 to 95 percent, non-condensing.

4. Altitude: Less than 20,000 feet above sea level.

1.07 COORDINATION

A. Coordinate location of field-mounted TVSS devices to allow adequate clearances for maintenance.

1.08 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 30 years from date of Substantial Completion.

PART 2: PRODUCTS

2.01 SURGE SUPPRESSORS

A. Provide ***Total Protection Solutions, Service Track ST 120, TK-ST120-3D240*** or equivalent.

B.

1. Comply with UL 1449 2nd Edition 2005 Revision. And UL 1283.
2. Short-circuit current rating equal to or greater than 200KAIC
3. Fabrication using bolted compression lugs for internal wiring.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status of each phase.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
10. Surge Counter.

C. Peak Single-Impulse Surge Current Rating: 60 kA per mode; 120 kA per phase.

D. Protection modes and UL 1449 SVR for High-Leg Delta circuits with 240/120 V (208 V, High Leg-Neutral), 3-Phase, 4-Wire plus Ground shall be as follows:

1. Line to Neutral: 400 V
2. Line to Ground: 400 V
3. Neutral to Ground: 400 V
4. Line to Line: 800 V
5. High-Leg to Neutral: 800 V

6. High-Leg to Ground: 800 V

7. High-Leg to Line: 1500 V

PART 3: EXECUTION

3.01 INSTALLATION

A. Install TVSS device adjacent to the existing load panel with conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide 30-A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

3.02 STARTUP SERVICE

A. Do not energize or connect service entrance equipment to their sources until TVSS devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.03 DEMONSTRATION

A. Train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION